Risks and Benefits of Better Drinking Water Infrastructure in Newfoundland and Labrador

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Introduction

Clean, safe drinking water is essential to all life and good health.

Over the past century, establishing reliable water sources has been one of the most significant improvements to population health in North America (Hrudey, 2008).

The reality is; there is still much work to be done in guaranteeing and maintaining all water supplies

Introduction

Risks emerging:

- Aging infrastructure
- Private wells
- Water quality
- Water monitoring
- Water safety
- Municipal operations and strategy around water

Where does water come as a risk?

Where does the World Economic Form rank water as a risk?

Where does water come as a risk?

In 2017 - Top 3 global risk behind weapons of mass destruction and Extreme Weather Events

Quiz

Part A – Current Culture

Part B – Newfoundland History

Part C – Water Related Trivia

Quiz

- **Part A** – Current Culture

1. The Tragically Hip played their final concert in August in what Canadian city? A. Toronto, B. Montreal, C. Ottawa, D. Kingston
2. What Happy Days US actor had a ‘beef’ with Newfoundland comedian Mark Critch over his support of Donald Trump? A. Henry Winkler B. Ron Howard, C. Scott Baio
3. What is the name of the theatre that the musical Come from Away is playing in New York? A. Gerarld Schoenfeld Theatre B. Oliver Brashich Theatre C. Carnegie Hall

Good stuff that is happening

The government of Newfoundland and Labrador is committed to providing residents with clean, safe drinking water in adequate supply.

Current testing procedures see the regular monitoring of public supplies for bacteriological contaminants, and a rotating testing schedule for chemical and physical contaminants (DOEC, 2013).

Bacteriological testing is available to private well owners on an on-demand basis from the Public Health Lab which is a division of Eastern Health and therefore ultimately funded by the Department of Health and Community Services

Risk Definitions

“RISK is anything that may enhance or impede an organization's ability to achieve its current or future objectives”

“RISK MANAGEMENT is the proactive mechanisms by which you exploit and manage risk”

What is risk management?

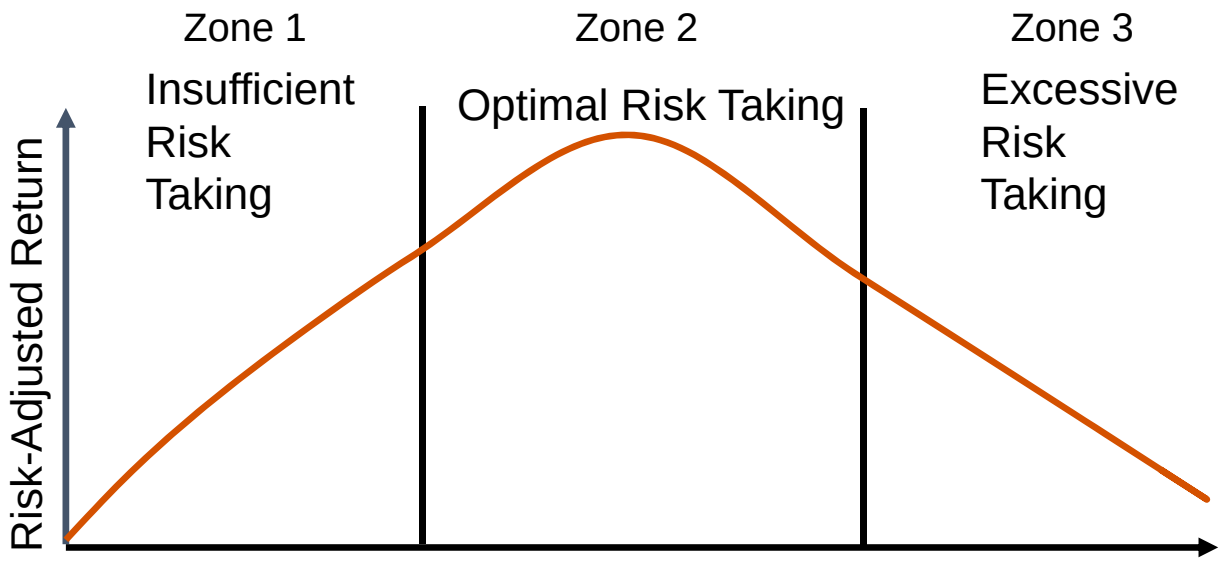
Not just using derivatives to manage interest rate risk

It is using a portfolio approach to manage the full range of risks faced by an enterprise – including a municipality

Risk management is not only about reducing downside potential or the probability of pain, but also about increasing upside opportunity or the prospects for gain

What is risk management?

