
ONTARIO CENTRE FOR MUNICIPAL BEST PRACTICES

200 University Ave., Suite 801, Toronto, Ontario, M5H 3C6

BEST PRACTICE SUMMARY REPORT

February, 2008

Water and Wastewater

PROJECT APPROACH

The focus of the 2007 Ontario Municipal Benchmarking Initiative (OMBI) business question was on wastewater inflow and infiltration (I&I) and water loss management for water supply systems.

The amount of inflow and infiltration that occurs within a wastewater collection system can significantly impact core performance measures relating to volume of wastewater treated, percentage of wastewater bypassing treatment, operating costs for wastewater collection and treatment, the number of wastewater main backups and customer complaints.

Water loss also plays a considerable role in adversely affecting performance measures such as water distribution efficiency, water accountability, water operating cost for water distribution and treatment, and volume of water treated. The two segments of the business question, allow for the assessment of relevant issues relating to both water distribution and wastewater collection systems.

Inflow and Infiltration

The occurrence of inflow and infiltration results in extraneous flows above the base sanitary sewage loadings in collection systems, and ultimately in wastewater treatment facilities. Inflow is associated with precipitation events where storm water enters the sanitary collection system, while infiltration is related to ground water entering a collection system. The inflow and infiltration segment of the business question focused on gathering information on the amount of I&I entering wastewater collection and treatment systems between OMBI municipalities, operating costs associated with I&I entering the wastewater collection and wastewater treatment systems, and options to reduce I&I. The goal of this assignment was to determine what initiatives are currently being undertaken or being proposed by OMBI Municipalities to address and prevent extraneous flows to wastewater treatment facilities due to inflow and infiltration.

Water Loss Management

Water loss management contributes to reduced water loss, environmental benefits, public accountability, financial improvements, more efficient water use and the safeguarding of public health and property. Currently, OMBI municipalities are tracking water loss with the performance measure “percentage of unaccounted for water,” but have recognized that this performance measure is too simplified and must be modified to account for other factors. The benefits associated with adopting the International Water Association (IWA) Water Balance methodology, which is advocated by the American Water Works Association (AWWA) and InfraGuide, along with the ease of utilizing the methodology by OMBI municipalities was investigated. New OMBI Performance Measures for water loss management were also investigated and best practice documentation for water loss management was developed. The goal of the water loss management section of the business question was to determine if OMBI Municipalities could estimate and quantify actual un-metered water use according to IWA Water loss management documents, determine the estimated annual operating costs associated with estimating water loss due to leakage for water distribution and water treatment systems, and conclude the appropriateness of the adoption of the IWA Water Loss Management Performance Measure by the OMBI Water & Wastewater Expert Panel.

Summarized below is the process utilized to identify inflow and infiltration and water loss management Best Practitioners and Best Practice (BP) case studies. The data and information review took place in two stages. The first stage involved a survey completed by OMBI municipalities, followed by round table discussions at OMBI Water & Wastewater Expert Panel meetings on July 9th and August 13th, 2007. The second stage included a review of National Water & Wastewater Benchmarking data, interviews with selected municipalities, and the subsequent documentation of selected BP case studies.

Stage 1: Ontario Municipal Benchmarking Initiative (OMBI) – Survey Data

The OMBI Water & Wastewater Expert Panel conducted two surveys concerning programs, operating practices, and procedures utilized by OMBI municipalities to address inflow and infiltration in wastewater systems and water loss management. The surveys helped identify the types of programs and protocols currently in place to address inflow and infiltration and water loss. The surveys were subdivided into the areas summarized below:

Inflow and Infiltration:

- OMBI performance measure data
- Wastewater collection system type
- Wastewater collection system maintenance and operational activities
- Wastewater collection system inflow and infiltration investigations
- Municipal by-laws and policies and procedures to control inflow and infiltration to wastewater collection systems
- Impact of inflow and infiltration on individual wastewater treatment plants

Water Loss Management

- OMBI performance measure data
- Water distribution system maintenance and operational activities
- Municipal policies and procedures
- Detail for unbilled authorized consumption

The surveys were completed by the following OMBI municipalities:

- City of Hamilton
- City of Ottawa
- City of Sudbury
- City of Thunder Bay
- City of Toronto
- City of Windsor
- District of Muskoka
- Region of Durham
- Region of Halton
- Region of Niagara
- Region of Peel
- Region of Waterloo
- Region of York

The survey information was compiled, reviewed, and analyzed. Using the survey results, the potential “best practitioners” were identified. (a copy of the survey has been attached at the end of this document).

