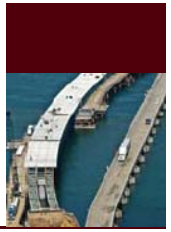
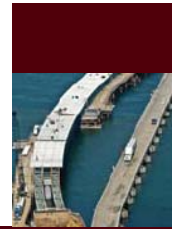
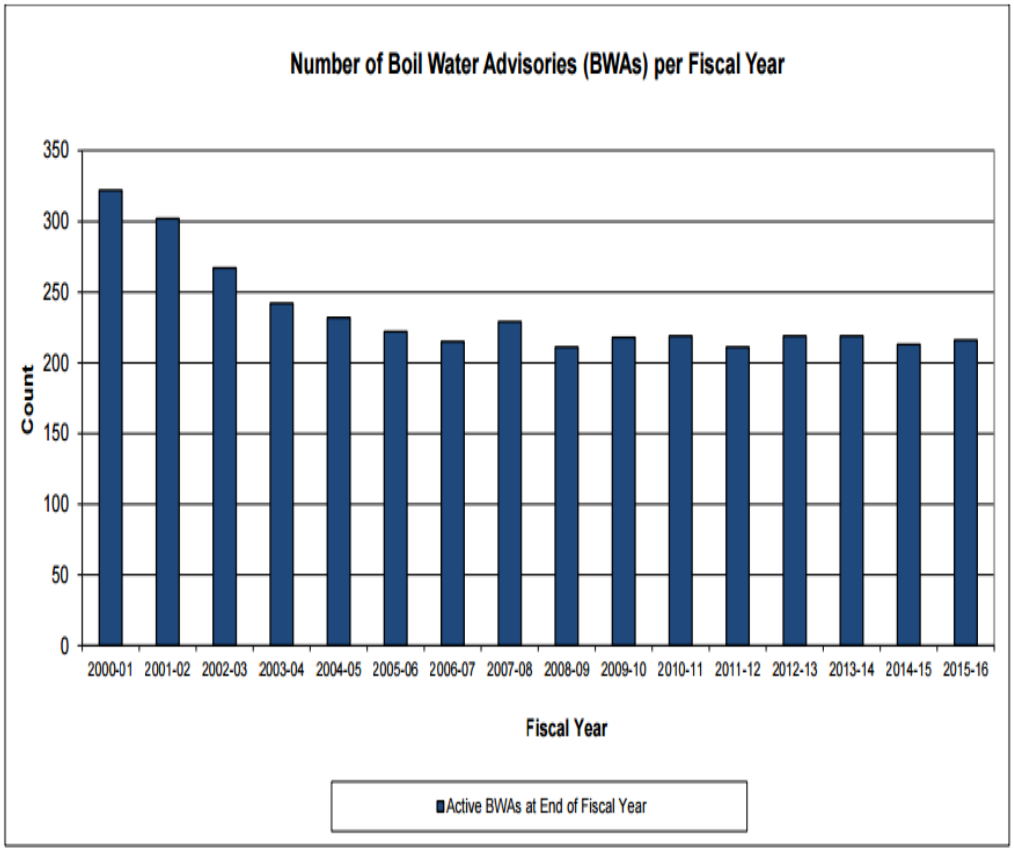


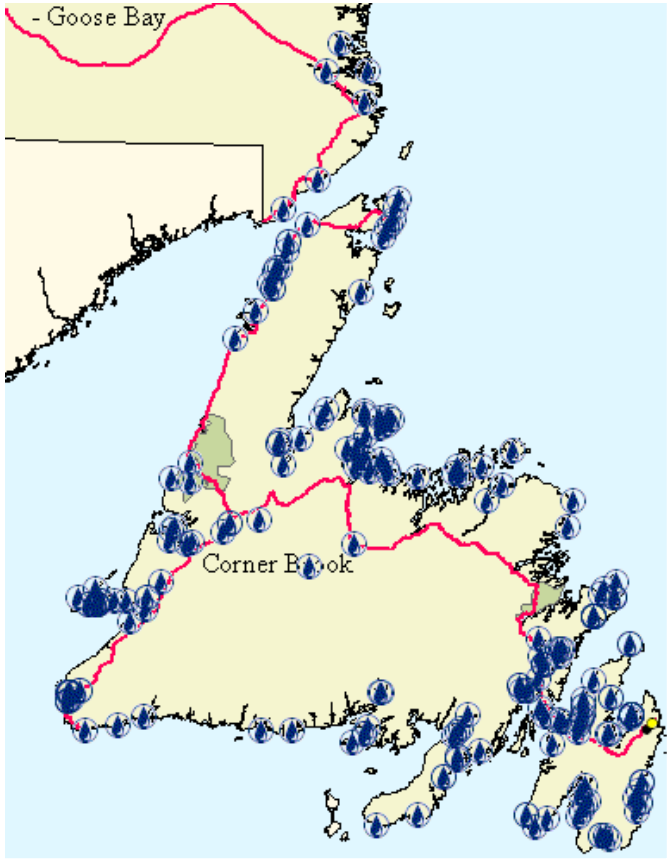
IMPLEMENTATION OF BWA STANDARD OPERATING PROCEDURES & DEVELOPMENT OF COST ACCOUNTING TOOL

Brad McIlwain | March 28,2017

Background




Number of Boil Water Advisories (BWAs) per Fiscal Year
Count
350
300
250
200
150
100
50
0
2000-01
2001-02
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
Fiscal Year
Active BWAs at End of Fiscal Year