- Also not just about ‘higher risk, higher return’
- Focus is on the relative or risk adjusted return



Definition of Risk Management

For the purposes of addressing risk within an organization:

Risk management is a systematic approach to setting the best course of action under uncertainty for an organization by identifying, assessing, understanding, acting on and communicating risk issues.

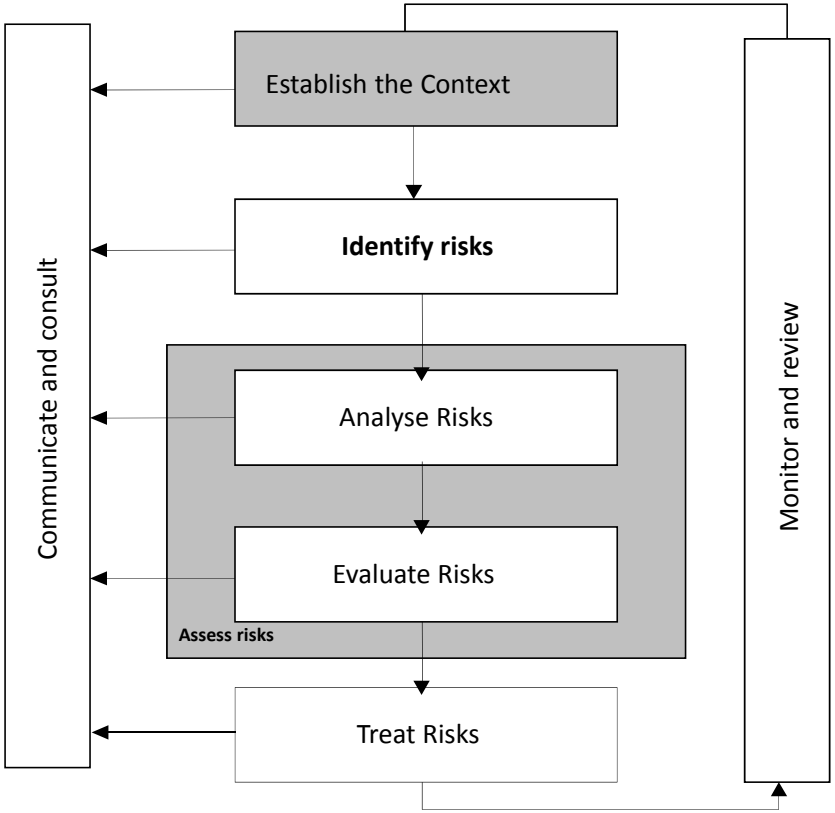
Risk

Every business/operational decision involves an element of risk

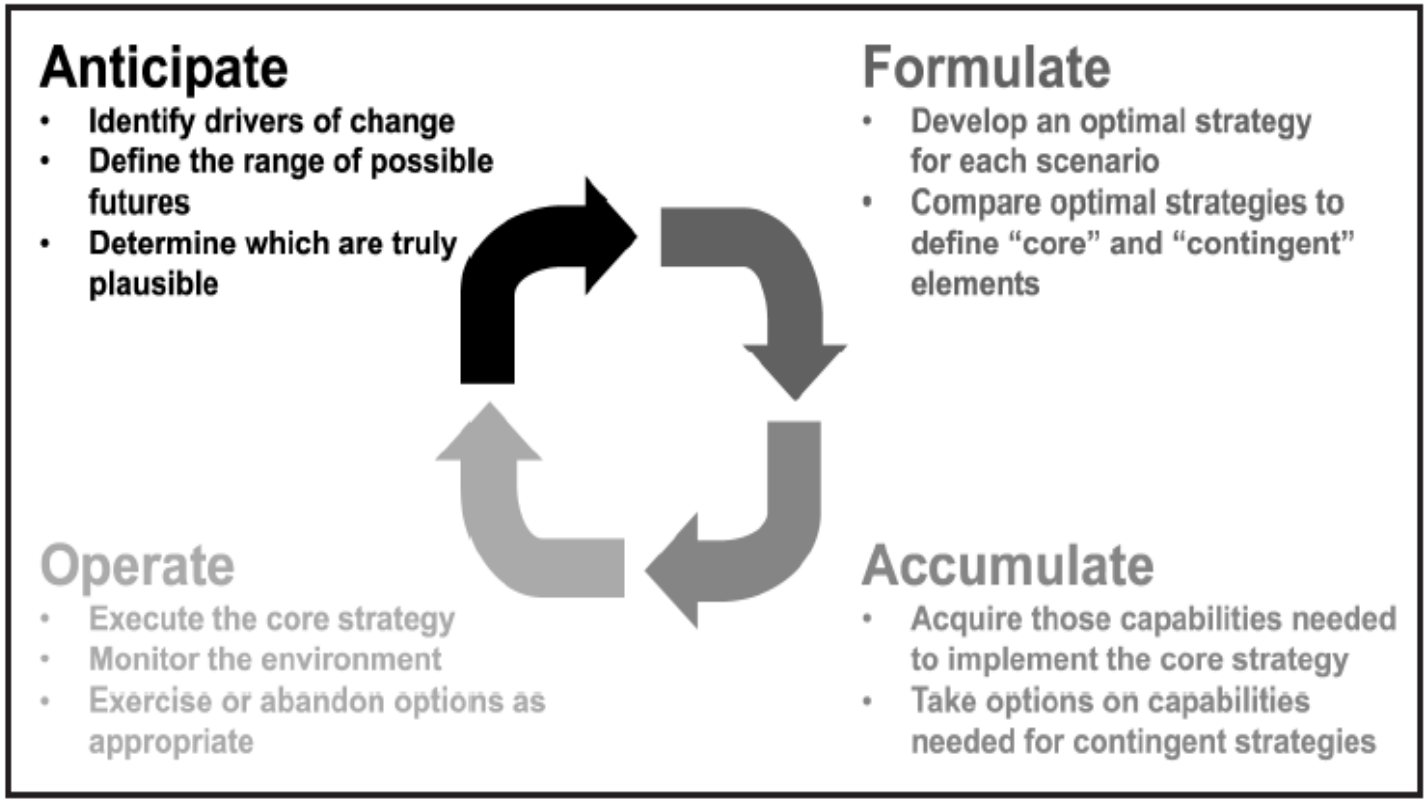
- Risks in making investments, credit management
- Developing and pricing new products/services
- Hiring and training new employees
- Establishing a culture that balances service delivery and risk management
- Aligning performance measurement and incentives with organizational objectives

ISO 3100

- Strategic
- Organizational
- Analysis of risks
- Risk evaluation criteria



Strategic Flexibility



Risk Management

Impact	Risk Management Actions		
Significant	Considerable management required	Must manage and monitor risks	Extensive management essential
Moderate	Risks may be worth accepting with monitoring	Management effort worthwhile	Management effort required
Minor	Accept risks	Accept, but monitor risks	Manage and monitor risks
	Low	**Medium**	**High**
	Likelihood		

Issues Emerging

There is no practice of any regular monitoring of private water supplies in the province, except at the installation of new, drilled wells

Chemical and physical testing are not available to residents of the province on private water supplies because of geography and high cost; despite being water quality monitoring parameters set forth by Health Canada.

The potential for contamination is very real, as the United States Geological Survey found 23% of 1,389 wells sampled across the US between 1991 and 2004 had at least one contaminant above health guideline values (De Simone et al., 2009).

While the most immediate health concerns in drinking water come from bacterial contaminants like *E.coli*, one cannot ignore the health risks from prolonged exposure to toxic chemical contaminants.

There is a growing body of evidence that prolonged exposure to even low levels of some chemicals can pose a health risk.

Issues Emerging

In general, threats to health are posed by microbiological contaminants or chemical contaminants. Microbiological contaminants typically refer to bacteria. Fecal bacteria, like *E. coli,* are the foremost concern for water safety (Health Canada, 2014b).

Issues with infrastructure such as Walkerton, Flint, Michigan etc.