OMBI municipalities were also asked to quantify “water losses” and calculate the Infrastructure Leakage Index based on IWA methodology.

During OMBI Water and Wastewater Expert Panel meetings, each attending Municipality provided an overview of their Inflow and Infiltration and Water Loss Management Projects, Protocols and Procedures that were either proposed, or currently under way. These discussions, in conjunction with the survey data, provided a good overview of the Municipalities active in Inflow and Infiltration and Water Loss management initiatives.

Stage 2A: Development & Potential Best Practitioner Questionnaire

In the second stage, Earth Tech conducted detailed interviews with the OMBI municipalities identified in Stage One as potential best practitioners. The results were used in developing the Best Practice reports for review by the OMBI Water and Wastewater Expert Panel, the OMBI Steering Committee, and the OCMBP for review and approval prior to publication on the OMBI and OCMBP websites.

From the analysis of Stage 1, nine potential best practicing municipalities were identified and selected for follow-up interviews:

- City of Ottawa
- City of Sudbury
- City of Thunder Bay
- City of Toronto
- Region of Durham
- Region of Halton
- Region of Niagara
- Region of Peel
- Region of York

The Stage 2A questionnaire was developed to obtain additional information and underlying factors to help identify and confirm best practices. The portion of the questionnaire relating to Inflow and Infiltration addressed inflow and infiltration program backgrounds how the programs identify areas and sources of inflow and infiltration, implemented inflow and infiltration reduction strategies, subsidy programs, and other factors that should be considered as a component of the best practice in question.

Similarly the water loss management portion of the questionnaire addressed program backgrounds, how the programs identify areas and sources of water loss, water loss reduction strategies, and other factors that should be considered as a component of the best practice in question.

From these interviews, a number of inflow and infiltration and water loss management practices and initiatives were identified. The results of the interviews were presented at an OMBI Water and Wastewater Expert Panel meeting. Five case study topics for eight municipalities were selected to be prepared as Best Practice Reports:

1. Inflow and Infiltration: Downspout Disconnection (City of Thunder Bay)
2. Inflow and Infiltration: Increasing System Knowledge, and Operation Coordination through Flow Monitoring (Region of Peel, Region of York, Region of Niagara)
3. Inflow and Infiltration: Customer Outreach – (Region of Halton, City of Toronto)
4. Water Loss Management: Adopting Water Loss Management Strategies (City of Ottawa, City of Greater Sudbury)
5. Water Loss Management: Cathodic Protection (Region of Durham)

In addition to the five best practice case studies listed above, general inflow and infiltration and water loss management practices identified during interviews with selected municipalities have also been summarized and reported. The general best practices also addressed the specific questions identified in the 2007 business question and background to inflow and infiltration and water loss management.

Stage 2B: Best Practice Case Study Report Development

Five best practice case studies and general Inflow and Infiltration and Water Loss Management Practices draft reports were completed, and presented to the OMBI Water and Wastewater Expert Panel. Each report was reviewed by the case study municipalities, as well as the OMBI Water & Wastewater Expert Panel review sub-committee. A roundtable discussion and review of the draft reports was also conducted during an OMBI Water & Wastewater Expert Panel meeting. Final comments, changes, and updates were made.

Next Steps:

The Best Practice Reports and the General Management Practices report have been finalized and submitted to the Ontario Municipal Benchmarking Initiative (OMBI) Program Director and the Ontario Centre for Municipal Best Practices for review and approval by the respective Steering Committees.

Once the documents are approved by the Steering Committees and have received approval by the Chief Administrative Officers of the OMBI Municipalities, the reports will be published on the Ontario Centre for Municipal Best Practices web site. The publication of the reports will promote the continued cooperation between OMBI and OCMBP in examining and reporting on Best Practices employed by Ontario Municipalities.