- Goose Bay
Corner B ok

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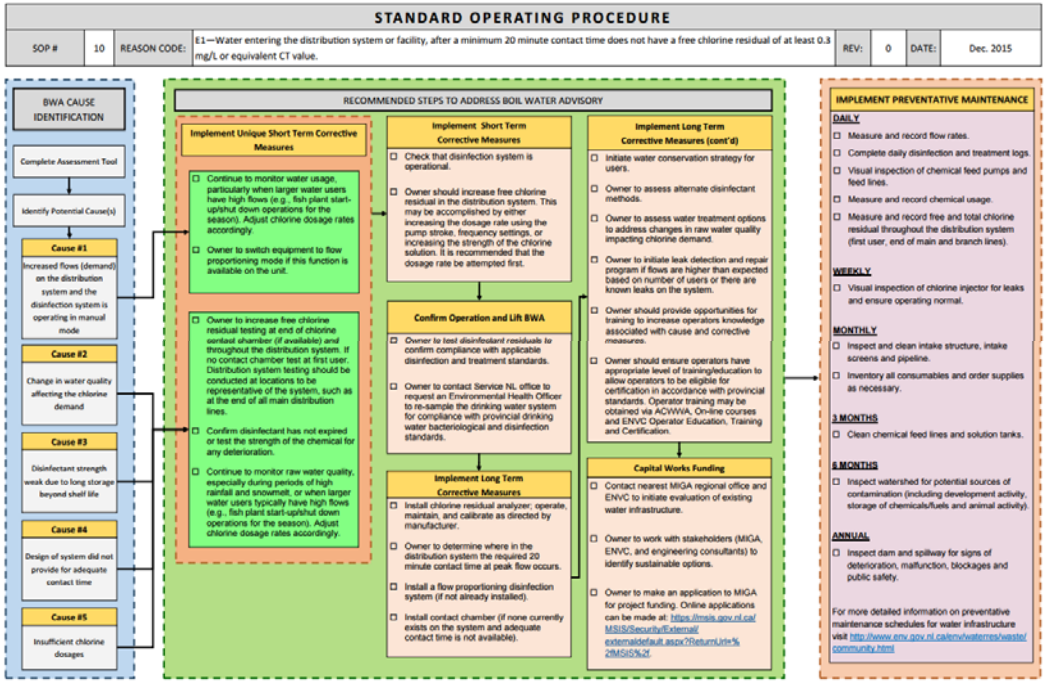
Experience
Vision
Commitment

Background



BWA Code	Description	Number in Place[1]
A	No disinfection system	32
B1	Off because of taste & odour	6
B2	Off because of perceived health risk of chlorination	1
B3	Off because of lack of funds to operate	12
C1	Off due to maintenance or mechanical failure	36
C2	Off due to lack of chlorine or other disinfectant	1
D1	Water distribution maintenance/repair	19
D2	Cross-connection discovered	8
D3	Inadequately treated water sent to dist. System	5
E1	Not meeting CT requirement	28
E2	Cl2 not detectable in distribution system	47
E3	Insufficient residual in system with other disinfectant	0
F3	Total Coliforms in repeat sampling	9
F2E/F4/F5	E. Coli detected	2/0/1
F6	Viruses detected	0
F7	Protozoa detected	0
G	System compromised due to disaster	0
H	Waterborne disease contamination	0

[1]ENVC BWA Summary, July 14, 2016

Project Objectives – Implementation of SOPs

- Pilot the SOPs in a number of communities
- Reduce overall number of BWAs in province
- Test the tools, recommend improvements

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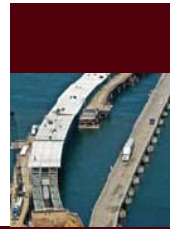
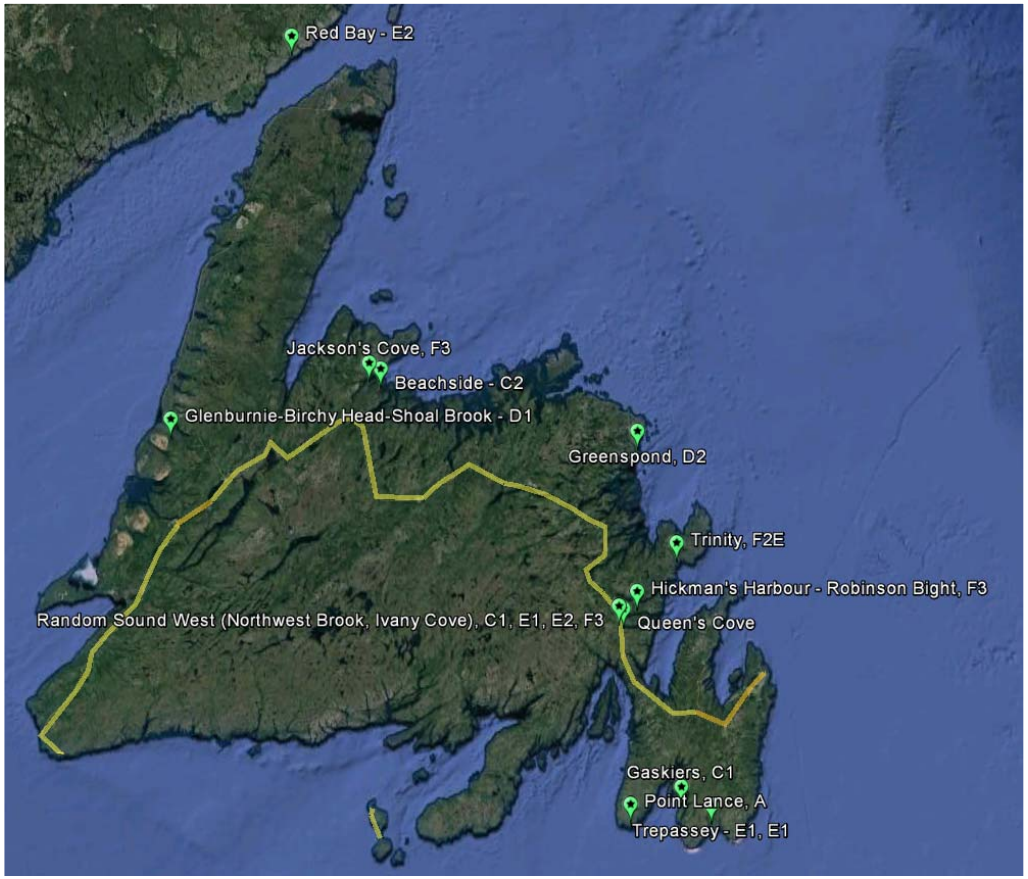
Implementation of SOPs – Community Selection



Community	Service Population	Disinfection System
Beachside	140	Sodium Hypochlorite
Gaskiers	233	Sodium Hypochlorite
Glenburnie	60	Sodium Hypochlorite
Greenspond	305	Gas
Hickman's Harbour	402	Sodium Hypochlorite
Jackson's Cove	40	Sodium Hypochlorite
Point Lance	105	
Random Sound West - Well #1	22	Sodium Hypochlorite
Random Sound West - Well #2	27	Sodium Hypochlorite
Random Sound West - Well #3	35	Sodium Hypochlorite
Queen's Cove	67	Sodium Hypochlorite
Red Bay	192	Calcium Hypochlorite
Trepassey - Broom Cove		Sodium Hypochlorite
Trepassey – Miller Pond	570	Gas
Trinity	89	Sodium Hypochlorite



