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Performance Benchmarking for Effectively Managed Water Utilities

Web Report #4313b

Subject Area: Management and Customer Relations

Performance Benchmarking for Effectively Managed Water Utilities

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Performance Benchmarking for Effectively Managed Water Utilities

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FOREWORD

The Water Research Foundation (WRF) is a nonprofit corporation dedicated to the development and implementation of scientifically sound research designed to help drinking water utilities respond to regulatory requirements and address high-priority concerns. WRF's research agenda is developed through a process of consultation with WRF subscribers and other drinking water professionals. WRF's Board of Trustees and other professional volunteers help prioritize and select research projects for funding based upon current and future industry needs, applicability, and past work. WRF sponsors research projects through the Focus Area, Emerging Opportunities, and Tailored Collaboration programs, as well as various joint research efforts with organizations such as the U.S. Environmental Protection Agency and the U.S. Bureau of Reclamation.

This publication is a result of a research project fully funded or funded in part by WRF subscribers. WRF's subscription program provides a cost-effective and collaborative method for funding research in the public interest. The research investment that underpins this report will intrinsically increase in value as the findings are applied in communities throughout the world. WRF research projects are managed closely from their inception to the final report by the staff and a large cadre of volunteers who willingly contribute their time and expertise. WRF provides planning, management, and technical oversight and awards contracts to other institutions such as water utilities, universities, and engineering firms to conduct the research.

A broad spectrum of water supply issues is addressed by WRF's research agenda, including resources, treatment and operations, distribution and storage, water quality and analysis, toxicology, economics, and management. The ultimate purpose of the coordinated effort is to assist water suppliers to provide a reliable supply of safe and affordable drinking water to consumers. The true benefits of WRF's research are realized when the results are implemented at the utility level. WRF's staff and Board of Trustees are pleased to offer this publication as a contribution toward that end.

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The authors of this report are indebted to the following utilities and individuals for their participation in this project by providing input on current utility practices, contributing to the development of the benchmarking framework, and testing the benchmarking tool developed for this project:

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Julia Hunt, Trinity River Authority, Texas
Laurie Krause, WaterOne, Water District #1 of Johnson County, Kansas
Crystal Knight-Lee, Washington Suburban Sanitary Commission, Maryland

EXECUTIVE SUMMARY

OBJECTIVES

The objectives of this project, "Performance Benchmarking for Effectively Managed Water Utilities", were to build upon past Effective Utility Management (EUM) work by:

- Identifying practice areas associated with achieving the Ten Attributes associated with EUM;
- Identifying key performance metrics for each practice area;
- Providing the capability for utilities to identify targets associated with each leading practice;
- Developing a benchmarking framework and assessment methodology;
- Developing a supporting benchmarking tool;
- Pilot testing the framework across an appropriate cross-section of utilities; and
- Making the tool available for the use and benefit of the water sector.

BACKGROUND

The U.S. Environmental Protection Agency (EPA) and organizations representing North American water and wastewater utilities have long been cognizant of the challenges water sector utilities are facing and have been identifying EUM practices to address them. In May 2006, EPA and six of these organizations formed the Effective Utility Management Collaborating Organizations to "formalize a collaborative effort among the signatory organizations in order to promote effective utility management" (EPA et al. 2008). They developed a framework for utility management that would result in effectively managed water utilities. These organizations, with the support of 16 water and wastewater utilities then identified the following "Ten Attributes of Effectively Managed Water Sector Utilities":

1. Product Quality
2. Customer Satisfaction
3. Employee and Leadership Development
4. Operational Optimization
5. Financial Viability
6. Infrastructure Stability
7. Operational Resiliency
8. Community Sustainability
9. Water Resource Adequacy
10. Stakeholder Understanding and Support

Despite the number of EUM-related documents available to the water sector, there were no specific or discrete recommendations on how utilities would develop and implement the Ten Attributes. WRF identified this opportunity to build upon the work performed so far by addressing some components that were not included in these efforts, including:

- An explicit identification of the practice areas used by water sector utilities to support the Ten Attributes, including a number of AWWA QualServe business systems areas referenced in the previous EUM documents; and
- A structured process benchmarking exercise that could help water sector utilities to identify relevant performance metrics within the practice areas that could be scored to guide the development of strategies to achieve performance excellence.

As a result, WRF sponsored this project to fill these gaps.

APPROACH

To achieve the project objectives, the project team executed the project in two phases. Figure ES.1 shows the implementation methodology of this phased approach. WRF and the Project Advisory Committee (PAC) encouraged a focus on the framework development and the EUM self-assessment benchmarking tool.

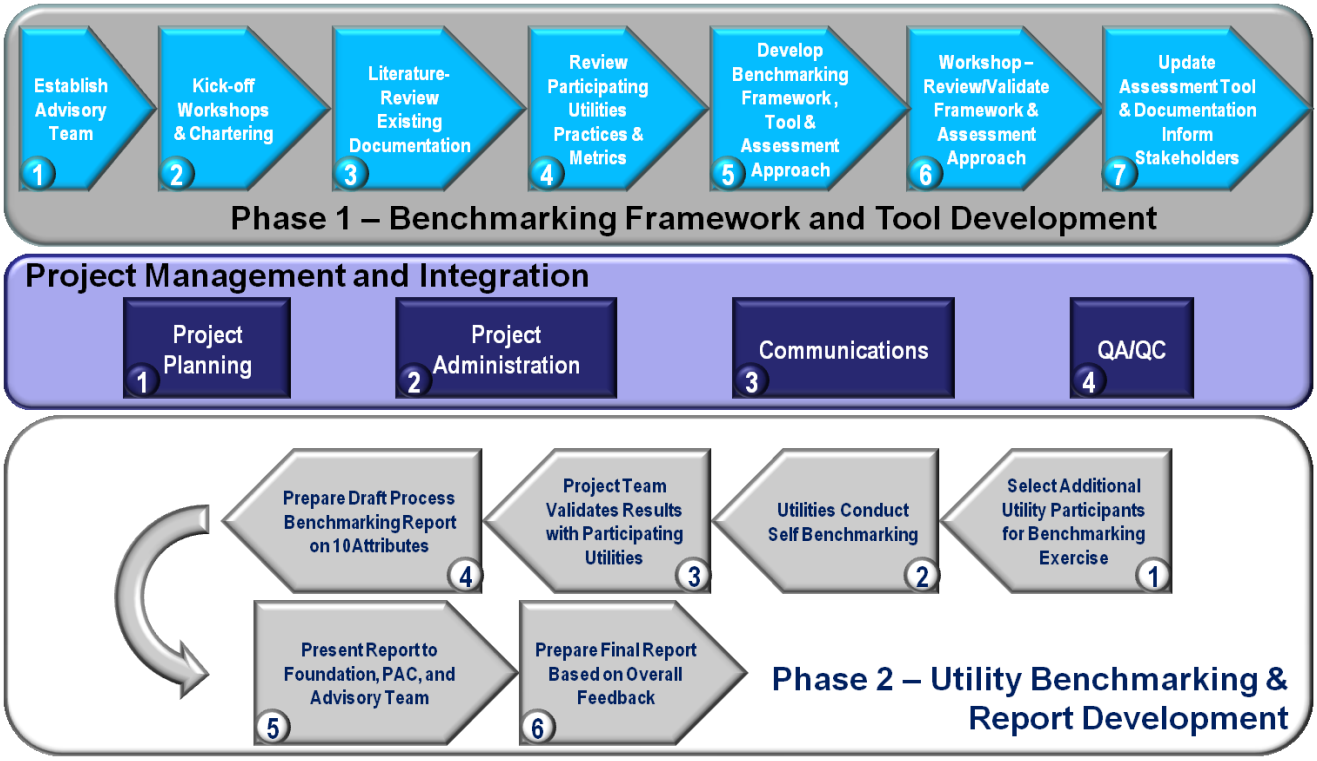


Figure ES.1 Project approach

RESULTS/CONCLUSIONS

Overall, the participating utilities found the tool useful in identifying gaps in performance and helping to identify steps that they can take to reduce the priority gaps. In addition, they offered many useful suggestions on refinements to the benchmarking framework[1], process, and how it can be used by other interested utilities. A number of the suggestions on functionality and contents made by utilities that tested the benchmarking tool have been incorporated into the tool that is included with this report.

Feedback from the utilities included a number of important recommendations, including:

- Form a benchmarking team to maximize the value of this effort.
- Secure executive leadership endorsement and engagement in the benchmarking process. Several utilities mentioned the value of engaging a cross-functional team that includes representatives from the diverse functions addressed in the Ten Attributes.
- Encourage dialogue about performance targets and current performance among colleagues from diverse sections within utility organizations. This was found to be useful in defining a path forward as an organization.
- Use the findings of the benchmarking efforts to inform other planning processes, including utility strategic plans, capital and operating budgets, and the development of internal initiatives to address priority gaps.
- Engage external stakeholders in the process. Some utilities did so even though the testing period for this project was confined to a short time period.
- Consider entering the benchmarking process progressively, conducting an initial self-assessment, and then building upon the process as useful initial insights and action steps are identified.