While the issue in Walkerton was a publicly administered system, and the issue has largely been attributed to operator error as well as out-dated and unsafe infrastructure, the water source was a well

Context

- Municipal infrastructure includes:
  - buildings,
  - structures,
  - facilities, such as water and sewer
  - equipment,
  - rolling stock,
  - furnishings, and
  - development and purchase of land

Why is infrastructure important?

Municipalities offer essential services to the population, including:

- fire protection,
- recreational activities,
- drinking water,
- collection and treatment of wastewater, and
- public transportation

Also offer ‘non-essential services’ – sense of community and place

Why is infrastructure important?

- Physical representation of what a community is
- Significant ongoing cost to a community
- Need for resilience within infrastructure

Infrastructure Versus Operations

Infrastructure expenditures differ from operating expenditures in three important ways:

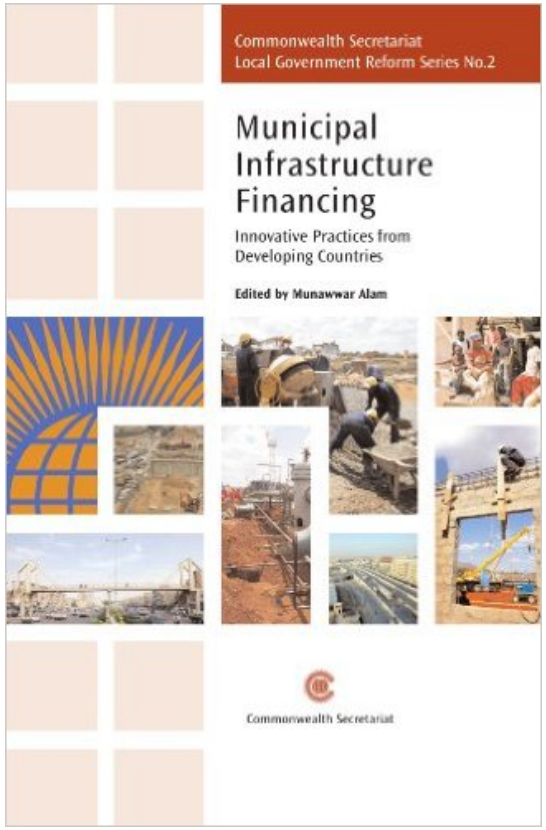
- Financing - lumpy
- Benefits – long-term
- Funding

Public Funding Trends

In Canada, the three main sources of municipal revenue:

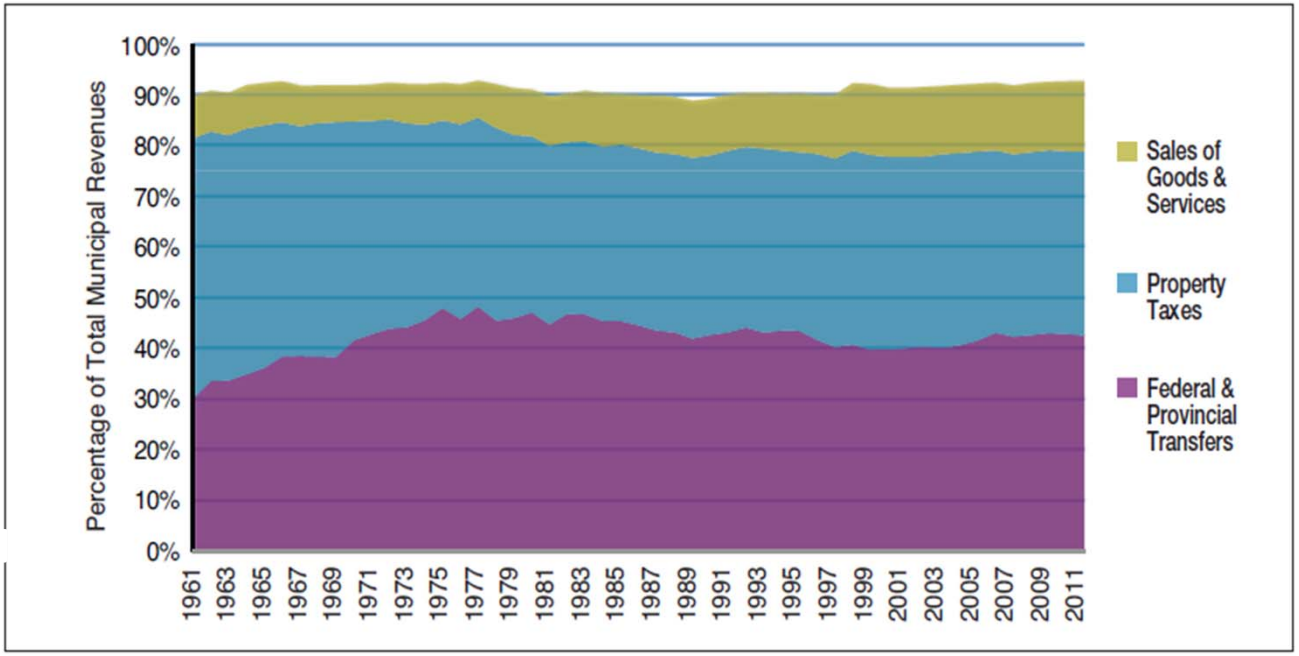
- Property tax (53%)
- User fees (22%) and
- Provincial transfers (17%).