Implementation of SOPs – Background Data Collection

Community	Alkalinity mg/L as $CaCO_3$	Colour TCU	Hardness mg/L as $CaCO_3$	pH	Turbidity NTU	DOC mg/L	Iron mg/L	Manganese mg/L
MAC/Aesthetic Objective		**15**		**6.5-8.5**	**1.0**		**0.300**	**0.050**
Beachside	19	31	24	7.0	0.29	5.3	0.023	0.002
Gaskiers	8	67	13	6.6	0.75	9.2	0.150	0.014
Glenburnie	22	45	29	7.1	0.31	5.3	0.096	0.009
Greenspond	2	68	5	5.7	0.44	6.3	0.135	0.009
Hickman's Harbour	8	15	8	6.8	0.57	3.6	0.033	0.036
Jackson's Cove	13	8	17	6.9	0.46	3.2	0.082	0.006
Point Lance	7	143	12	6.4	0.94	14.2	0.765	0.037
Random Sound West - Well #1	60	2	178	7.6	0.09	1.1	0.013	0.007
Random Sound West - Well #2	55	0	52	7.7	0.09	0.6	0.008	0.002
Random Sound West - Well #3	64	14	74	7.6	0.18	4.0	0.007	0.002
Queen's Cove	7	79	7	6.5	0.94	7.8	0.477	0.076
Red Bay	2	38	1	6.2	0.51	4.7	0.220	0.003
Trepassey - Broom Cove	0	60	2	5.9	0.85	5.3	0.132	0.014
Trepassey - Miller Cove	2	69	4	6.2	0.46	7.4	0.203	0.016
Trinity	0	43	2	5.6	0.68	6.2	0.068	0.020

Implementation of SOPs – Community A

BOIL WATER ADVISORY SYSTEM ASSESSMENT FORM

Town Name	Community A		
Assessor Name	CF		
Assessor Title			
Contact Phone #		Date of Assessment	14-Oct-16

Boil Water Advisory Issue Date	08-Nov-12
BWA Reason Code	C1

Cause(s) of BWA	1.	Unsatisfactory sample result in most recent test
	2.	Water quality is adversely affected by precipitation
	3.	

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Implementation of SOPs – Community A

STANDARD OPERATING PROCEDURE

SOP #	10	REASON CODE:	E1—Water entering the distribution system or facility, after a minimum 20 minute contact time does not have a free chlorine residual of at least 0.3 mg/L or equivalent CT value.	REV:	0	DATE:	Dec. 2015

BWA CAUSE IDENTIFICATION

- ☑ Complete Assessment Tool
- Identify Potential Cause(s)

Cause #1
Increased flows (demand) on the distribution system and the disinfection system is operating in manual mode

Cause #2
Change in water quality affecting the chlorine demand

Cause #3
Disinfectant strength weak due to long storage beyond shelf life

Cause #4
Design of system did not provide for adequate contact time

Cause #5
Insufficient chlorine dosages

RECOMMENDED STEPS TO ADDRESS BOIL WATER ADVISORY

Implement Unique Short Term Corrective Measures

- ☐ Continue to monitor water usage, particularly when larger water users have high flows (e.g., fish plant start-up/shut down operations for the season). Adjust chlorine dosage rates accordingly.
- ☐ Owner to switch equipment to flow proportioning mode if this function is available on the unit.
- ☑ Owner to increase free chlorine residual testing at end of chlorine contact chamber (if available) and throughout the distribution system. If no contact chamber test at first user. Distribution system testing should be conducted at locations to be representative of the system, such as at the end of all main distribution lines.
- ☑ Confirm disinfectant has not expired or test the strength of the chemical for any deterioration.
- ☐ Continue to monitor raw water quality, especially during periods of high rainfall and snowmelt, or when larger water users typically have high flows (e.g., fish plant start-up/shut down operations for the season). Adjust chlorine dosage rates accordingly.

Implement Short Term Corrective Measures

- ☑ Check that disinfection system is operational.
- ☑ Owner should increase free chlorine residual in the distribution system. This may be accomplished by either increasing the dosage rate using the pump stroke, frequency settings, or increasing the strength of the chlorine solution. It is recommended that the dosage rate be attempted first.

Confirm Operation and Lift BWA

- ☑ Owner to test disinfectant residuals to confirm compliance with applicable disinfection and treatment standards.
- ☑ Owner to contact Service NL office to request an Environmental Health Officer to re-sample the drinking water system for compliance with provincial drinking water bacteriological and disinfection standards.

Implement Long Term Corrective Measures

- ☐ Install chlorine residual analyzer; operate, maintain, and calibrate as directed by manufacturer.
- ☑ Owner to determine where in the distribution system the required 20 minute contact time at peak flow occurs.
- ☑ Install a flow proportioning disinfection system (if not already installed).
- ☒ Install contact chamber (if none currently exists on the system and adequate contact time is not available).

Implement Long Term Corrective Measures (cont'd)

- ☐ Initiate water conservation strategy for users.
- ☐ Owner to assess alternate disinfectant methods.
- ☐ Owner to assess water treatment options to address changes in raw water quality impacting chlorine demand.
- ☐ Owner to initiate leak detection and repair program if flows are higher than expected based on number of users or there are known leaks on the system.
- ☐ Owner should provide opportunities for training to increase operators knowledge associated with cause and corrective measures.
- ☐ Owner should ensure operators have appropriate level of training/education to allow operators to be eligible for certification in accordance with provincial standards. Operator training may be obtained via ACWWA, On-line courses and ENVC Operator Education, Training and Certification.

Capital Works Funding

- ☐ Contact nearest MIGA regional office and ENVC to initiate evaluation of existing water infrastructure.
- ☐ Owner to work with stakeholders (MIGA, ENVC, and engineering consultants) to identify sustainable options.
- ☐ Owner to make an application to MIGA for project funding. Online applications can be made at: https://msis.gov.nl.ca/MSIS/Security/External/externaldefault.aspx?ReturnUrl=%2fMSIS%2f.

IMPLEMENT PREVENTATIVE MAINTENANCE

DAILY
- ☐ Measure and record flow rates.
- ☐ Complete daily disinfection and treatment logs.
- ☐ Visual inspection of chemical feed pumps and feed lines.
- ☐ Measure and record chemical usage.
- ☐ Measure and record free and total chlorine residual throughout the distribution system (first user, end of main and branch lines).

WEEKLY
- ☐ Visual inspection of chlorine injector for leaks and ensure operating normal.

MONTHLY
- ☐ Inspect and clean intake structure, intake screens and pipeline.
- ☐ Inventory all consumables and order supplies as necessary.