A number of utilities expressed interest in further development and research related to identifying appropriate performance targets for some of the practice areas, and the possible need for additional performance measures within some of the practice areas. In addition they recommended three primary areas for future development of the benchmarking process and tool:

- Develop a library of strategies for addressing priority performance gaps
- Provide for cross-utility comparisons of utility targets and performance
- Develop a process for future updates to the tool and self-assessment process

APPLICATIONS/RECOMMENDATIONS

Based on the experience of the project team in conducting benchmarking studies and suggestions from the utilities that used the benchmarking tool, the following approach is recommended for the successful application of the tool within a utility:

1. Form a benchmarking team and develop an initial plan of action.
2. Select EUM attributes to address.

[1] Framework is used here, and throughout the report, to mean the combination of practice areas and performance measures defined by the full project team, for the Ten Attributes of Effective Utility Management.

3. Select associated practice areas and performances measures to address.
4. Revise plan of action (if needed).
5. Conduct self-assessment benchmarking for selected attributes, practice areas, and performance measures.
6. Evaluate results and identify methods to narrow priority gaps.
7. Develop follow-up plans.

Each utility's context, however, is unique, including different goals for conducting self-assessments, varying histories with performance measurement, and varying availability of information and other resources to populate the assessment. As such, adaptation of the approach and the sequence of these steps may be needed to provide maximum efficiency and value.

MULTIMEDIA

Some of the material covered in this report can be found on the #4313 project page. These include the benchmarking self-assessment tool and user guide developed for this project, which was designed using Microsoft Excel 2007 and Visual Basic.

The tool enables users to customize and select specific attributes and weigh these attributes in relation to one other. Users can select any grouping of the Ten Attributes and the model creates a customized self-assessment containing only the relevant attributes, practice areas and performance measures chosen by the user. Based on the custom framework, the tool allows users to score both current and target performance for the selected practices.

PARTICIPANTS

Close to 30 water sector utilities from the United States, Canada, UK and Australia participated in this project. They were of different sizes (from less than 100,000 customers to over millions of customers), geographies (different parts of North America), and types (water, wastewater, and stormwater).

CHAPTER 1:
INTRODUCTION

BACKGROUND

Utilities are facing significant challenges as they strive to increase the quality and lower the cost of services to their customers. These challenges include:

- Increased customer level of service demands
- Financial constraints
- Aging infrastructure
- Security and emergency response concerns
- Growth
- Climate change and reduced environmental footprint pressures
- Stricter regulatory requirements
- Retirement of experienced staff and related workforce shortages

The U.S. Environmental Protection Agency (EPA) and organizations representing North American water and wastewater utilities have long been cognizant of these challenges and have been identifying Effective Utility Management (EUM) practices to address them. For example, EPA's Office of Water has been working with utilities to promote the adoption of innovative management system approaches to ensure utilities are sustainable into the future. One such effort was documenting the management systems at eight leading utilities, the drivers to implement these approaches, their costs and benefits, successes and challenges, and roles that stakeholders can and do play in the process of developing and implementing the system (Ross & Associates Environmental Consulting 2005).

In May 2006, EPA, the American Public Works Association (APWA), the Association of Metropolitan Water Agencies (AMWA), the American Water Works Association (AWWA), the National Association of Clean Water Agencies (NACWA), the National Association of Water Companies (NAWC), and the Water Environment Federation (WEF) formed the Effective Utility Management Collaborating Organizations (Collaborating Organizations). The Collaborating Organizations entered into a Statement of Intent to "formalize a collaborative effort among the signatory organizations in order to promote Effective Utility Management" (EPA et al. 2008) and developed a framework for utility management that would result in effectively managed water utilities. The seven organizations formed and chartered the Effective Utility Management Steering Committee (Steering Committee) to advise them on a future joint water utility sector management strategy that would be applicable to water, wastewater, and combined utilities across the country. The Steering Committee, made up of representatives from 16 water and wastewater utilities, prepared a synthesis of findings and recommendations for the Collaborating Organizations on a future water sector strategy. In this report, *Findings and Recommendations for a Water Utility Sector Management Strategy* (APWA et al. 2007), the following "Ten Attributes of Effectively Managed Water Sector Utilities" were identified:

1. Product Quality
2. Customer Satisfaction

3. Employee and Leadership Development
4. Operational Optimization
5. Financial Viability
6. Infrastructure Stability
7. Operational Resilience
8. Community Sustainability
9. Water Resource Adequacy
10. Stakeholder Understanding and Support

These attributes provide reference points for utility managers seeking to improve organization-wide performance. Additional sources on EUM can be found in Chapter 3, Literature Review.

OBJECTIVES

Despite the number of EUM-related documents available to the water sector, *Effective Utility Management: A Primer for Water and Wastewater Utilities* (EPA et al. 2008) (the Primer) and related documents offered no specific or discrete recommendations on how utilities would develop and implement the attributes. WRF identified this opportunity to build upon the work developed in the Primer and the AWWA QualServe program by addressing some components that were not included in either of these efforts, including:

- An explicit identification of the practice areas used by water sector utilities to support the Ten Attributes and to excel in the various QualServe business systems areas, and the associated metrics.
- A structured process benchmarking exercise that could help water sector utilities to identify practice areas and achieve performance excellence.

As a result, WRF sponsored this research project to fill the gaps identified above. The project had the following objectives:

- Identify practice areas associated with achieving the Ten Attributes.
- Identify key metrics and potential targets associated with each leading practice.
- Develop a benchmarking framework and assessment methodology. The framework refers to the combination of practice areas and performance measures defined for the Ten Attributes during this project, as elaborated in Chapter 4.
- Develop supporting benchmarking tool(s).
- Pilot test the framework across an appropriate cross-section of utilities (for example, water and wastewater of various sizes in different geographies).

Project Team

The project team consisted of CH2M HILL, Englewood, Colorado; Demarche Consulting, Seattle, Washington; GHD, Charlotte, North Carolina; and Ross Strategic, Seattle, Washington. CH2M HILL was the prime contractor and led the overall effort. Michael Matichich was the principal investigator and attribute lead for Financial Viability. Yakir Hasit was the project

manager, Fair Yeager, deputy project manager and lead engineer, and Jaason Englesmith, software tool developer. Additional members of CH2M HILL's project team included Alan Ispass, who served as senior advisor to the project management team and as attribute lead for Operational Resiliency. Other attribute leads included Paul Swaim (Product Quality), Robert Pickett (Employee Leadership and Development), Andrea Ramage (Community Sustainability), Steve McNicol (Operational Optimization), and Armin Munevar (Water Resource Adequacy). Linda Paralez, Demarche Consulting, led the Customer Satisfaction attribute, participated in the workshops and contributed to the authorship of the report. Wayne Francisco, GHD, led the Infrastructure Stability attribute, participated in the workshops, and reviewed the final report. Rob Greenwood, Ross Strategic, led the Stakeholder Understanding and Support attribute and reviewed the final report. Rob was supported by Morgan Hoenig from Ross Strategic.

Utility Participants

As discussed in Chapter 2, Project Approach, the project was executed in two phases. During Phase 1, 20 utilities agreed to participate from the project outset by providing input on their leading EUM practices and by joining teleconferences and workshops, when possible. One additional utility joined the project during Phase 1. Some of them also tested the benchmarking tool developed during Phase 2. Of these 21 utilities, 17 participated in Phase 1 and are listed in Table 1.1.

Table 1.1
Phase 1 participating utilities and their practice areas

Utility	Type	Type of Ownership	Size	Region	Practice areas
Albuquerque Bernalillo County Water Utility Authority, New Mexico	W/WW	Public	Large	U.S.	All Ten Attributes
Charleston Water System, South Carolina	W/WW	Public	Medium	U.S.	Water Resource Adequacy, Customer Satisfaction, Operational Resiliency
City of Calgary, Water Resources, Alberta	W/WW	Public	Large	Canada	Customer Satisfaction, Infrastructure Stability, Operational Resiliency, Stakeholder Understanding and Support, Community Stability, Product Quality

(continued)

Table 1.1 (Continued)
Phase 1 participating utilities and their practice areas

Utility	Type	Type of Ownership	Size	Region	Practice areas
Clean Water Services[1], Oregon	WW/SW	Public		U.S.	Not available
Green Bay Metropolitan Sewerage District, Wisconsin	WW	Public	Medium	U.S.	Financial Viability, Customer Satisfaction, Infrastructure Stability, Community Stability
Gwinnett County Department of Water Resources, Georgia	W/WW	Public	Medium	U.S.	Stakeholder Understanding and Support, Infrastructure Stability, Customer Satisfaction
Louisville Water Company, Kentucky	W	Public	Large	U.S.	Financial Viability, Operational Resiliency, Customer Satisfaction, Infrastructure Stability, Water Quality
Metropolitan Sewer District of Greater Cincinnati, Ohio	WW	Public	Large	U.S.	Employee Leadership and Development, Operational Optimization, Infrastructure Stability, Stake Holder Understanding and Support
Onondaga County Water Authority, New York	W	Public	Medium	U.S.	Customer Satisfaction, Financial Viability, Operational Resiliency, Operational Optimization
Peoples Water Service Company of Florida, Inc., Florida	W	Private	Small	U.S.	Financial Viability, Operational Resiliency, Operational Optimization

(continued)

Table 1.1 (Continued)
Phase 1 participating utilities and their practice areas

Utility	Type	Type of Ownership	Size	Region	Practice areas
The Regional Municipality of Durham, Works Department, Ontario	W/WW	Public	Large	Canada	Customer Satisfaction, Infrastructure Stability, Operational Resiliency, Stakeholder Understanding and Support, Community Stability, Product Quality
Region of Peel, Ontario	W/WW	Public	Large	Canada	Financial Viability, Customer Satisfaction, Infrastructure Stability, Stakeholder Understanding and Support, Community Stability, Product Quality
South East Water, Victoria	W/WW	Public (Economic Regulator)	Large	Australia	All Ten Attributes
Toronto Water, Ontario	W/WW	Public	Large	Canada	Employee Leadership and Development, Product Quality, Stakeholder Understanding and Support
Tualatin Valley Water District, Oregon	W	Public	Medium	U.S.	Customer Satisfaction, Financial Viability, Operational Resiliency, Operational Optimization
Union Sanitary District, California	WW	Public	Medium	U.S.	Product Quality, Customer Satisfaction, Employee Leadership and Development, Operational Optimization, Financial Viability, Operational Resiliency