Stage 1: Survey of OMBI Municipality Inflow and Infiltration Management Practices & Protocols

OMBI 2007 Supplementary Survey on Wastewater Inflow & Infiltration			
Reporting Municipality:	Information Prepared By:	Date Prepared:	Page 1 of 8
Core OMBI Performance Measures:			
Please insert information on OMBI Performance Measures from your 2007 OMBI Submission (2006 Data).			
OMBI Data Warehouse Reference	OMBI Performance Measure	2006 Data	
WWTR002	Serviced Population		
WWTR205	KM of Wastewater Pipe (excluding connections)		
WWTR105	Average age of Wastewater Pipe		
WWTR305	Operating Cost of Collection per KM of Pipe		
WWTR210	Megalitres of Wastewater Treated per 100,000 population.		
WWTR310M	Operating Cost (\$000's) / Megalitre Treated & Disposed Wastewater Treatment Plants		
WWTR110M	Percentage of Wastewater Estimated to have Bypassed Treatment.		
WWTR405M	Annual Number of Wastewater Main Backups per 100 KM of Wastewater main		
WWTR801	Total Number of Primary Wastewater Plants.		
WWTR802	Total Number of Secondary Wastewater Plants.		
WWTR803	Total Number of Tertiary Plants		
WWTR806	Average Day Utilization of Individual Wastewater Treatment Plants (Provide data for individual plants on pages 7 & 8 of survey)	Refer to pages 7 & 8 of survey	
WWTR807	Peak Utilization of Individual Wastewater Treatment Plants (Provide data for individual plants on pages 7 & 8 of survey)	Refer to pages 7 & 8 of survey	
WWTR808	Estimated length of wastewater service connections. (Within right of way)		
Not Applicable	Variation in seasonal flow rates and estimates of total annual Inflow & Infiltration (Suggested New Measure)	Methodology for this measure to be developed by Expert Panel.	
Additional Comments:			

OMBI 2007 Supplementary Survey on Wastewater Inflow & Infiltration

Reporting Municipality:	Information Prepared By:	Date Prepared:	Page 2 of 8
-------------------------	--------------------------	----------------	-------------

Information on Wastewater Collection Systems: This section of the survey is intended to provide a brief profile of your wastewater collection system(s) relative to the nature of the system(s) design and related response to precipitation events.

Type of Wastewater Collection System	Description of System	Estimated Percentage of Wastewater Collection System By Type: <small>(By ratio of system length or by ratio of serviced area)</small>
Combined Wastewater Collection System.	System initially designed to accommodate both storm drainage and sanitary sewage with flows in excess of storm sewer capacity designed to overflow into sanitary sewage system.	
Partially Combined Wastewater Collection 1	Sewage system initially designed to accommodate sanitary sewage and flows from foundation drainage connected to sanitary sewage system. Downspouts discharged to grade or connected to storm sewer system.	
Partially Combined Wastewater Collection 2	Sewage system initially designed to accommodate sanitary sewage, flows from foundation drainage and downspouts connected to sanitary sewage system.	
Separated Wastewater Collection System	Sewage system initially designed to accommodate sanitary sewage flows only. Flows from foundation drainage are handled by sump pumps with discharge to grade or by gravity connection to a separate storm sewer system. Flows from downspouts are directed to grade or connected by to a separate storm sewer system.	
Other Types of Wastewater Systems	Description of system to be provided.	

Additional Comments:

OMBI 2007 Supplementary Survey on Wastewater Inflow & Infiltration

Reporting Municipality:

Information Prepared By:

Date Prepared:

Page 3 of 8

Information on Municipal Wastewater Collection System Maintenance & Operation Activities.

Description of Activity	Questions related to Activity	Municipality Response	Estimated Annual Expenditure or Total Estimated Cost
Wastewater Collection System Inspections	1. Do you have an annual CCTV sewer inspection program ?		
	2. What percentage of your wastewater water collection system is inspected on an average annual basis?		
	3. What convention do you employ to rate sewer deficiencies and how do you prioritize repairs?		
	4. How many wastewater maintenance chambers are in your system?		
	5. What percentage of your wastewater water collection system maintenance chambers are inspected on an average annual basis?		
	4. Where does the rectification of inflow and infiltration to your wastewater system fall with your priorities for addressing system deficiencies?		

Comments:

OMBI 2007 Supplementary Survey on Wastewater Inflow & Infiltration

Reporting Municipality:	Information Prepared By:	Date Prepared:	Page 4 of 8
-------------------------	--------------------------	----------------	-------------

Information on Municipal Wastewater Collection System Maintenance & Operation Activities.