Most transfers are conditional (specific purpose) transfers from provincial governments.



Funding

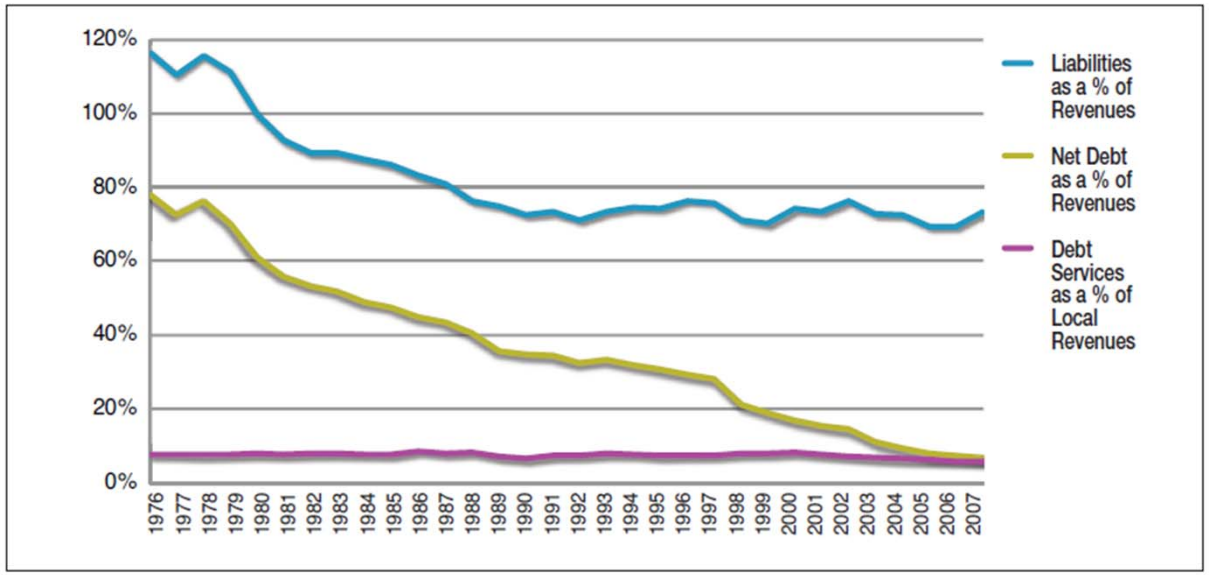
FIGURE 7: COMPOSITION OF MUNICIPAL REVENUE (CANADIAN AVERAGE)



Cansim table 380-0035 – Income and expenditure sub-sector accounts, local governments

Public Funding Trends

Figure 9: Net and Gross Debt as a Percentage of Local Government Revenue (Canadian Average)



Source: Cansim table 380-0035 – Income and expenditure sub-sector accounts, local governments
Cansim table 385-0014 – Balance sheet of local governments