(continued)

Table 1.1 (Continued)
Phase 1 participating utilities and their practice areas

Utility	Type	Type of Ownership	Size	Region	Practice areas
United Utilities Water PLC, Warrington	W/WW	Public (Economic Regulator)	Large	UK	Customer Satisfaction, Infrastructure Stability, Operational Resiliency, Stakeholder Understanding and Support

Notes:

[1] Clean Water Services joined in the middle of Phase 1 and did not provide its practice areas

SW=stormwater, W=water, WW= wastewater

Large >= 500,000 customers, Medium >=100,000 and < 500,000 customers, Small = <100,000 customers

During Phase 2, the following public water utilities that were not involved in its development were recruited to test the tool and provide feedback:

- Beaver Water District, Arkansas
- Charlotte-Mecklenburg Utility Department, North Carolina
- Covington Water District, Washington
- Fort Wayne City Utilities, Indiana
- New York City Department of Environmental Protection, New York
- City of Scottsdale, Arizona
- Santa Clara Valley Water District, California
- Tampa Bay Water, Florida
- Toho Water Authority, Florida
- Trinity River Authority, Texas
- WaterOne, Water District #1 of Johnson County, Kansas
- Washington Suburban Sanitary Commission, Maryland

Report Organization

This chapter (Chapter 1) provides project background and objectives. The remainder of the report is organized as follows:

- Chapter 2, Project Approach, presents the overall approach taken and describes the two phases of the project and the tasks performed in their execution.
- Chapter 3, Literature Review, provides a review of available literature and utility practice areas related to EUM. This review helped identify some practice areas and associated metrics. The chapter provides a synthesis of the results, the details are provided in Appendix A.

- Chapter 4, Survey of Participating Utility Current Practice Areas and Performance Measures, summarizes the results of an effort that was conducted by gathering information from the participating Phase 1 utilities; details are provided in Appendix B.
- Chapter 5, Development of Benchmarking Framework, describes the development of the practice areas, associated performance measures, and the resulting benchmarking framework.
- Chapter 6, Benchmarking Self-Assessment Tool, provides an overview of the benchmarking self-assessment tool. Both the tool and the user guide can be accessed on the #4313 project page.
- Chapter 7, Phase 2 Benchmarking Tests, provides the results of the benchmarking tool tests conducted during Phase 2 by the participating utilities.
- Chapter 8, Recommended Approach for Conducting a Self-Assessment, provides the recommended approach for conducting a self-assessment based on the conclusions drawn from the feedback received by the utilities and recommendations made by the Project Advisory Committee (PAC) and other technical experts.
- Chapter 9, Conclusions and Recommendations, summarizes the major findings and recommendations of the study and provides recommendations for future enhancements to the self-assessment tool.

CHAPTER 2:
PROJECT APPROACH

INTRODUCTION

To achieve the project objectives, the team executed the project in two phases, with project management provided throughout. Figure 2.1 shows the implementation methodology of this phased approach. WRF and the PAC encouraged a focus on the framework development and the EUM self-assessment benchmarking tool.

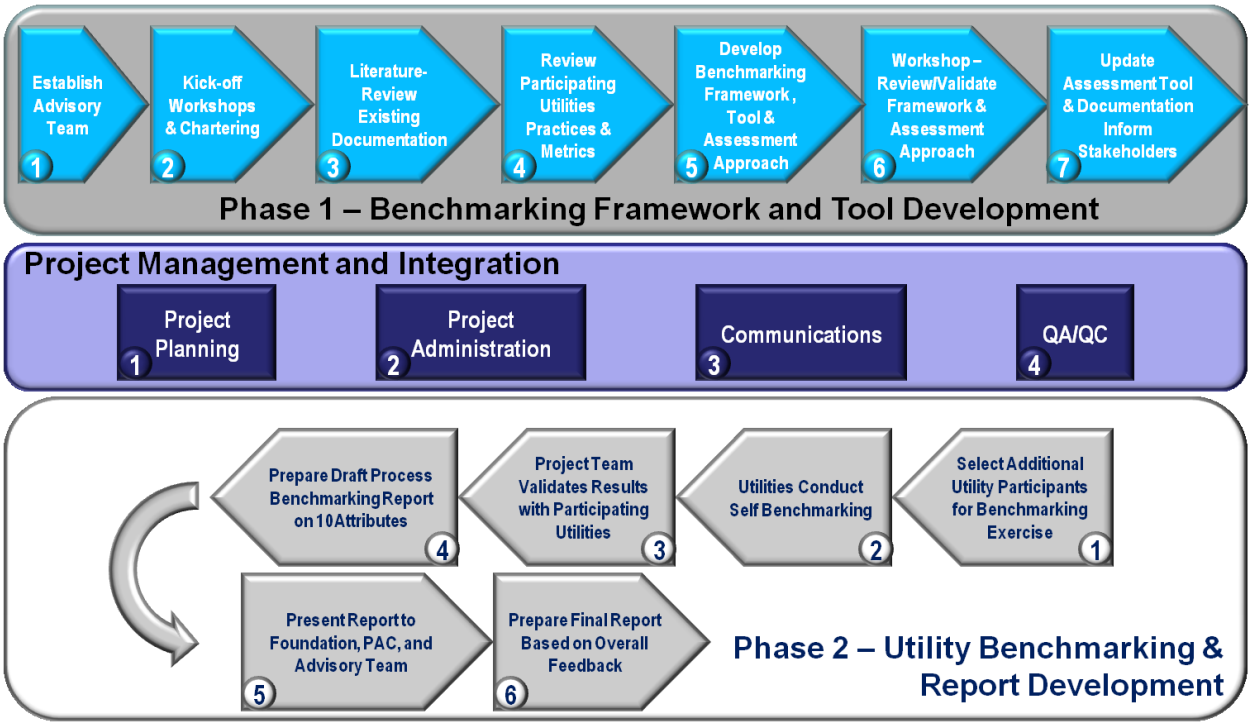


Figure 2.1 Project approach

PHASE 1

Phase 1 identified the key metrics and practice areas associated with achieving the Ten Attributes as described below.

Literature Review

The goals of the literature review development were twofold: (1) to review, summarize, and extend the literature summaries developed to date on EUM, and (2) to support the development of practice areas and benchmarking metrics for those practices. This approach helped the team to become familiar not only with relevant work that had been done to date, but also with relevant planned projects. The literature review was developed in a tabular format by

attribute for easy reference in subsequent benchmarking framework and tool development (Appendix A.)

Utility Surveys

As described in Chapter 1, this research effort engaged the participation of nearly 20 utilities representing a diverse group in terms of geographic location, system size, age of assets, and ownership model. The effort included a number of utilities, such as the Union Sanitary District and the Louisville Water Company, both of which have been active participants in the EUM program since its inception. Input from the participating utilities on practices and performance measures that they found useful within the Ten Attributes provided valuable input during the development of the benchmarking framework.

Data requests were sent to all utility participants. Participants were asked to identify practice areas and metrics that they currently employ for each of the Ten EUM Attributes (Appendix B.) For practices currently in use, they were asked to describe the practice and then provide information on the following:

- Depth of implementation of the practice (capability and execution)
- Metrics used to track performance for the practice
- Supporting information related to the practice/measures if applicable
- Any comments deemed important by the utility representatives

Development of Benchmarking Framework

Based on information compiled from the literature review and the participating utility responses to the Phase 1 data requests, the team developed a benchmarking framework to capture quantitative metrics and convert qualitative metrics to quantitative metrics to support the assessment process. The framework was assembled in a hierarchical format as follows: (1) attribute, (2) practice areas within the selected attribute, and (3) performance measures within the identified practice areas.

After identifying specific performance measures, the team developed a scoring matrix for each, capturing specific targets for degree of implementation and level of performance achieved for each measure. The format for the performance measurement was developed by the project team after a review of prior approaches to performance measurement, such as the process benchmarking developed by the Water Services Association of Australia (WSAA) (Gee and Vincent 2008), focusing on capability with regard to the measure and extent of execution of the measure, and applicability to the Ten Attributes of EUM.

After the team developed the draft benchmarking framework and initial vision of the self-benchmarking tool functionality, the PAC, participating utilities, and advisory team from the six associations were provided an overview of materials. A workshop afforded an opportunity for the project stakeholders to review, modify, and update the framework via breakout sessions. Participant feedback, gathered during the workshop or individual review comments of those unable to attend, was compiled into an updated framework. This framework provided the basis of the development of the self-benchmarking tool.

Development of Benchmarking Tool

Team members then designed and developed a Microsoft Excel 2007 with Visual Basic assessment tool that supports the overall benchmarking framework. The tool was developed in coordination with the PAC to ensure practicality, ease of use, and adaptability for future use. The tool includes useful reports that can identify opportunity gaps and suggest generic strategies that can be customized for each utility. The team also developed a User Guide to aid utilities in completing their self-assessments in the testing phase.

PHASE 2

During Phase 2, the EUM framework, methodology, and tool were tested with water and wastewater utilities, as described in the following sections.