3 MONTHS
- ☐ Clean chemical feed lines and solution tanks.

6 MONTHS
- ☐ Inspect watershed for potential sources of contamination (including development activity, storage of chemicals/fuels and animal activity).

ANNUAL
- ☐ Inspect dam and spillway for signs of deterioration, malfunction, blockages and public safety.

For more detailed information on preventative maintenance schedules for water infrastructure visit http://www.env.gov.nl.ca/env/waterres/waste/community.html

Implementation of SOPs – Community B

BOIL WATER ADVISORY SYSTEM ASSESSMENT FORM

Town Name	Community B		
Assessor Name	BM		
Assessor Title			
ontact Phone #		Date of Assessment	27-Oct-16

Boil Water Advisory Issue Date	03-Apr-12
BWA Reason Code	D1

Cause(s) of BWA	1.	Chlorine system not being operated.
	2.	Animals may be present in the watershed
	3.	
	4	

Page 1

Implementation of SOPs – Community B

STANDARD OPERATING PROCEDURE

SOP #	5	REASON CODE:	C1—Disinfection system is off due to maintenance or mechanical failure		0	DATE:	Dec. 2015

BWA CAUSE IDENTIFICATION

Complete Assessment Tool

Identify Potential Cause(s)

Cause #1

Disinfection system turned off for planned preventative maintenance

Cause #2

Disinfection system turned off due to component failure

RECOMMENDED STEPS TO ADDRESS BOIL WATER ADVISORY

Implement Unique Short Term Corrective Measures

- ☐ Owner to order new parts to complete repairs, turn disinfection system on and have redundant critical spare parts available for the disinfection system.
- ☐ Upon completing maintenance, owner to turn disinfection system on.
- ☐ Upon completing maintenance, owner to turn disinfection system on.

Implement Short Term Corrective Measures

- ☐ Owner to flush distribution system.
- ☐ Owner to increase disinfectant residual in the distribution system in accordance with provincial disinfection standards.

Confirm Operation and Lift BWA

- ☐ Owner to test disinfectant residuals to confirm compliance with the Drinking Water Treatment Standards.
- ☐ Owner to contact Service NL office to request an Environmental Health Officer to re-sample the drinking water system for compliance with provincial drinking water bacteriological and disinfection standards.

Implement Long Term Corrective Measures

- ☐ Owner may replace or upgrade disinfection system (as required).
- ☐ Owner to ensure adequate funds available to operate and maintain disinfection system.
- ☐ Implement preventative maintenance programs to minimize mechanical failure.
- ☐ Owner may obtain services from regional operator(s) if available.
- ☐ Owner should provide opportunities for training to increase operators knowledge associated with cause and corrective measures.
- ☐ Owner should ensure operators have appropriate level of training/education to allow operators to be eligible for certification in accordance with provincial standards. Operator training may be obtained via ACWWA, On-line courses and ENVC Operator Education, Training and Certification.

Capital Works Funding

- ☐ Contact nearest MIGA regional office and ENVC to initiate evaluation of existing water infrastructure.
- ☐ Owner to work with stakeholders (MIGA, ENVC, and engineering consultants) to identify sustainable options.
- ☐ Owner to make an application to MIGA for project funding. Online applications can be made at: https://msis.gov.nl.ca/MSIS/Security/External/externaldefault.aspx?ReturnUrl=%2fMSIS%2f.

IMPLEMENT PREVENTATIVE MAINTENANCE

DAILY

- ☐ Measure and record flow rates.
- ☐ Complete daily disinfection and treatment logs.
- ☐ Visual inspection of chemical feed pumps and feed lines.
- ☐ Measure and record chemical usage.
- ☐ Measure and record free and total chlorine residual throughout the distribution system (first user, end of main and branch lines).

WEEKLY

- ☐ Visual inspection of chlorine injector for leaks and ensure operating normal.

MONTHLY

- ☐ Inspect and clean intake structure, intake screens and pipeline.
- ☐ Inventory all consumables and order supplies as necessary.

3 MONTHS

- ☐ Clean chemical feed lines and solution tanks.

6 MONTHS

- ☐ Inspect watershed for potential sources of contamination (including development activity, storage of chemicals/fuels and animal activity).

ANNUAL

- ☐ Inspect dam and spillway for signs of deterioration, malfunction, blockages and public safety.

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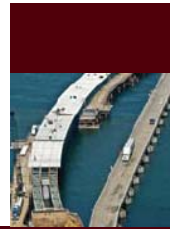
Implementation of SOPs – Community C



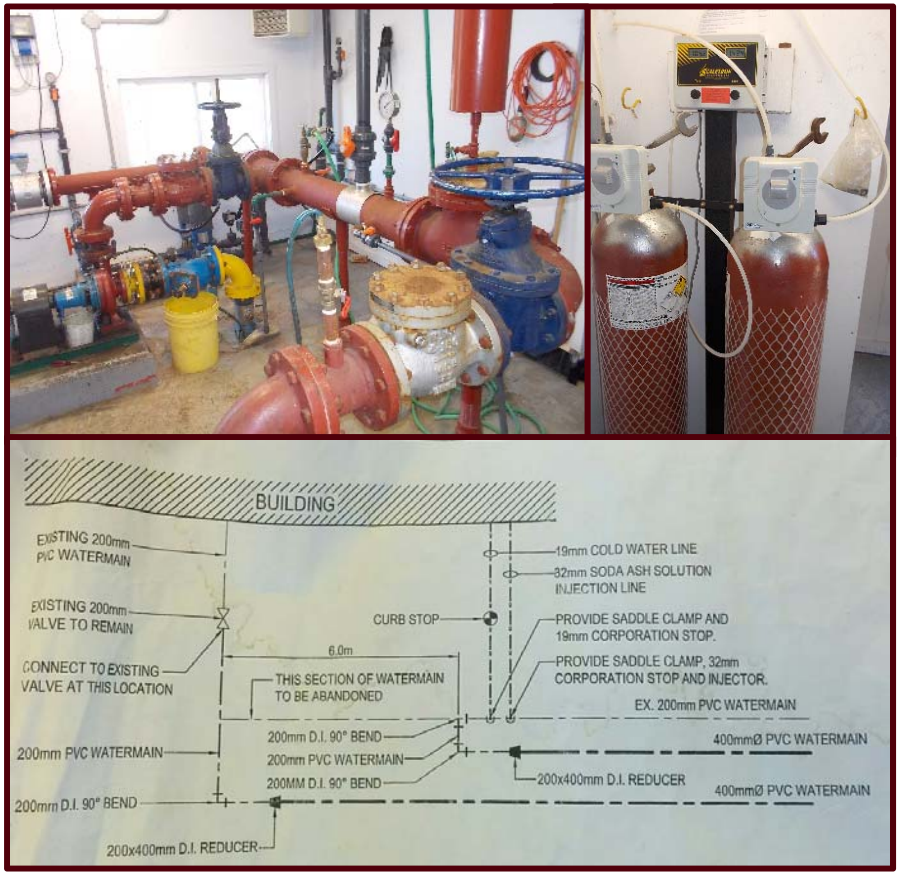
BOIL WATER ADVISORY SYSTEM ASSESSMENT FORM

Town Name	Community C		
Assessor Name	BM		
Assessor Title			
Contact Phone #		Date of Assessment	04-Oct-16