Description of Activity	Questions related to Activity	Municipality Response		Estimated Annual Expenditure or Total Estimated Cost
System Repair / Replacement (Pipes and maintenance chambers)	1. Do you have an inventory of sewer deficiencies and have you quantified the cost associated with the required repair or replacement?			
	2. What is the estimated total value of identified wastewater collection system deficiencies.			
	3. What is your average annual budget allocation (five year average) allocated for sewer repair / replacement.			
	4. What techniques do you employ to rectify sewer deficiencies (i.e. Spot Repairs, Reaming & Sealing, Sewer Relining, Complete Replacement etc.) and what is the approximate percentage of your annual budget for repair / replacement applicable to each category?	Repair Technique	Approximate % of Program	\$ / annum
		Spot Repairs (Excavation)		
		Complete Replacement		
		Reaming & Sealing		
		Sewer Relining		
Maintenance Chamber Repair				
Other (Describe)				

Comments:

OMBI 2007 Supplementary Survey on Wastewater Inflow & Infiltration

Reporting Municipality:	Information Prepared By:	Date Prepared:	Page 5 of 8
--------------------------------	---------------------------------	-----------------------	-------------

Information on Municipal Wastewater Collection System Inflow & Infiltration Investigations

Description of Activity	Questions related to Activity	Municipality Response	Estimated Annual Expenditure or Total Estimated Cost
Wastewater Collection System Inflow & Infiltration Investigations	1. Does your municipality have a "Master Plan" to examine Inflow & Infiltration to your wastewater system to address impacts on both the collection system and wastewater treatment facilities? If yes please provide a brief description of the plan.		n.a.
	2. Does your municipality conduct Inflow & infiltration investigations on an annual basis?		n.a.
	3. What is your annual budget allocation for Inflow and Infiltration Investigations? (Five Year Average)		
	4. Are your Inflow & Infiltration Investigations of a reactive nature as a result of Basement flooding events?		
	5. Please indicate the type of Inflow & Infiltration investigations conducted by your municipality by placing an 'x' in the table provided. Provide by bullet point summary any specialized equipment or analysis techniques utilized in your investigations.	Inflow & Infiltration Investigations	Insert 'X'
		Flow Monitoring / Ultrasonic Devices	
		Flow Monitoring / Weirs	
		Smoke Testing of Wastewater System	
		Dye Testing of Downspouts	
	•		
•			
•			
•			

Comments:

OMBI 2007 Supplementary Survey on Wastewater Inflow & Infiltration

Reporting Municipality:	Information Prepared By:	Date Prepared:	Page 6 of 8
--------------------------------	---------------------------------	-----------------------	-------------

Municipal By-Laws and Policies / Procedures to Control Inflow to Wastewater Collection Systems

Description of Activity	Questions related to Activity	Municipality Response
Municipal Policies, Procedures and By-Laws	1. Does your municipal Sewer Use By-Law or specific polices & procedures prevent the connection of foundation drainage and downspouts to the wastewater collection system for new construction ?	In your response please provide information related to the success of implementing the By-Law.
	2. Does your municipal Sewer Use By-Law or specific polices & procedures prevent the connection of sump pumps from existing development to the wastewater collection system?	In your response please provide information related to the success of implementing the By-Law.
	3. Does your municipal Sewer Use By-Law or specific polices & procedures prevent the connection of downspouts from existing development to the wastewater collection system?	In your response please provide information related to the success of implementing the By-Law.
	4. Has your Municipality undertaken programs to identify areas where downspouts and /or sump pump discharges are connected to the wastewater collection system?	In your response please provide information on the reason why such investigations were undertaken
	5. Has your municipality undertaken programs in those areas with downspouts and / or sump pumps connected to the wastewater collection systems to eliminate this source of extraneous flow to the wastewater system?	In your response please provide a brief outline of the type of program undertaken, approximate number of homes involved and results achieved.
	6. Has Municipal funding been made available to assist property owners in the disconnection of downspouts or sump pump drainage from the wastewater collection system?	In your response please provide information related to the program.
Comments:		

OMBI 2007 Supplementary Survey on Wastewater Inflow & Infiltration

Reporting Municipality:	Information Prepared By:	Date Prepared:	Page 7 of 8
--------------------------------	---------------------------------	-----------------------	-------------