Recruitment of Additional Utilities

While the types of initial utility participants provided adequate depth and breadth, the team solicited additional participants to increase the overall value of the benchmarking results. The team developed informational materials on the objectives, processes, expected results, and benefits to utilities. Requests for participation were distributed via WRF's Water Current e-newsletter and AMWA's e-newsletter. Also a few utilities expressed interest in participating after attending a technical presentation about the research effort at the 2012 Utility Management Conference. In addition to Phase 1 participants, 27 other utilities were recruited to participate in the benchmarking test, with 12 of these utilities ultimately completing the testing process. In total, 25 utilities provided feedback on the tool and benchmarking process at the close of the Phase 2 test period.

Benchmarking Test

In addition to the User Guide, the team developed materials on the overall benchmarking framework, assessment process, and use of the self-assessment tool. These resources were shared via a series of webinars with the utility participants. After the webinars, the team distributed a testing package to utilities; the package included the webinar presentation, instructional memorandum, the tool, and the User Guide. The team then assigned liaisons to each utility to serve as primary points of support contact during the testing effort. To capture feedback, the team developed a standardized form that was distributed to utility participants midway through the testing period.

Refinements to Benchmarking Framework and Tool

Upon completion of the self-assessment using the tool, participating utilities forwarded their feedback and, in some cases, their completed tool, via the standardized form to the team for review and validation. The team verified that the process was followed accurately and that the benchmarking scores (if provided by the utility) and supporting rationale (in the form of comments) were realistic. The research team reviewed the feedback provided by the utilities, which ranged from high-level suggestions on functionality of the tool to specific language and

elements used in defining some of the practice areas and performance measures. The team considered the recommendations using several criteria including:

- Consistency with research and feedback by the full project team throughout the research project
- Frequency (i.e., similar comments made by several utilities)
- Applicability to multiple utility contexts (i.e., would the suggested revision decrease the usability of the tool by some utilities)
- Feasibility within the schedule/resource constraints of the current research project

Based on this review, a number of changes were made and are part of the tool delivered in this project. These include:

- The capability for utilities to edit the definition of the performance measures to meet their specific contexts;
- Addition of several performance measures; and
- Revision of the definition of the scales for a number of performance measures.

A number of other potential modifications left for future revisions, such as the provision for cross-utility comparisons, are described in Chapter 9, Conclusions and Recommendations.

Development of Recommendations

The team prepared the draft "Performance Benchmarking for Effectively Managed Water Utilities" report that built on previous documentation and utility participant assessment results; it then developed overall conclusions and recommendations. As part of the report development process, the team conducted a PAC meeting where feedback was discussed and agreement reached on changes to enhance the overall report so that it can create the desired value for potential users.

CHAPTER 3:
LITERATURE REVIEW

INTRODUCTION

Reviewing existing EUM-related studies and other published documents was a critical part of the project. The goals of the literature search were to:

- Review, summarize, and extend the literature summaries developed to date on EUM, and
- Support development of practice areas and benchmarking metrics for those practices.

http://www.thewire.com/politics/2014/02/worlds-winter-olympic-sites-are-warming-and-we-have-graphs-prove-it/358067/

This chapter summarizes the literature review and overall findings. A table that includes all of the literature reviewed is included in Appendix A. This review covers materials published or presented through the summer of 2011; therefore, EUM and related materials published or presented after that time are not included in this report.

SUMMARY OF LITERATURE REVIEW

The EPA, six sponsoring utility industry organizations, and a number of water sector utilities performed considerable work to develop the Primer (EPA et al. 2008). Follow-on work continued as additional documents were published. One document—*Effective Water and Wastewater Utility Management Case Studies* (Columbus Water Works et al. 2009)—summarizes case studies in the application of EUM principles. References to relevant documents for each attribute and for EUM as a whole developed during these efforts have been posted to an EPA-hosted web site (www.watereum.org). This site includes an interactive version of the Primer. Other related research and activities, such as AWWA's QualServe program (AWWA 1997), provided additional information that was considered in the execution of this research project. To ensure that work conducted in this project built upon this existing body of identified literature, a primary goal of this literature review was to review and summarize the key related documents included in these past efforts.

The Ten Attributes of EUM identified in the Primer do not readily fit the requirements for metric benchmarking, where clear quantitative metrics can be identified and benchmarked. A number of the measures that would qualify as practice areas are qualitative in nature. Therefore, the approach taken in this project dealt with qualitative metrics by using process or performance benchmarking where each evaluation process focuses on capability with regard to the leading practice and extent of execution of the practice within the utility. Detailed information on benchmarking and performance parameters can be found in publications by Alegre et al. (2006), Cabrera et al. (2011), Matos et al. (2003), and Parena et al. (2002).

Publicity about and interest in the Primer led to a number of journal articles, conference papers, and other publications that addressed the elements identified in the Primer, including several related research projects sponsored by WRF. A comprehensive summary of WRF-sponsored EUM-related studies was prepared by Reekie (2011). As a result, a related goal for this literature review was to identify and summarize these additional documents that shed light

on the development of practice areas, performance measures, and suggested methods for using them to accomplish utility and industry goals.

Support Development of Practice Areas and Associated Benchmarking Metrics

Because this project was specifically tasked with establishing practice areas and ways to measure them based on existing literature, input from participating utilities, and the experience of the project team, a specific goal for the literature review was to identify practice areas and candidates for performance measurements and scales identified in the existing literature. Some practice areas for each of the Ten Attributes are identified in the Primer, as are potential performance measurement areas. The literature review was intended to review and summarize those elements and provide opportunities to refine, revise, and extend those elements through material in other documents identified and reviewed by the project team. For example, because performance scales that allow a utility to assign a score to actual performance compared with target performance are needed to accomplish the benchmarking intended for this project, any discussions in the literature related to development of such performance scales for identified practice areas were identified and cited to the extent possible.

The team's review of EUM-related documents and other reference materials identified no literature gaps that would have prevented the team from meeting the objectives identified for this research project.

Structure of the Literature Review

Details of the literature review can be found in Appendix A, which is organized as tables for each of the Ten Attributes identified in the Primer. For each attribute, the literature review table contains the following items:

- Document Referenced: Document reviewed and, when available, a full citation of the source.
- Document Description: A brief description of document contents, when available.
- Potential Leading Practice: Practices identified in the document, when available.
- Metric (used to track effectiveness): Metrics identified in the document, when available.
- Utilities (using referenced Leading Practice): Any utilities referenced in the document as implementing the practice. In most cases, the documents did not mention specific utilities.

Summary of the Literature Review

Table 3.1 lists the most common practice areas observed in the literature review.

Table 3.1
EUM practice categories observed from the literature review

Attribute	Practice Categories
Product Quality (PQ)	Regulatory Compliance Adherence to Guidelines
Customer Satisfaction (CS)	Customer Service Billing and Payment Customer Perception/Satisfaction Customer Outreach Customer Service Improvement Projects Call Centers
Employee and Leadership Development (ED)	Employee Recruitment, Retention, and Satisfaction Succession Planning Leadership Training
Operational Optimization (OO)	Benchmarking Operational Efficiency Resource Optimization
Financial Viability (FV)	Financial Procedural Integrity Maintenance of Strong Bond Rating Budget Management Effectiveness Rate Adequacy Balance Debt and Equity Funding
Infrastructure Stability (IS)	Maintenance Management Asset Reinvestment Planning Risk Analysis Asset Inventory Levels of Service Condition Assessment
Operational Resiliency (OR)	Risk and Vulnerability Assessments Health and Safety of Employees Business Continuity Planning Emergency Preparedness and Response Planning
Community Sustainability (SU)	Watershed Health Community Health Green and Sustainable Infrastructure Planning Greenhouse Gas Emissions Climate Change Service Affordability
Water Resource Adequacy (WA)	Water Supply Adequacy Supply and Demand Management Water Supply Reliability
Stakeholder Understanding and Support (SS)	Stakeholder Outreach Stakeholder Perception and Satisfaction Media and Press Coverage Comparative Rates

CHAPTER 4:
SURVEY OF PARTICIPATING UTILITY PRACTICE AREAS AND PERFORMANCE MEASURES

GOALS AND STRUCTURE OF CURRENT PRACTICE INFORMATION

This chapter summarizes the contributions from participating utilities to identify their practice areas related to the Ten Attributes and associated performance measures. To develop the draft benchmarking framework, the team used the following: (1) input from utilities (summarized in this chapter), (2) the literature review (Chapter 3), and (3) the team's own experience in identifying practice areas and performance measures.

The participating utilities were listed previously in Table 1.1. Data requests were sent to each participant early in the project. Participants were asked to identify practice areas and metrics that they currently employ for each of the Ten Attributes. For practices currently in use, participating utilities were asked to describe the practice and provide information about:

- Depth of implementation of the practice (capability and execution).
- Metrics used to track performance for the practice.
- Supporting information related to the practice/measures, if applicable.
- Comments deemed important by the utility representatives.

UTILITY SURVEY SUMMARY

Overall, the participating utilities identified an extensive group of practices and metrics related to Effective Utility Management. In many cases, the participating utilities reported use of practices and metrics similar to those reported by other utilities, but with slightly different names or with variations in practice/usage. Table 4.1 summarizes the practices for the Ten Attributes.