Boil Water Advisory Issue Date	03-Dec-12
BWA Reason Code	E1

Cause(s) of BWA	1.	Not providing a high enough free chlorine dose
	2.	Not measuring free chlorine residual
	3.	High concentration of organics in water
	4	

Page 1



Implementation of SOPs – Community C

STANDARD OPERATING PROCEDURE

SOP #	10	REASON CODE:	E1—Water entering the distribution system or facility, after a minimum 20 minute contact time does not have a free chlorine residual of at least 0.3 mg/L or equivalent CT value.	REV:	0	DATE:	Dec. 2015

BWA CAUSE IDENTIFICATION

- Complete Assessment Tool
- Identify Potential Cause(s)

Cause #1
Increased flows (demand) on the distribution system and the disinfection system is operating in manual mode

Cause #2
Change in water quality affecting the chlorine demand

Cause #3
Disinfectant strength weak due to long storage beyond shelf life

Cause #4
Design of system did not provide for adequate contact time

Cause #5
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RECOMMENDED STEPS TO ADDRESS BOIL WATER ADVISORY

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Confirm Operation and Lift BWA

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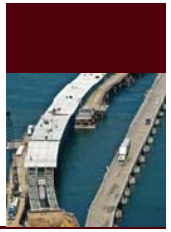
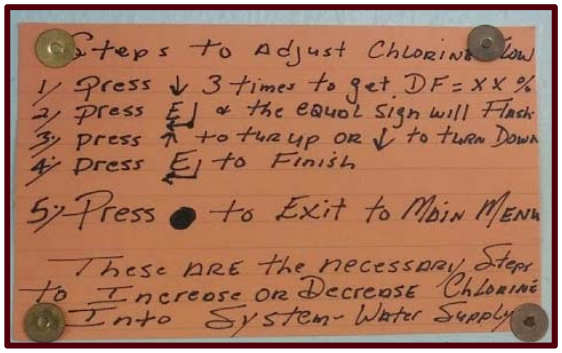
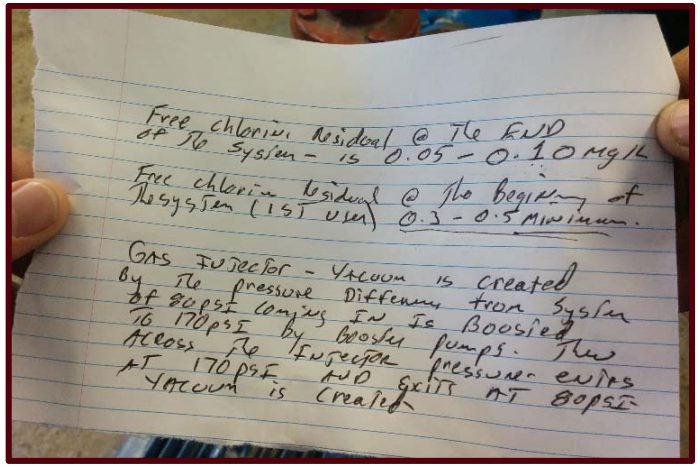
Implementation of SOPs – Next Steps

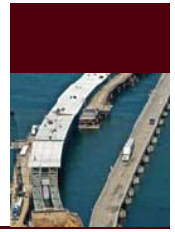


- Assist with funding applications
- Help initiate preventive maintenance plans
  - Encourage use of log sheets (daily, weekly, monthly, quarterly, annual checks)
- Revise assessment form and complete minor revisions to SOPs

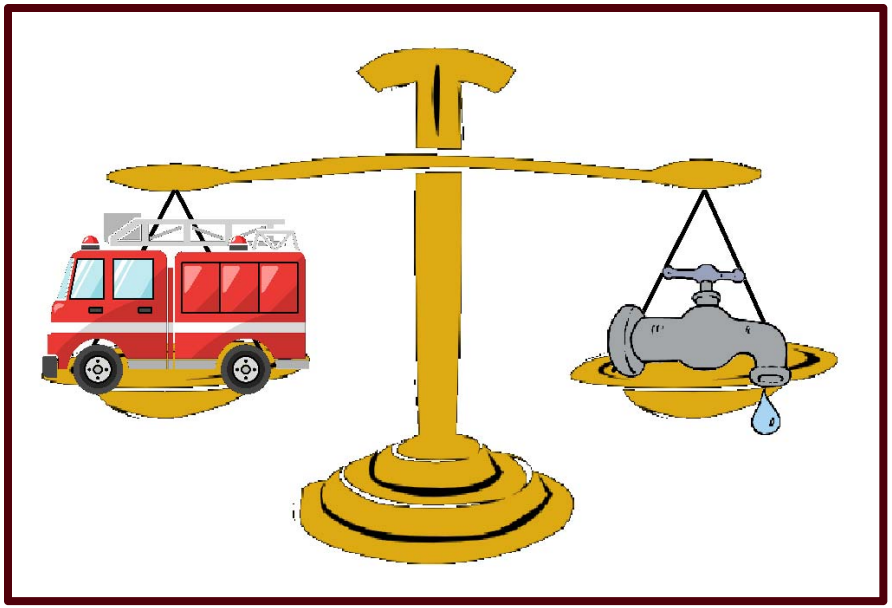




Project Objectives – Cost Accounting Tool



- Develop a tool for financial planning
  - Realize current costs for operating water system
  - Identify amount that should be spent
    - Preventive maintenance
    - Best practices for sampling and monitoring
  - Identify rates for full cost recovery
  - Identify capital and annual costs for upgrades
- The tool must:
  - Be simple to use, yet contains sufficient inputs to provide reasonable outputs
  - Be based on reliable cost estimates
  - Generate reasonable outputs