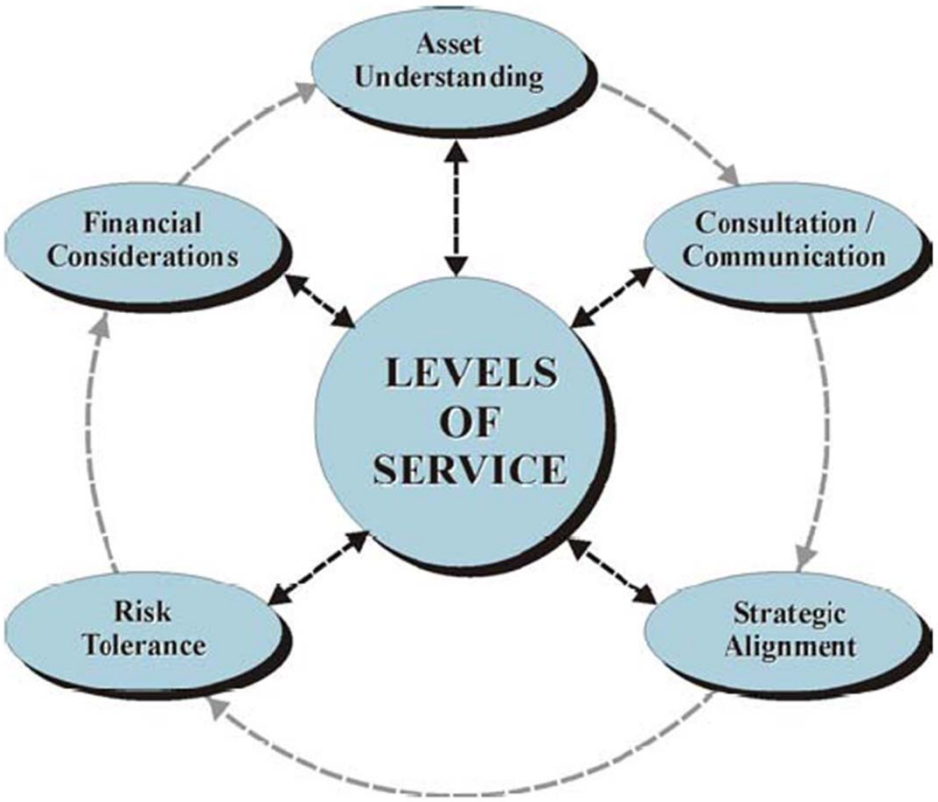
Public Funding Trends

Funding - Three key issues

1. How can municipal governments **choose the appropriate infrastructure projects around water**, including coordination across government boundaries?
2. **How can they finance it**?
3. How can an **overall federal/provincial/municipal structure** be created in which incentives:
   - to get the means of financing
   - to maintain the infrastructure,
   - and to use the infrastructure efficiently and equitably

   are not unduly distorted?

Establishing Levels Of Service



Quiz

- **Part B** – Newfoundland History

1. How many kilometers does the province of Newfoundland and Labrador cover? A. 290,000 B. 420,000 C. 370,000
2. According to the Dictionary of Newfoundland English, what is a crubeen? A. a pig's trotter? B. A boat operated by one person C. The top of a barrell
3. What year did Sir Humphrey Gilbert claim Newfoundland as an English possession? A. 1583, B. 1614 C. 1543

Planning And Defining Municipal Infrastructure

- Strategic Planning
- Information Management
- Project Management
- Building Public Support and Acceptance
- Continuous improvement
- Prioritization models

Infrastructure Management Processes

- Infrastructure management processes
- First set of issues:
  - **asset identification,**
  - **appraisal, and**
  - **valuation**
- Second set of issues:
  - **asset deployment,**
  - **utilization, and**
  - **reinvestment.**

Management

- The asset management strategy enables infrastructure to provide:
  - the **desired levels of service in a sustainable way,**
  - **while managing risk, and**
  - **at the lowest lifecycle cost**

Asset Management

- Asset management provides:
  - transparent,
  - rational, and
  - accountable cost-effective management of municipal infrastructure systems.
- It provides best value for money, saving unnecessary cost.

Critical Infrastructure

Why is critical infrastructure important?

In order to minimize the impact on communities and society in the case of severe disturbances affecting municipal infrastructure systems

Systems must be resilient to failures, i.e. that they are able continue operations or quickly recover a stable state after a major mishap

What is Critical Infrastructure?