Table 4.1
Practice areas in use for each attribute by participating utilities

Attribute	Practice areas
Product Quality	Air quality Wastewater treatment effectiveness/compliance Drinking water quality/compliance Biosolids beneficial use Reduce water service interruptions Minimize wastewater treatment toxicity events Prevent sanitary sewer overflows Reduce wastewater service interruptions (blockages) Provide safe high-quality water Protect public health

(continued)

Table 4.1 (Continued)
Practice areas in use for each attribute by participating utilities

Attribute	Practice areas
Product Quality (continued)	Preventative maintenance of the water distribution system Enhance and protect the environment Systematic process compliance (findings per internal audits)
Attribute	Practice areas
Customer Satisfaction	Understand overall customer satisfaction Track complaints Accurate meter reading and billing Customer contact center efficiency and responsiveness Service reliability Use of social media
Employee and Leadership Development	Succession planning Leadership development High performing workforce Retain talent through employee satisfaction Recruit talent
Operational Optimization	Energy optimization Resource optimization: cost metrics Resource optimization: human resources Resource optimization: other
Financial Viability	Set appropriate balance between debt and equity funding for capital program Return on assets Maintain adequate cash reserves, working capital, and margins Maintain efficient operation and maintenance costs in relation to customers and volume of sales Maintain strong bond rating Debt service coverage ratio Recognize and support stockholder interest Rate comparisons Budget management effectiveness: capital budget Budget management effectiveness: operating budget Set rates and financial forecasts for a multi-year period Minimize uncollected bills Vet major investments through rigorous process Develop funding plans that account for growth

(continued)

Table 4.1 (Continued)
Practice areas in use for each attribute by participating utilities

Attribute	Practice areas
Infrastructure Stability	Capital program delivery Rehabilitation and replacement rate Planned maintenance effectiveness Condition assessment/system integrity Minimize water loss Development and implementation of strategic asset management plan Risk management plan/program
Operational Resiliency	Reduce recordable incidents of work-related injury or illnesses Maintain sufficient staffing levels Emergency response readiness Use of standard operating practices Energy co-generation Solid waste recycling/composting Class A biosolids disposal Risk management program
Community Sustainability	Promote customer service affordability Implement environmental management system Support community programs Implement successful recycling and resource conservation programs to support sustainability Actively support employee and corporate participation in establishing and supporting community goals Manage greenhouse gas emissions to support environmental goals Promote sustainability through capital improvement program sustainability review Promote energy efficiency Support overall utility system efficiency Support environmental stewardship
Water Resource Adequacy	Long-term water supply adequacy Track current water demand Reduce water consumption Long-term ambient water quality Minimize real water losses Provide adequate capacity
Stakeholder Understanding and Support	Actively engage stakeholders in decisions that affect them Secure support and understanding from stakeholders

Inevitably, some overlap occurs in topics addressed by the attribute areas, and thus there is a related need to make decisions about where to best cover certain topics. For example, Financial Viability requires support for adequate rate increases, which involves securing Stakeholder Understanding and Support. Product Quality (for example, availability of water and taste of drinking water) typically has a major impact on Customer Satisfaction. As the

participating utilities provided input on practice areas and metrics within the attributes, some related topic areas appeared under different attributes. It is the opinion of the team that some identified practices and metrics are likely best assigned to other attributes. Thus the team worked with the PAC, project team members, and several participating utilities to align the practice areas and associated measures to the appropriate attribute in the development of the framework as described in Chapter 5.

UTILITY SURVEY CONCLUSIONS

The utilities provided several hundred measures overall. Most measures were reported in the Operational Optimization attribute, and fewest were reported in the Stakeholder Understanding and Support attribute. The distribution and count of measures are shown on Figure 4.1.

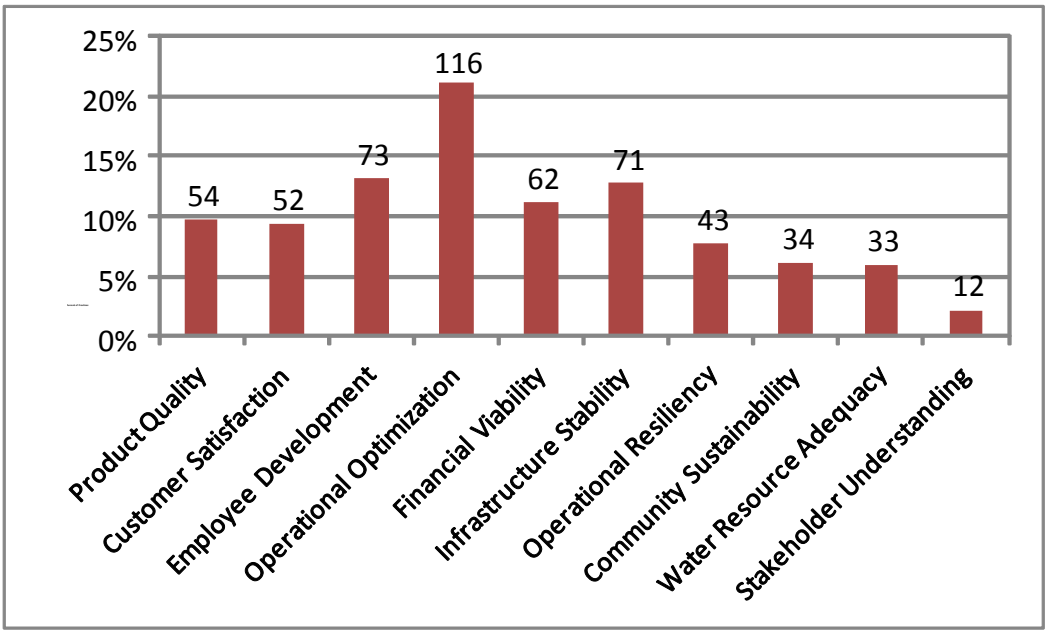


Figure 4.1 Distribution of reported practices

Participating utilities identified many practice areas and associated measures that were later applied in the development of the benchmarking framework. The full compilation of material provided by the participating utilities is provided in Appendix B. To make the summary tables more concise in Appendix B, some similar practices and metrics were combined in Appendix B.1, although they were named differently by the utilities. For reference purposes, Appendix B.2 provides a compilation of all practices and metrics as contributed by the participating utilities. Appendix B.2 also includes more detailed descriptions on usage, and in some cases additional comments provided by the participating utilities. As a result of the use different metrics and units for some measures, contributions from utilities outside of North America are included only in Appendix B.2, in which the specification of units and measurements is more defined by each utility system.

CHAPTER 5:
DEVELOPMENT OF BENCHMARKING FRAMEWORK

INTRODUCTION

A primary goal of this project is to provide utilities the ability to conduct self-assessments of the Ten Attributes identified in the Primer at a sufficiently detailed level to allow them to identify priority areas for improvement and to chart a path forward to narrow identified gaps in performance. To facilitate such self-assessments, a more detailed framework than that used in the Primer was needed. The team developed an initial draft of the benchmarking framework based on the findings of the literature review (Chapter 3), participating utility existing practices (Chapter 4), and the experience and insights of the team members regarding the Ten Attributes. The format and contents of the draft framework were vetted through several rounds of review with the PAC, the six industry associations, the Phase 1 participating utilities, and the Foundation.

After those reviews, the draft framework was embedded into the Excel-based benchmarking tool developed for this project. The draft framework was then used as the basis for testing during Phase 2, which is reported in Chapter 7. Based on feedback provided by participating utilities, refinements were made to some practice areas and performance measures. The version of the framework described in this chapter and embedded in Version 1.0 of the tool that accompanies this report incorporates the refinements that were made in response to feedback provided during the testing phase. This version number is used to differentiate it from future updates that may be released by WRF.

As described in the remainder of this chapter, the primary organization for the framework consists of practice areas defined within each of the Ten Attributes. Associated with each practice area is one or more performance measures.

DEVELOPMENT OF PRACTICE AREAS

For each of the Ten Attributes, the team identified areas where a utility could undertake activity to improve its performance. The term "practice areas," rather than a more normative term such as "best practices," was deliberately selected because within these topic areas, performance measures that reflect a range of performance are defined. In some cases, the high end of defined performance did reflect industry practice areas. In other cases, particularly in relatively new and emerging areas such as community sustainability, the definition of practice areas for some measures is evolving or is in the process of being defined by the industry.

In most cases, the practice areas are framed as actions that a utility can undertake. For example, for the Product Quality attribute, the team defined the three practice areas as follows:

- Comply with regulatory and reliability requirements
- Address customer needs
- Address public health and ecological needs

No minimum or maximum number of practice areas was established. The number was defined in light of the subject matter requirements within each attribute. Some attributes had as

few as two practice areas identified; some had as many as five. The practice areas identified for each of the Ten Attributes are shown in the framework outline (Figure 5.3). Over time, as the subject matter and technologies evolve in the water industry and as experience with benchmarking processes evolve, the number and nature of practice areas within the Ten Attributes may also evolve.

DEVELOPMENT OF PERFORMANCE MEASURES

Within each practice area, at least one performance measure was defined so that utilities could track their progress in achieving performance goals in areas they define as high priority. After consideration of several formats for tracking progress, a two-dimensional matrix was selected. The selected format affords utilities the ability to track both the level of performance achieved and the degree of implementation within their organizations for each performance measure.

While many utilities track performance overall, adding 'degree of implementation' allows tracking of a second important dimension. The specific formulation of the degree of implementation portion of the performance measure varies depending on the nature of the performance measure. In some cases, this portion of the measure is used to address whether the level of performance is achieved for only a portion of the organization or for only a limited time in situations where long-term performance is needed to be successful. In other cases, it is used to address whether the performance level has been achieved throughout the utility operations or only by some functions or groups within the utility.