Impact of Inflow & Infiltration on Individual Wastewater Treatment Facilities

A	B	C	D			E	F	G	H	I	J	K	L	M					
WWTP Reference Number	Name of WWTP	Treated Effluent Receiver	Level of Treatment Provided			MOE Rated WWTP Capacity	2006 Average Utilization (WWTR806)	2006 Peak Utilization (WWTR807)	2006 Total Volume of Wastewater Treated	2006 Estimated Annual Base Wastewater Flow (Refer to Note #1 below.)	2006 Estimated Annual Volume of Inflow & Infiltration (Column 'H' minus Column 'I')	2006 Variable Operation & Maintenance Costs per Megalitre Treated (Refer to Note # 2 below for definition of variable costs)	2006 Estimated Annual Inflow & Infiltration Cost of Treating (Column 'J' times Column 'K')	Types of Collection Systems Tributary to WWTP					
			P	S	T									P	P1	P2	S	O	
WWTP 1						ML/Day	ML/Day	# Days > 90 %	ML	ML	ML	\$ / Megalitre Treated	\$ / Annum						
Explanatory Notes WWTP 1:																			
WWTP 2																			
Explanatory Notes WWTP 2:																			
WWTP 3																			
Explanatory Notes WWTP 3:																			
WWTP 4																			
Explanatory Notes WWTP 4:																			
WWTP 5																			
Explanatory Notes WWTP 5:																			

Notes:(1) The methodology to be employed to calculate the "Estimated Base Annual Wastewater Flow" will be discussed at the June 4th meeting of the OMBI Water & Wastewater Expert Panel. The "Base Wastewater Flow" would be calculated utilizing both the average daily sewage flow from the residential and ICI sectors and nominal infiltration to the system (during non wet weather events) for each of the municipalities wastewater treatment plants.
(2) Variable Operating & Maintenance Costs are those which are dependent on flow volumes treated such as energy costs (Electricity, Natural Gas , Diesel Fuel), Treatment Chemicals and Equipment Maintenance. Fixed cost for manpower and charge backs for other services which should not vary with flow volumes are not included.

OMBI 2007 Supplementary Survey on Wastewater Inflow & Infiltration

Reporting Municipality:	Information Prepared By:	Date Prepared:	Page 8 of 8
--------------------------------	---------------------------------	-----------------------	-------------

Impact of Inflow & Infiltration on Individual Wastewater Treatment Facilities

A WWTP Reference Number	B Name of WWTP	C Treated Effluent Receiver	D Level of Treatment Provided			E MOE Rated WWTP Capacity	F 2006 Average Utilization (WWTR806)	G 2006 Peak Utilization (WWTR807)	H 2006 Total Volume of Wastewater Treated	I 2006 Estimated Annual Base Wastewater Flow (Refer to Note #1 below.)	J 2006 Estimated Annual Volume of Inflow & Infiltration (Column 'H' minus Column 'I')	K 2006 Variable Operation & Maintenance Costs per Megalitre Treated (Refer to Note # 2 below for definition of variable costs)	L 2006 Estimated Annual Cost of Treating Inflow & Infiltration (Column 'J' times Column 'K')	M Types of Collection Systems Tributary to WWTP					
			P	S	T									P	P1	P2	S	O	
WWTP 6						ML/Day	ML/Day	# Days > 90 %	ML	ML	ML	\$ / Megalitre Treated	\$ / Annum						
Explanatory Notes WWTP 6:																			
WWTP 7																			
Explanatory Notes WWTP 7:																			
WWTP 8																			
Explanatory Notes WWTP 8:																			
WWTP 9																			
Explanatory Notes WWTP 9:																			
WWTP 10																			
Explanatory Notes WWTP 10:																			

Notes:(1) The methodology to be employed to calculate the "Estimated Base Annual Wastewater Flow" will be discussed at the June 4th meeting of the OMBI Water & Wastewater Expert Panel. The "Base Wastewater Flow" would be calculated utilizing both the average daily sewage flow from the residential and ICI sectors and nominal infiltration to the system (during non wet weather events) for each of the municipalities wastewater treatment plants.
 (2) Variable Operating & Maintenance Costs are those which are dependent on flow volumes treated such as energy costs (Electricity, Natural Gas , Diesel Fuel), Treatment Chemicals and Equipment Maintenance. Fixed cost for manpower and charge backs for other services which should not vary with flow volumes are not included.