Critical infrastructure can be defined as:

- physical facilities,
- supply chains,
- information technologies and
- communication networks,

which if

- destroyed,
- degraded or
- rendered unavailable for an extended period,

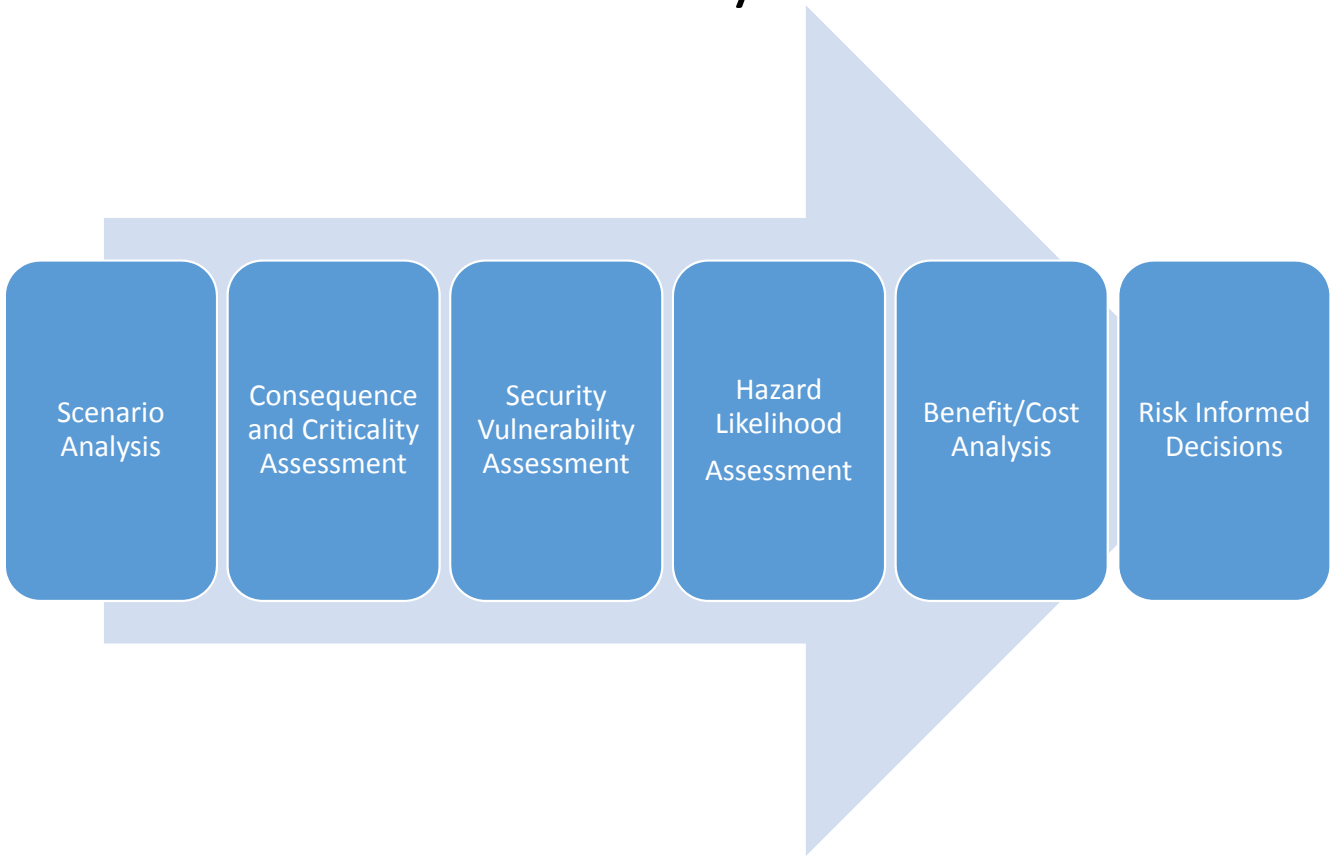
would significantly impact on the social or economic wellbeing of a municipality and the province.

Benefits of Understanding and Managing Critical Infrastructure

There are effectively four benefits of engaging in an improved approach to dealing with municipal critical infrastructure:

1. A strong and effective stakeholder – municipality partnership;
2. Enhanced risk management of the infrastructure operating environment;
3. Effective understanding and management of strategic issues around critical infrastructure; and
4. A mature understanding and application of municipality/organizational resilience to deal with critical infrastructure.