Figure 5.1 shows one of the performance measures for the Product Quality attribute. As shown, utilities conduct a self-assessment rating, both at their current level of performance/degree of implementation and at their target level of performance/degree of implementation for each performance measure they include in their self-assessment.

Some of the performance measures, such as the one shown on Figure 5.1, are quantitative in nature. Some of the performance measures, in light of the nature of the subject addressed and/or the state of development of the topic in the water sector are more qualitative in nature. Figure 5.2 shows one of the performance measures for the Financial Viability attribute, which is defined in a more qualitative performance scale.

Attribute 1: Product Quality

Practice Area 1. Comply with Regulatory and Reliability Requirements

Performance Measure 3. Degree to Which Near Compliance Misses are Minimized (water)

Main Menu

Purpose is to monitor and count the 'near miss' events that provide insight about the reliability of the water system, and are indicators of potential failure	Level of Performance Achieved				
	More than five near misses. Closest near miss is greater than 90% of allowable performance level for agency defined compliance metrics.	More than five near misses. Closest near miss is greater than 60% of allowable performance level for agency defined compliance metrics.	Two or more near misses. Closest near miss is greater than 90% of allowable performance level for agency defined compliance metrics.	Two or more near misses. Closest near miss is greater than 60% of allowable performance level for agency defined compliance metrics.	One near miss, below 90% of allowable performance level for agency defined compliance metrics.
Degree of Implementation					
Near misses above target level during more than 6 months of the past year.					
Near misses above target levels during 3-6 months of the past year.			Current		
Near misses above target levels during 1-3 months of the past year.					
Near misses at or below target level during each month of the past year.					Target
Near misses at or below target level during each month of the past two years.					

Legend:	green = current	blue = target	yellow = current+target

Figure 5.1 Example performance measure for product quality

Attribute 5: Financial Viability

Practice Area 2. Provide Financial Integrity

Performance Measure 1. Financial Policy Integrity

Main Menu

In order to ensure that utilities meet financial commitments, such as reserve and coverage requirements made to bondholders, policies need to be developed for these matters so that expected performance levels are clearly defined [...]	Level of Performance Achieved				
	No financial accounting policies in place to govern areas such as internal controls, audits [...]	Financial policies have been developed but are not currently used to guide utility decisions and actions.	Financial policies exist but are not consistently used to guide utility decisions and actions.	Financial policies exist and are generally used to guide utility decisions and activities, but there are exceptions when policies do not	Financial policies exist and are routinely used to guide utility decisions and activities.
Degree of Implementation: Not yet implemented					
Partially implemented in only a few departments/divisions (engineering, accounting, construction, etc.).					
Partially implemented in all departments/divisions.			Current		
Partially implemented in all departments/divisions, fully implemented for at least some departments/divisions.					
Fully implemented in all departments/divisions.					Target

Legend:	green = current	blue = target	yellow = current+target

Figure 5.2 Example performance measure for financial viability

BENCHMARKING FRAMEWORK

Performance measures for all attributes and practice areas are embedded in the benchmarking tool that accompanies this project report. Figure 5.3 contains an outline that identifies all practice areas and performance measures that comprise the benchmarking framework developed for this project.

1. Product Quality
    - 1.1. Comply with Regulatory and Reliability Requirements
        - *1.1.1.* Degree of Success in Achieving Target Drinking Water Compliance Rate (percent)
        - *1.1.2.* Degree of Success in Achieving Target Wastewater Treatment Effectiveness Rate (percent)
        - *1.1.3.* Degree to Which Near Compliance Misses are Minimized (water)
        - *1.1.4.* Degree to Which Near Compliance Misses are Minimized (wastewater)
        - *1.1.5.* Meet National and Other Applicable Objectives for Residuals Quantity and Quality
        - *1.1.6.* Extent to Which Supplemental Local Goals are Addressed
    - 1.2. Address Customer Needs
        - *1.2.1.* Achievement of Target Drinking Water Flow and Pressure (percent)
        - *1.2.2.* Achievement of Target Fire Suppression Flow and Pressure (percent)
        - *1.2.3.* Extent to Which Service Interruptions are Reduced to Target Levels (percent)
        - *1.2.4.* Extent to Which Sewer Backups are Reduced to Target Levels (percent)
        - *1.2.5.* Extent to Which Sanitary Sewer Overflows are Reduced to Target Levels
        - *1.2.6.* Extent to Which Combined Sewer Overflows are Reduced to Target Levels
        - *1.2.7.* Extent to Which Safe Drinking Water Act Secondary Standards are met
    - 1.3. Address Public Health and Ecological Needs
        - *1.3.1.* Achievement of Water Reuse Targets (percent)
        - *1.3.2.* Achievement of Beneficial Biosolids Usage Targets (percent)
2. Customer Satisfaction
    - 2.1. Minimize Customer Complaints
        - *2.1.1.* Extent to Which Customer Service Complaint Rates Fall within Target Levels
        - *2.1.2.* Extent to Which Technical Quality Complaint Rates Fall within Target Levels
    - 2.2. Achieve Target Level of Customer Service Delivery
        - *2.2.1.* Degree of Field Call Responsiveness (water)
        - *2.2.2.* Degree of Field Call Responsiveness (wastewater)
        - *2.2.3.* Degree to Which Error-driven Billing Adjustments Are Minimized
        - *2.2.4.* Degree to Which Service Start/Stop Responsiveness Falls Within Target Levels
        - *2.2.5.* Extent to Which Customer Issues are Resolved by Call Center/Customer Service at the time of the First Call
        - *2.2.6.* Degree to Which Customer Service Responsiveness Falls Within Target Levels
        - *2.2.7.* Degree of Abandoned Calls
    - 2.3. Receive Positive Customer Perceptions
        - *2.3.1.* Degree of Positive Customer Feedback Received
        - *2.3.2.* Perception of Effectiveness at Dispute Management and Resolution
    - 2.4. Efficiently Deliver Customer Service
        - *2.4.1.* Efficiency of Customer Service (Ratio of Cost/O&M Spending)
3. Employee and Leadership Development
    - 3.1. Recruit Appropriate Talent
        - *3.1.1.* Degree of Success in Implementing a Recruitment Strategy
        - *3.1.2.* Extent to Which Job Descriptions are Implemented
        - *3.1.3.* Adequacy of Interview and Selection Processes
    - 3.2. Retain Existing Talent
        - *3.2.1.* Degree of Implementation of Retention Management Plans
        - *3.2.2.* Degree of Implementation of Onboarding Programs
        - *3.2.3.* Degree of Implementation of Job Satisfaction Programs
        - *3.2.4.* Degree of Success in Employee Engagement
    - 3.3. Address Succession Planning Needs
        - *3.3.1.* Adequacy of Workforce Forecasting
        - *3.3.2.* Adequacy of Succession Plan
    - 3.4. Strengthen Core Competencies
        - *3.4.1.* Degree of Success in Implementing Performance Management Systems
        - *3.4.2.* Degree of Implementation of Learning Programs
        - *3.4.3.* Level of Management Training Achieved

Figure 5.3 Outline of the benchmarking framework (continued)

4. Operational Optimization
    - 4.1. Provide for Ongoing Operational Improvements
        - *4.1.1.* Track Record in Providing for Ongoing Operational Improvements
        - *4.1.2.* Extent to which Operational and Technology Improvements Are Deployed
        - *4.1.3.* Extent to Which Automated Regulatory Monitoring & Reporting Systems are Implemented (water)
        - *4.1.4.* Extent to Which Automated Regulatory Monitoring & Reporting Systems are Implemented (wastewater)
    - 4.2. Minimize Resource Use and Losses from Day to Day Operations
        - *4.2.1.* Degree of Implementation of Resource Optimization Plans
        - *4.2.2.* Degree of Energy Optimization
        - *4.2.3.* Degree of Labor Optimization
        - *4.2.4.* Degree of Chemicals Optimization
        - *4.2.5.* Degree of Residuals Optimization
        - *4.2.6.* Degree of Maintenance Optimization
5. Financial Viability
    - 5.1. Develop Sound Financial Plan
        - *5.1.1.* Degree to Which Financial Planning Efforts Support Strong Bond Ratings
        - *5.1.2.* Degree to Which Rate Increase Level is Supported by Planning Studies
        - *5.1.3.* Appropriateness of Rate Planning Horizon
        - *5.1.4.* Appropriateness of Balance of Capital Spending Between Debt and Equity Expenditures
    - 5.2. Provide Financial Integrity
        - *5.2.1.* Financial Policy Integrity
        - *5.2.2.* Financial Procedural Integrity
    - 5.3. Achieve Budget Management Effectiveness
        - *5.3.1.* Appropriateness of Annual Revenue to Expenditure Ratio (operating)
        - *5.3.2.* Appropriateness of Annual Revenue to Expenditure Ratio (capital)
        - *5.3.3.* Appropriateness of Annual Revenue to Expenditure Ratio (overall)
        - *5.3.4.* Degree to Which Long-term Life-cycle Accounting Employs Risk-Based Considerations
        - *5.3.5.* Adequacy of Operating Reserves
6. Infrastructure Stability
    - 6.1. Develop and Implement an Asset Management Program
        - *6.1.1.* Degree of Implementation of an Asset Management (AM) Framework
        - *6.1.2.* Degree of Implementation of Levels of Service
        - *6.1.3.* Degree of Development of an Asset Management Plan
    - 6.2. Maintain Knowledge of Assets and Costs
        - *6.2.1.* Level of Asset Inventory
        - *6.2.2.* Level of Asset Condition Information
        - *6.2.3.* Level of Asset Performance Information
        - *6.2.4.* Availability of Cost of Asset Ownership Information
    - 6.3. Incorporate Risk-Based Analysis into Decisions
        - *6.3.1.* Degree to Which Risk of Failure Analysis is Incorporated in Decision-Making
        - *6.3.2.* Extent to Which Critical Assets are Identified
        - *6.3.3.* Extent to Which Risk Mitigation Options are Identified and Evaluated as Part of Decision-Making
7. Operational Resiliency
    - 7.1. Incorporate Risk Assessments into Decision-making
        - *7.1.1.* Extent to Which Vulnerability Assessments (VAs) are Conducted and Recommendations Implemented
    - 7.2. Implement Risk Mitigation
        - *7.2.1.* Emergency Response and Recovery Planning
        - *7.2.2.* Business Continuity Planning / Continuity of Operations Planning
        - *7.2.3.* Crisis Communications
        - *7.2.4.* Business Risk
    - 7.3. Sustain Employee Resiliency
        - *7.3.1.* Achievement in Employee Injury Time Reduction