Stage 1: Survey of OMBI Municipality Water Loss Management Practices & Protocols

OMBI 2007 Supplementary Survey on Water Loss Management			
Reporting Municipality:	Information Prepared By:	Date Prepared:	Page 1 of 6
Core OMBI Performance Measures:			
Please insert information on OMBI Performance Measures from your 2007 OMBI Submission (2006 Data).			
OMBI Data Warehouse Reference	OMBI Performance Measure	2006 Data	
WATR002	Serviced Population		
WATR205	KM of Distribution Water Pipe (excluding connections)		
WATR120	Average age of Water Pipe		
WATR305M	Operating Cost For Distribution per KM of Water Distribution Pipe		
WATR210	Megalitres of Water Treated per 100,000 population.		
WATR212	Percentage of Water Utilized for Industrial, Commercial and Institutional Uses		
WATR215	Wateruse (Megalitres Distributed per Household)		
WATR225	Percentage of Water Unaccounted For (Current OMBI Measure)		
WATR310M	Operating Cost (\$000's) / Megalitre Water of Drinking Water Treated		
WATR315M	Operating Cost for the Treatment and Distribution of Drinking Water Treated		
WATR410M	Number of Water Main Breaks per 100 KM of Pipe (Excluding Connections)		
WATR801	Total Number of Water Treatment Plants		
WATR802	Total Number of Groundwater Treatment Plants.		
WATR803	Total Number of Surface Water Plants		
WATR804	Total Number of Groundwater Plants with Disinfection Only		
WATR805	Total Number of Groundwater Plants with Enhanced Treatment and Disinfection		
WATR806	Total Number of Surface Water Treatment Plants Utilizing Conventional or Direct Filtration		
WATR807	Total Number of Surface Water Treatment Plants Utilizing Membrane Filtration		
WATR810	Average Utilization Rate of Individual Water Treatment Plants		
WATR811	Peak Capacity Utilization of Water Individual Treatment Plants		
WATR813	Estimated Length of Allowances for Service Connections (Within Right of Way)		
WATR814	Estimated Length of Hydrant Supply Leads		

OMBI 2007 Supplementary Survey on Water Loss Management

Reporting Municipality:	Information Prepared By:	Date Prepared:	Page 2 of 6
-------------------------	--------------------------	----------------	-------------

Information on Municipal Water Distribution System Maintenance & Operation Activities.

Description of Activity	Questions related to Activity	Municipality Response	Estimated Annual Expenditure or Total Estimated Cost	
Water Distribution System Inspections	1. Do you have an annual Leak Detection program?			
	2. What is the estimated annual cost for your leak detection program?			
	3. What percentage of your distribution system is inspected for leaks on an average annual basis?			
	4. What techniques / technologies do you employ to detect leaks in your system. Please itemize in your response including both field investigation and in house analysis / software.	Leak Detection Techniques and Analysis		
		•		
		•		
		•		
		•		
		•		
		•		
5. How many hydrants & valve assemblies are in your distribution system?				
6. What percentage of your hydrant and valve assemblies are inspected for leakage on an average annual basis?				
7. How do you classify leaks in your distribution system and how do you prioritize repairs?				
8. What is average length of time between identification of a leak (i.e.. Major, Minor , Pinhole etc.) and carrying out the necessary repair. If average times vary depending on the severity of the leak please provide this information in your response.				
9. What steps do you take to minimize water loss between the time the leak is detected and the repair being carried out.				

OMBI 2007 Supplementary Survey on Water Loss Management

Reporting Municipality:	Information Prepared By:	Date Prepared:	Page 3 of 6
--------------------------------	---------------------------------	-----------------------	--------------------

Information on Municipal Water Distribution Maintenance & Operation Activities.

Description of Activity	Questions related to Activity	Municipality Response	Estimated Annual Expenditure or Total Estimated Cost	
System Repair / Replacement Water Distribution System	1. Do you have an inventory of your water distribution system by pipe material and age?	Comments:		
	1. Do you have an inventory of watermain distribution system deficiencies and have you quantified the cost associated with the required repair or replacement?	Comments:		
	2. What is the estimated total value of identified water distribution system deficiencies. Is this data summarized by pipe material?	Comments:		
	3. What is your average annual budget allocation (five year average) allocated for watermain distribution system repair & replacement? (Including distribution pipes, hydrants / valve assemblies, valves and service connections.)	Comments:		
	4. What techniques do you employ to rectify water distribution system deficiencies (i.e. Spot Repairs, Relining, Complete Replacement etc.) and what is the approximate percentage of your annual budget for repair / replacement applicable to each category?	Repair Technique		Approx. % of Program
		Spot Repairs (Excavation)	Comments:	
		Complete Replacement	Comments:	
		Relining	Comments:	
		Hydrant Repairs / Replacement	Comments:	
		Valve Repairs / Replacement	Comments:	
Other (Describe)		Comments:		
Other (Describe)	Comments:			
Other (Describe)	Comments:			
		\$ / annum		