Framework for Critical Infrastructure Analysis



Measures of Critical Infrastructure

Loss Dimension	Description	Unit of Measure
Casualty	Measures the number of people injured or killed	Number of fatality equivalents
Economic	Measures direct economic damage including property loss, repair and cleanup costs, environmental losses as well as the lost to other assets due to the failure	Current year dollars
Mission Disruption	Measures degree of mission disruption for each relevant mission	Percentage reduction in available production capacity
Recuperation Time	Measures the time to reconstitute lost functionality and productive capacity	Time (days or years appropriate)

Considerations and Process – Critical Infrastructure

Evaluating Critical Infrastructure

- Mission and community impact
- Safety and environmental impact
- Ability to isolate single-point-failures
- Preventive Maintenance (PM) history
- Corrective Maintenance (CM) history
- Mean-Time-Between-Failures (MTBF) or “Reliability”
- Probability of failure
- Spares lead time
- Asset replacement value
- Planned utilization rate

Steps to Addressing Critical Infrastructure and Water

1. Identify all parts and connections to the identified critical infrastructure specifically water related infrastructure
2. ‘Disconnect’ unnecessary infrastructure – what’s not critical
3. Evaluate and strengthen the resiliency of any remaining infrastructure
4. Removing or disabling unnecessary services
5. Do not rely on proprietary protocols to protect your infrastructure
6. Implement the security/protection features provided by partners

Steps to Addressing Critical Infrastructure and Water

7. Perform audits of critical infrastructure to identify operational/security concerns
8. Conduct physical security surveys and assess all remote sites connected to the critical infrastructure to evaluate their resilience
9. Establish teams within municipalities to identify and evaluate possible attack scenarios
10. Clearly define roles, responsibilities, and authorities for managers, councillors and citizens
11. Document infrastructure and identify systems that serve critical functions or contain sensitive information that require additional levels of protection
12. Establish a rigorous, ongoing risk management process

Quiz - Part C

- **Part C** – Water Related Trivia

1. Where is the most expensive (on a per person basis) water and sewer system in Newfoundland and Labrador? _____
2. While parasites are less of a problem in Newfoundland and Labrador, one particular species, *Giardia lamblia*, is the most concerning (DOEC, 2009). According to Newfoundland and Labrador Communicable Disease Surveillance (2016), the province saw _____ cases of giardiasis in 2015. Symptoms include gastrointestinal upset, liver or respiratory infections, and central nervous syndromes or muscular symptoms (DOEC, 2009). A. 18 B. 52 C. 23
3. Health Canada recommends _____ separate physical and chemical parameters be monitored for concentrations in water if they are relevant to a particular region (Health Canada, 2014b). A. 28 B. 70 C. 91

Benefits - Management

- The asset management strategy is the set of planned actions that will enable the assets to provide the **desired levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost**

Lessons Learnt And Other Considerations

- Infrastructure funding, design and funding around water infrastructure are **strategic decisions** that **council makes on behalf of the community both now and in the future**
- Enhancing the asset management planning process needs:
  - Direction and support from Council
  - Public engagement
  - External Support and Collaboration
  - An Open and Ongoing Process
  - Evolves Over Time
  - Some direction for staff to develop guidelines and practices

Lessons Learnt And Other Considerations

- **Consultation/communication can occur in an informal manner**, particularly for the smaller municipalities
- There needs to be a **clear understanding of the municipalities' goals/strategic alignment** and the municipality's mission objectives
- **Financial considerations are paramount** in the decision-making process on municipal infrastructure – even water
- The locai municipality should **establish an intergovernmental agreement to regulate development that affects water and water related issues**

Lessons Learnt And Other Considerations

Municipalities should design a **regional growth management partnership model and ensure water is addressed**

Intergovernmental agreements, consent resolutions, and strategic partnership agreements are key instruments

Importance of **good project management**

Concept of strongly **differentiating maintenance and repair from capital renewal in addressing water issues**

A complete inventory of all infrastructure and their condition related to water

Thank you for the opportunity to speak

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