Figure 5.3 (continued)

- *7.3.2.* Health and Safety Training
- *7.3.3.* Health and Safety Plan

8. Community Sustainability
   - 8.1. Utility Organization
     - *8.1.1.* Leadership
     - *8.1.2.* Sustainability Plan
     - *8.1.3.* Management System
     - *8.1.4.* Sustainability Reporting
   - 8.2. Infrastructure Project Sustainability
     - *8.2.1.* Project Planning, Design, and Engineering
     - *8.2.2.* Infrastructure Procurement
     - *8.2.3.* General Procurement
   - 8.3. Natural Environment
     - *8.3.1.* Water Management
     - *8.3.2.* Water Conservation
     - *8.3.3.* Stormwater
     - *8.3.4.* Energy
     - *8.3.5.* Waste Reduction
     - *8.3.6.* Ecosystem Services
     - *8.3.7.* Pollution Prevention
     - *8.3.8.* Climate Change Adaptation
   - 8.4. Economic Strength
     - *8.4.1.* Economic Competitiveness
     - *8.4.2.* Local Sourcing
     - *8.4.3.* Local Payroll
   - 8.5. Social Equity
     - *8.5.1.* Use of Strategic Financial Planning to Minimize Overall Rate Impacts
     - *8.5.2.* Appropriate Use of Affordability Programs to Protect Specially Impacted Groups
     - *8.5.3.* Degree of Success in Keeping Customer Bills Within Affordable Levels
     - *8.5.4.* Community Support
9. Water Resource Adequacy
   - 9.1. Achieve Water Supply Adequacy
     - *9.1.1.* Adequacy of Long-Term Water Supply
     - *9.1.2.* Adequacy of the Ratio of Short-term Supply to Short-term Demand (12-mo rolling average)
     - *9.1.3.* Degree of Implementation of a Basin Supply Plan
     - *9.1.4.* Degree of Implementation of Drought Management Plan
     - *9.1.5.* Degree of Implementation of a Source Water Protection Plan
   - 9.2. Optimize Reduction of Non-Revenue Water
     - *9.2.1.* Degree of Success in Achieving Target Levels of Annual Non-revenue Water (NRW)
     - *9.2.2.* Degree of Success in Achieving Target % of Real Water Loss
   - 9.3. Implement Water Conservation
     - *9.3.1.* Degree of Success in Achieving Target Per Capita Use
   - 9.4. Achieve Water Supply Reliability
     - *9.4.1.* Degree of Implementation of Demand Management/Demand Reduction Plans
     - *9.4.2.* Frequency of Full Satisfaction of Demand
     - *9.4.3.* Consideration of Supply/Demand Uncertainty
     - *9.4.4.* Degree of Success in Managing Raw Water Turbidity to Target Levels
10. Stakeholder Understanding and Support
    - 10.1. Stakeholder Identification
      - *10.1.1.* Degree of Success in Stakeholder Identification and Analysis
    - 10.2. Stakeholder Engagement Plan
      - *10.2.1.* Degree of Success in Developing and Executing a Stakeholder Engagement Plan
    - 10.3. Oversight Body Engagement Strategy

Figure 5.3 (continued)

10.3.1. Success in Gaining Oversight Body Understanding

10.4. Media Interaction Program

10.4.1. Degree of Success in Interacting with Media (traditional and emerging) to Achieve Accurate Coverage

10.4.2. Degree of Success in Establishing Positive Coverage by the Media (traditional and emerging)

10.5. Stakeholder Support Performance Measurement System

10.5.1. Level of Stakeholder Support Received for Critical Strategic and Operational Directions

Figure 5.3

CHAPTER 6:
BENCHMARKING SELF-ASSESSMENT TOOL

This chapter describes system requirements and features, and provides sample outputs for the benchmarking self-assessment tool that was developed for this project. The Excel model is posted on the #4313 project page. Also posted at that link is a User Guide that includes annotated screen shots from the model and a more detailed step-by-step guide on how to use the tool.

SYSTEM REQUIREMENTS

The self-assessment tool is designed to work with Microsoft Excel 2007. It should be noted that the tool employs several Visual Basic modules that contain objects that are not compatible with earlier versions of Excel.

Upon opening the tool, users may or may not be presented with a security warning, depending on their current trust center settings. For the tool to operate properly, macros must be enabled via the security alert window or through the trust center.

TOOL FEATURES

The tool is designed to enable users to customize and select specific attributes and to weigh those attributes in relation to one other. Users can select any grouping of the Ten Attributes and the model creates a customized self-assessment containing only the relevant data and information pertaining to those chosen attributes (Figure 6.1).

1. Select Attributes | 2. Select Practice Areas | 3. Select Performance Measures | 4. Create Framework

Ten Attributes of Effective Utility Management	Weighting Factor	
1: Product Quality	0	0%
2: Customer Satisfaction	0	0%
3: Employee and Leadership Development	0	0%
4: Operational Optimization	0	0%
5: Financial Viability	0	0%
6: Infrastructure Stability	0	0%
7: Operational Resiliency	0	0%
8: Community Sustainability	0	0%
9: Water Resource Adequacy	0	0%
10: Stakeholder Understanding and Support	0	0%

* A weighting factor of zero will exclude that Attribute/Practice Area from evaluation

Figure 6.1 Example screen to select attributes

The self-assessment tool includes practice areas for each of the Ten Attributes as well as key metrics to measure performance for each practice. The tool allows users to select and weight their utility's relevant practices and then score those practices.

After developing the customized self-assessment containing the attributes and practice areas relevant to their utility, users or utility focus groups can score each performance measure based on current levels and self-identified targets (Figure 6.2). The performance measures are scored on a two-dimensional matrix, requiring users to select the intersection of level of performance and degree of implementation. Each matrix is specific to the attribute, practice area, and performance measure selected. The tool contains a scoring algorithm, calculated based on the user's selections that quantifies both current and target performance. The tool allows users to indicate that both current and target performance is the same.

Attribute 1: Product Quality

Practice Area 1. Comply with Regulatory and Reliability Requirements

Performance Measure 1. Degree of Success in Achieving Target Drinking Water Compliance Rate (percent)

Main Menu

Drinking Water Quality Index (DWQI) is a QualServe measure defined as 100 X (number of days in full compliance for the year/365)	Level of Performance Achieved				
	DWQI of less than 90%	DWQI of 90-95%	DWQI of 95-99%	DWQI of >99%	DWQI of 100%
Degree of Implementation					
Target DWQI has not been achieved.					
Target DWQI achieved consistently for 1-2 consecutive years		Current			
Target DWQI achieved consistently for 3-5 consecutive years				Target	
Target DWQI achieved consistently for more than five consecutive years					

Legend:	yellow = current	blue = target	green = current & target

Figure 6.2 Example screen to select current and target performance for a measure

When scoring is complete, users can run an assessment verification within the tool that verifies that each selected performance measure has been successfully completed. The tool then tabulates the scores and provides summary results at both the attribute and the utility levels.

The attribute summary contains each practice area score, its relative weighting as defined by the user, and the overall attribute total. These summaries include a radar chart showing the relative impact and contribution each practice area had on the overall attribute total (Figure 6.3). Convenient links are provided to return the user to each specific performance measure that was completed.