OMBI 2007 Supplementary Survey on Water Loss Management

Reporting Municipality:	Information Prepared By:	Date Prepared:	Page 4 of 6
-------------------------	--------------------------	----------------	-------------

Information on Municipal Water Distribution System: Cathodic Protection Programs

Description of Activity	Questions related to Activity	Municipality Response	Estimated Annual Expenditure or Total Estimated Cost
Cathodic Protection Programs	1. Does your Municipality have a Cathodic Protection Program to prevent or decrease the corrosion rate on existing water distribution infrastructure. Please provide details of your program in your Municipal response.	Comments:	
	2. What is the estimated annual cost of carrying out the Cathodic Protection program?	Comments:	
	3. Has the program been successful in reducing the number and frequency of breaks in your water distribution system?	Comments:	
	4. Have you quantified the cost savings related to the program?	Comments:	
	5. Have you been able to estimate the extended life cycle of water distribution assets which have been included in your cathodic protection program.	Comments:	
	6. Do your Municipal design standards / criteria require that ferrous components of your distribution system on new construction be cathodically protected.	Comments:	
	7. What is the typical cost of the initial installation of cathodic protection on new construction.	Comments:	
	8. What is your estimated annual cost of maintaining the cathodic protection (Monitoring and Anode replacement) for water distribution system. (Including existing and new installations)	Comments:	

Comments:

OMBI 2007 Supplementary Survey on Water Loss Management

Reporting Municipality:	Information Prepared By:	Date Prepared:	Page 5 of 6
--------------------------------	---------------------------------	-----------------------	-------------

Information on Municipal Policies & Procedures

Description of Activity	Questions related to Activity	Municipality Response	Estimated Annual Expenditure or Total Estimated Cost
Municipal Policies and Procedures	1. Does your Municipality have a program in place to prevent or decrease the unauthorized use of water. Please provide details of your program in your Municipal response.	Comments:	
	2. What is the estimated capital cost of initiating this program?	Comments:	
	3. Has the program been successful in reducing the unauthorized use of water?	Comments:	
	4. Have you quantified the cost savings related to the program?	Comments:	
	5. What is the estimated annual cost of maintaining the program?	Comments:	

Comments:

**NATIONAL WATER & WASTEWATER BENCHMARKING SPREADSHEET
DETAIL FOR UNBILLED AUTHORIZED CONSUMPTION INPUTS FOR 2006**

Reporting Municipality:	Information Prepared By:	Date Prepared:	Page 6 of 6
-------------------------	--------------------------	----------------	-------------

Unbilled Authorized Consumption [G]=[H]+[I]

Unbilled Metered [H] and Unmetered [I] Consumption

Consumption Category	# of Metered Accounts	Metered Use ML	Unmetered Use ML	Description of Method of Estimating Unmetered Use
Bulk Water Fill Stations				
City Buildings (Offices, Libraries etc)				
Irrigation (Parks, Cemeteries, Golf Courses, etc.)				
Pools				
Fire Fighting and Training				
Water Main Flushing Program				
Water Main Flushing on Demand				
Automatic Flushing of Dead End Mains				
Manual Flushing of Dead End Mains				
Winter Bleeding				
Water Sampling (purging)				
Hydrant Testing				
Reservoir Overflow				
Street Sweeper (street cleaning)				
Sewer/Storm Drain Flushing/Cleaning				
Filtration Plant and Facilities				
Sewage Treatment Plant and Facilities				
Construction Use				
Unbilled Accounts				
<i>Reservoir Cleaning</i>				
<i>Other (eg pump station analysers and flush lines)</i>				
TOTAL UNBILLED AUTHORIZED CONSUMPTION				
Total Production Volume				System Length Service Connections
				% of Production Volume
				m³/km/day
				L/connection/day