Project Partners:
G.A. Isenor Consulting Limited
Blaine S. Rooney Consulting Limited

Cost Accounting Tool

- Many communities are not aware of the true cost of operating their system or what level of funding should be allocated for maintenance
- Community water rates may not reflect actual cost of operation
- Where resources are limited, water systems may become neglected
- Purpose of this project was to help understand cost of proper operation and maintenance and identify water rates to sustainably fund operations

Cost Accounting Tool

COST ACCOUNTING TOOL

Inputs (existing expenses and revenues)

- Community data
- Treatment and Disinfection System
- Current costs
- Current Revenues

Calculations

- O&M Cost Curves
- Capital Cost Curves
- Financing

Outputs

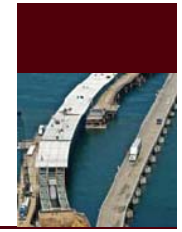
Existing Operations

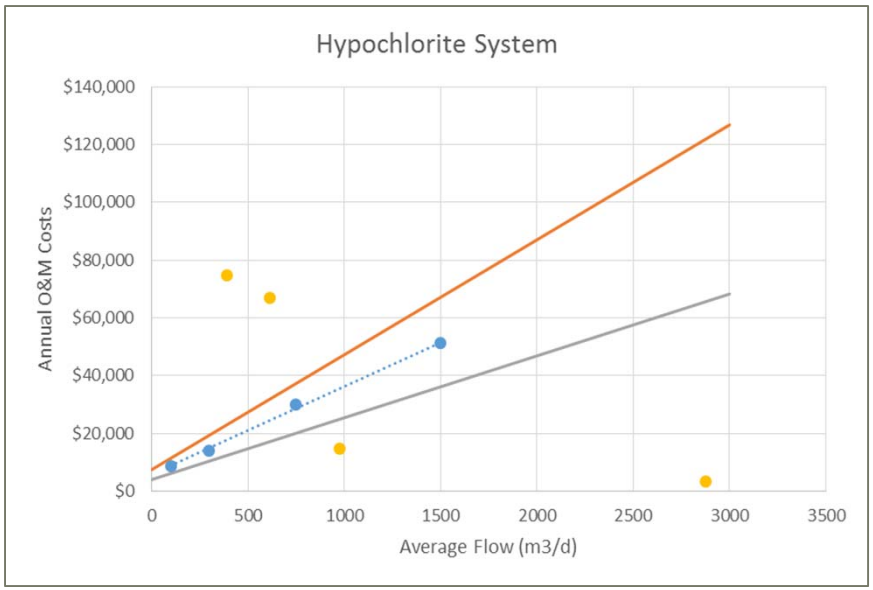
- Recommend annual O&M budget
- Recommend water rate
- Identify gaps between present and recommended water rates

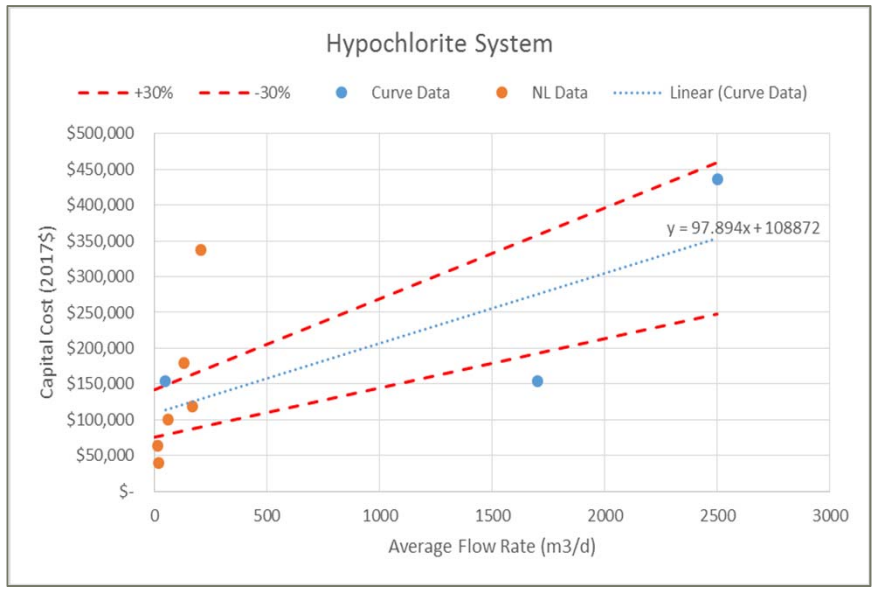
Upgrades

- Upgrade Costs (O&M, Capital, Replacements)
- Identify recommended rate cost
- Identify gaps between present and recommended water rates

Cost Accounting Tool







Newfoundland Labrador

Province of Newfoundland & Labrador

Full Cost Accounting Tool

To Achieve Complete Cost Recovery of Drinking Water Supply System Operation & Maintenance

Community:

Geographic Region:

Avalon (St. John's)
Eastern (Clarenville)
Central (Gander)

Date:

Year: 2017

Begin

Cost Accounting Tool

Community Data

General Information

Community:	Community A
System:	Surface Water System 1
Type of Water Supply:	Surface Water

Geographic Region: (●) St. John's/Avalon ( ) Central ( ) Labrador ( ) Eastern ( ) Western

Date: March 6 **Year:** 2017

Population

Enter the current population of the community:	500
Enter service population for the water system being evaluated:	350

**Note: The cost analysis that follows is based on the population served by the water supply system specified above and not the total community populaiton.*

Existing System Flows

If flow data is available, enter it below. If flow data is not entered, the Cost Accounting Tool will automatically estimate flows based on population data.

Average Flow	75	usgpm	409 m^3/d	**Per Capita Consumptior *1168 L/p/d***
Maximum Day Flow		<Units>	m^3/d	
Peak Hour Flow		<Units>	m^3/d	

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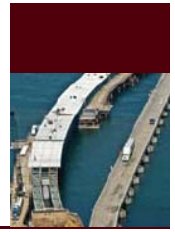
Cost Accounting Tool



Description of Existing Water Supply System

Existing Treatment & Disinfection Systems

Select the disinfection system operated at the facility:

- ○ Sodium Hypochlorite (liquid chlorine)
- ◉ Chlorine Gas
- ○ Onsite Sodium Hypochlorite Generation (Mixed Oxidants)
- ☐ UV Disinfection

Existing Treatment & Disinfection Systems

Does the treatment process include pH adjustment with any of the following chemicals:

○ None ◉ Soda Ash ○ Lime ○ Caustic Soda

Select the treatment processes that are provided at the existing facility:

- ◉ None
- ○ Inline Filtration
- ○ Iron / Manganese Removal
- ○ Arsenic Removal
- ○ Membrane Treatment
- ○ Conventional WTP
- ○ PWDU

Existing Pumping Systems

Does the existing water supply system include any of the following pumping systems:

- ☐ Ground water pumping
- ☐ Low lift pumping (pumping from surface water source to treatment building)
- ☑ High lift pumping (pumping from treatment building to distribution system)
- ☐ Distribution System Pumping

If distribution system pumping is provided, approximately what fraction of the distribution system is fed from the booster pumping station? <Percentage>

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Cost Accounting Tool

Existing Expenditures

Enter the actual expenditures from the most recent year. If budgets have also been prepared for next year, enter the data in the budget column.

Source of Supply		Item Descriptions
Expenditure	***2016 Actual***	***2018 Budget***
Wages and Benefits	$20,000	
Maintenance of Source of Supply - Surface Water Watersheds incl. travel	$5,000	
Maintenance of Source of Supply - Groundwater Recharge Areas incl. travel		
Professional Services - Consulting & Engineering		
Other		
Other		
Total	***$25,000***	***$0***

Pumping		Item Descriptions
Expenditure	***2016 Actual***	***2018 Budget***
Wages and Benefits	$10,000	
Maintenance of Pump Station Structures incl. travel		
Maintenance of Pumps and Controls incl. travel	$5,000	
Electricity	$3,000	
Fuel for Generators and for Building Heat	$2,500	
Professional Services		
Other		
Other		
Total	***$20,500***	***$0***

Existing Revenue

Revenue

Enter the number of customers in the Surface Water System 1 supply system: 300

Note: The number of customers is equivalent to the total number of service connections; not the population. If the number of customers is unknown, the value will be automatically estimated based on population by assuming that there are 2.3 people per dwelling.

Enter the annual water rate/water tax charged to each customer: $120

If industrial/commercial customers are charged a different rate:

- **Enter the number of commercial/industrial customers charged at this rate** 1
- **Enter the rate charged to each commercial customer** $100

Enter the total revenue generated from other sources: $500

Total Revenue ***$36,600***

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Cost Accounting Tool

Analysis of Existing Rates/Water Tax

Current Balance

Total Revenue	$36,100
Total Expenditures	$90,500
Balance	$0

This indicates that existing revenues are not sufficient to cover the costs of operation.

Evaluation of Existing Costs

Item	*Actual 2016*	*Best Practices O&M Costs* [1]
Source of Supply	$25,000	$10,800
Pumping	$20,500	$12,500
Treatment & Disinfection	$10,000	$35,700
Transmission & Distribution	$5,000	$123,500
Administration	$30,000	$18,250
Total	$90,500	$200,750

This result indicates that the community should consider increasing the budget for operation and maintenance of the water supply system.

[1] *Typical/Recommended expenditures have been calculated based on the size of the community and characteristics of the water supply system. These values were estimated assuming best practices are followed for items such as monitoring, preventive maintenance, etc. While every water supply system is unique, large variations*

Gap Analysis

	Annual Water Tax per Customer	Gap From Current
Current	$120	-
Minimum to Fund Existing Operations	$302	$182
Minimum to Fund Best Practices Operations	$669	$549

Water taxes should be increased to a minimum of $302 per household to fund existing operations. If water system operation budgets are increased, taxes should be further increased.

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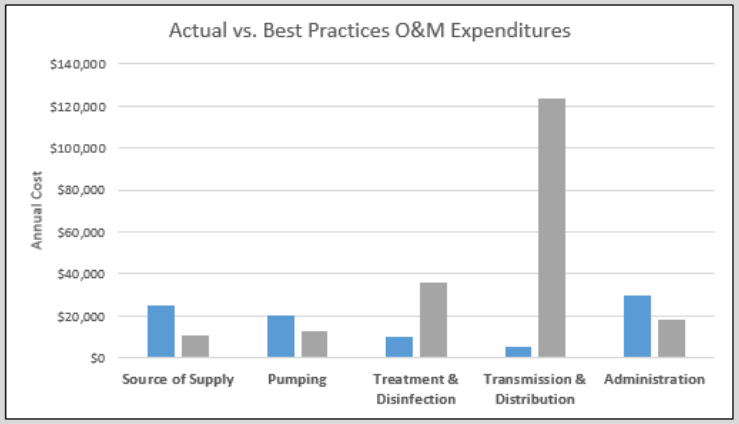
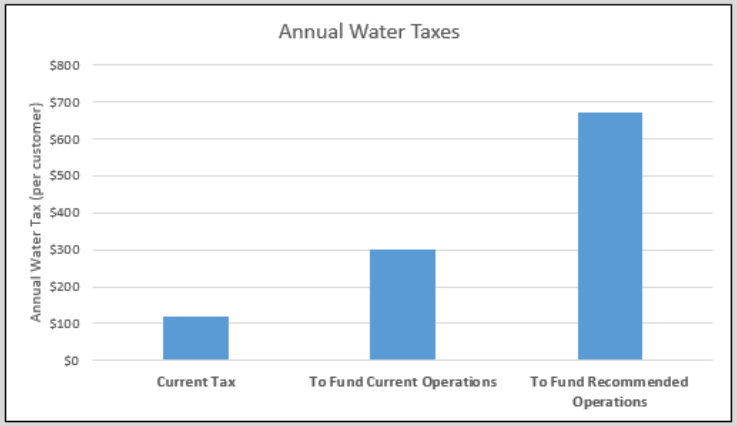




Cost Accounting Tool

Upgrades: Description of Proposed System

Disinfection System Following Upgrades

What type of chemical disinfection system will be used?

- (●) Sodium Hypochlorite (liquid chlorine)
- ( ) Chlorine Gas
- ( ) Mixed Oxidants (Onsite generated sodium hypochlorite)

Will existing disinfection equipment be used or will new equipment be purchased?

- (●) New
- ( ) Existing

Will the disinfection system be housed in a new or existing building? or existing building?

- (●) New
- ( ) Existing

Will UV disinfection be provided?

- ( ) Yes
- (●) No

If UV disinfection is being provided, will it be a new or existing equipment?

- (●) New
- ( ) Existing

If UV disinfection is being provided, will it be in a new or existing building?

- (●) New
- ( ) Existing

Upgrades: Description of Proposed System

Proposed Treatment Process

Specify the processes that will be included, whether the equipment will be new or existing, and if the equipment will be installed in a new or existing building.
Note: you only need to select the processes that are included. Those that are not included can be left as is.

Treatment Process	Equipment			Building (if process included)	
pH Adjustment System	( ) Not included	( ) New	(●) Existing	(●) New	( ) Existing
Inline Pressure Filtration	(●) Not included	( ) New	( ) Existing	( ) New	(●) Existing
Fe and/or Mn Removal	(●) Not included	( ) New	( ) Existing	(●) New	( ) Existing
As Removal	(●) Not included	( ) New	( ) Existing	( ) New	(●) Existing
Membrane Treatment	(●) Not included	( ) New	( ) Existing	( ) New	(●) Existing
Conventional WTP	( ) Not included	(●) New	( ) Existing	(●) New	( ) Existing
PWDU	(●) Not included	( ) New	( ) Existing	( ) New	(●) Existing

Describe the types of pumps that will be included in the proposed system

Specify the processes that will be included, whether the equipment will be new or existing,

and if the equipment will be installed in a new or existing building.
Note: you only need to select the processes that are included. Those that are not included can be left as is.

Pumping Processes	*Included in Upgrades*	*New or Existing Equipment?*	*With VFDs?*	*New or Existing Building*
Well Pump	No	<Equipment>	No	<Building?>
Low Lift Pump	Yes	New	Yes	New
High Lift Pump	No	<Equipment>	No	<Building?>

Treated Water Storage

Cost Accounting Tool

Costs for Proposed Upgrades

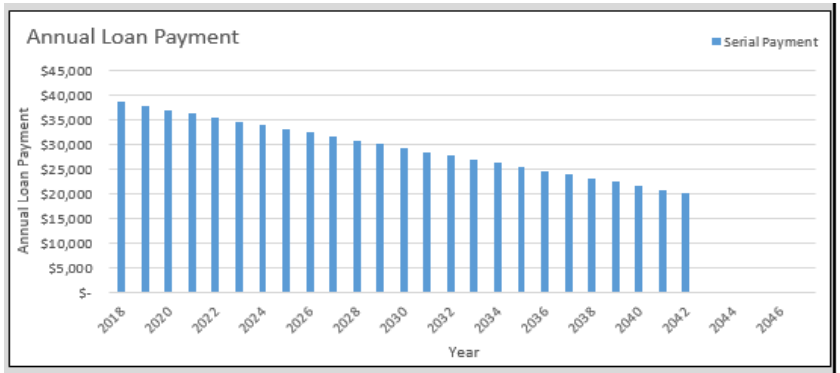
Capital Costs for Upgrades

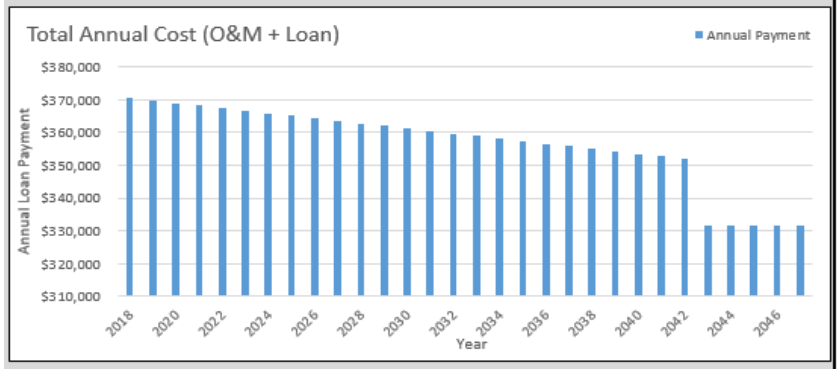
Enter the fraction of the capital cost will be covered by government funding: 90%

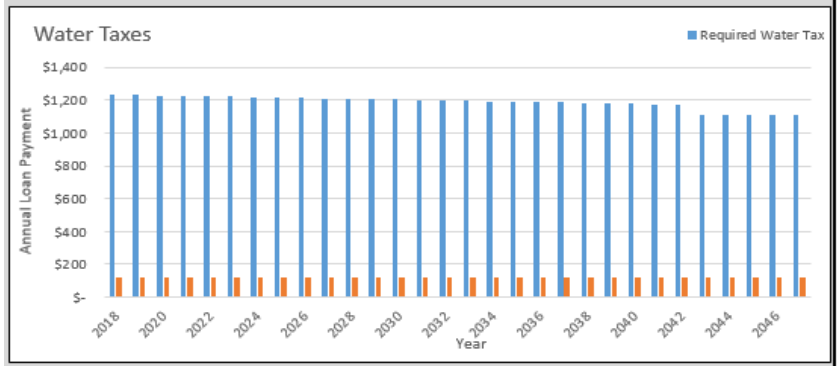
Upgrade Component	Capital Budget Estimate	Government Contributions	Net Funding Required
New Well(s)			
Sodium Hypochlorite System	$65,000	$58,500	$6,500
Gas Chlorination System			
Onsite Sodium Hypochlorite Generation System			
UV Disinfection System			
pH Adjustment System			
Pressure Filtrations System			
Iron/Manganese Removal System			
Arsenic Removal System			
Membrane Filtration System			
Conventional Water Treatment System	$2,105,000	$1,894,500	$210,500
PWDU			
Pumping Systems	$49,000	$44,100	$4,900
Building Upgrades	$1,682,000	$1,513,800	$168,200
Yard Piping	$52,000	$46,800	$5,200
Treated Water Storage	$1,028,000	$925,200	$102,800
Range of Probable Cost			
-30%	$3,486,700	$3,138,030	$348,670
Median	$4,981,000	$4,482,900	$498,100
+30%	$6,475,300	$5,827,770	$647,530

Operation and Maintenance Costs

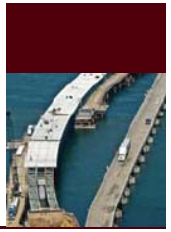
Item	Opinion of Probable O&M Costs [1]
Source of Supply	$12,800
Pumping	$15,400
Treatment & Disinfection	$119,900
Transmission & Distribution	$153,600
Administration	$30,170
Total	$331,870





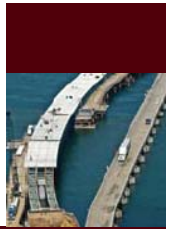


Next Steps – Cost Accounting Tool



- Pilot the tool in eight communities
- Refine cost curves
- Improve layout
- Provide detailed instructions

Conclusion



Thank you.