Attribute 1: Product Quality

Practice Area Scores		Current	Target	Weight
1.1	Comply with Regulatory and Reliability Requir	9	35	33%
1.2	Address Customer Needs	42	35	33%
1.3	Address Public Health and Ecological Needs	50	100	33%
Total Weighted Attribute Score		34	57	

Performance Measure Scores		Current	Target
1.1.1	Degree of Success in Achieving Target Drinking	9	49
1.1.2	Degree of Success in Achieving Target Wastew	9	21
1.2.2	Achievement of Target Fire Suppression Flow a	35	35
1.2.3	Extent to Which Service Interruptions are Red	49	35
1.3.1	Achievement of Water Reuse Targets (percent	50	100

Main Menu

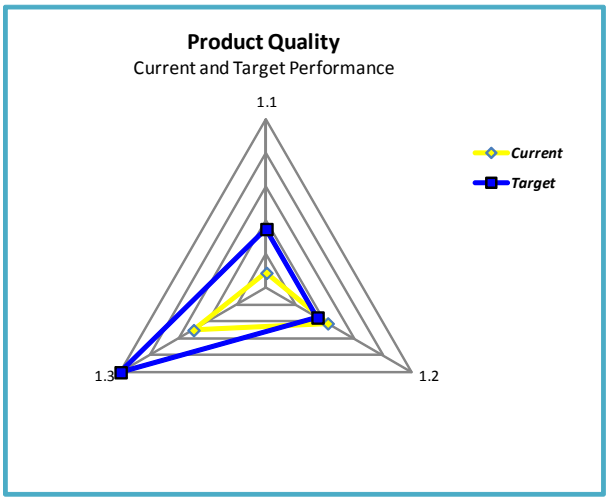
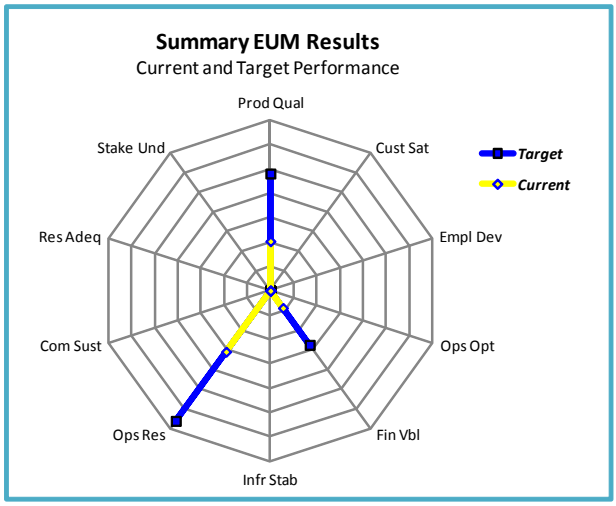


Figure 6.3 Example radar chart showing relative impact and contribution each practice had on an attribute's score

Calculation Definition for Figure 6.3: Performance measures that have been included in the self-assessment are averaged together within a practice area (e.g. 1.1.1, 1.1.2, 1.1.3, etc.) for both current and target scores to calculate the combined practice area (e.g. 1.1) current and target scores. Each practice area (e.g. 1.1, 1.2, 1.3) for both current and target scores are multiplied by their respective weights (as defined by the user) and summed together to calculate the total weighted attribute current and target scores.

The utility summary (Figure 6.4) contains the score of each of the attributes that the utility selected, their relative weight as defined by the user, and the overall raw (unweighted) utility score for all of the attributes selected. The summary also includes a radar chart showing the relative impact and contribution each attribute had on the overall utility score. The data in the results table and the axes on the chart may not be completely populated; this is dependent on the number of attributes that were included during the development of the customized self-assessment.

EUM	Current	Target	Weight
Att 1 : Product Quality	20	48	38%
Att 2 : Customer Satisfaction	-	-	0%
Att 3 : Employee and Leadership Development	-	-	0%
Att 4 : Operational Optimization	-	-	0%
Att 5 : Financial Viability	9	28	48%
Att 6 : Infrastructure Stability	-	-	0%
Att 7 : Operational Resiliancy	31	66	14%
Att 8 : Community Sustainability	-	-	0%
Att 9 : Water Resource Adequacy	-	-	0%
Att 10 : Stakeholder Understanding and Support	-	-	0%
Total Weighted Utility Score	16	41	



Main Menu

Figure 6.4 Example radar chart showing relative impact and contribution each attribute had on overall utility score

Calculation Definition for Figure 6.4: The total weighted attribute current and target scores for each of the attributes (1, 2, etc.) that have been included in the self-assessment, calculated as defined in the calculation definition for Figure 6.3, are multiplied by their respective weights (as defined by the user) and summed together to calculate the total weighted utility current and target scores.

Users can revise what is included in their customized self-assessment by turning on/off Attributes, Practices Areas, and Performance Measures, even after scoring. For example, a utility might decide, after team discussion of the results, that there is insufficient information to support the scoring that has been conducted, and that it is best to exclude one of the performance measures or practice areas until more reliable information is available.

CHAPTER 7:
PHASE 2 BENCHMARKING TESTS

OVERVIEW OF PHASE 2 TESTING

During Phase 2, participating utilities were asked to test the benchmarking tool and provide feedback on its usefulness in defining strategies to help narrow priority gaps between current and target performance. Sixteen of the 17 participating utilities from Phase 1 were joined by another 27 utilities that were specifically recruited to ensure the performance of a robust test and provide good representation across utilities of various sizes and types.

ELEMENTS OF PHASE 2 TESTING

Each of the 43 utilities that participated in Phase 2 testing followed the same process. Their primary activities included attending training, performing a self-assessment using the benchmarking tool, and reporting on their experiences after using the tool. Specific activities are shown in Figure 7.1 and described in the following sections. Out of 43 utilities, 25 provided feedback to the project team at the close of the testing process. How this feedback was incorporated into the tool is discussed at the end of this chapter.

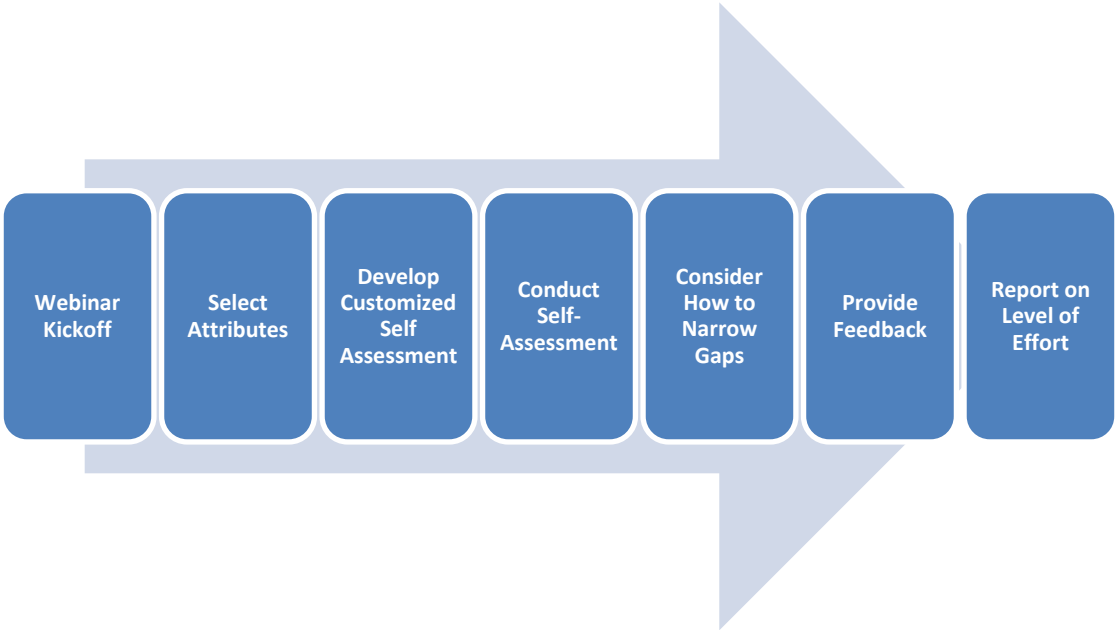


Figure 7.1 Phase 2 testing steps

Webinar Kickoff

Two webinar sessions were held to review the process for Phase 2 testing and to conduct training in the use of the Excel-based benchmarking tool. Each utility was requested to have a representative attend at least one session.

Select Attributes

Utilities were asked to select at least three of the Ten Attributes of Effective Utility Management as defined in the Primer. It was recommended that utilities limit their effort to three attributes to allow for sufficient time within the defined testing period. If a utility was not familiar with the Primer or the Ten Attributes, it was recommended that they review related materials at www.watereum.org to help determine the appropriate attributes for their organization. To facilitate the process, a list of practice areas and performance measures for each attribute was provided as an attachment to the Phase 2 instructions.

Develop Framework

Once attributes were selected, participating utilities used the self-assessment benchmarking tool to develop their customized self-assessment and identify practice areas within their selected attributes for assessment. For each attribute selected, the utility was required to choose at least one practice area for assessment. Utilities were encouraged to include all practice areas that were relevant to their operation. For each practice area, the utilities assigned a weight indicating relative importance. They also selected performance measures within each selected practice area.

Conduct Self-Assessment

Utilities conducted the self-assessment using the benchmarking tool and identified both current and target performance for all performance measures included in their utility-specific framework. A validation check is incorporated in the tool to ensure that users successfully completed the self-assessment. The validation confirms that a) at least one practice area has been selected for each selected attribute, b) at least one performance measure has been selected for each selected practice area, and c) all selected performance measures include a score for both current and target performance.

Consider How to Narrow Gaps

The benchmarking tool provides summary results at the attribute level as well as specific results for each practice area and performance measure. For priority attributes/practice areas/performance measures with significant gaps, the utilities were encouraged to review the detailed data tables and identify strategies that could be used to reduce the gaps.

Provide Feedback

As an output of their participation, utilities were asked to provide feedback on the benchmarking process, framework, and tool that was developed for this project. This information was reviewed and analyzed, and the findings are provided later in this chapter.

Report on Level of Effort

Participants were informed that the level of effort for participating in this process would depend on a number of factors including the number of attributes selected, participants' familiarity with EUM, availability of information, and the size of the project team. The research team's estimate was that a minimum level of effort of approximately 20 to 30 person-hours would be required to participate in the Phase 2 testing process. Participants were requested to provide a summary of their level of effort upon completion of Phase 2.

SCHEDULE FOR PHASE 2 TESTING

Utility self-assessment using the benchmarking tool was the second of six steps of the overall Phase 2 project schedule (Figure 7.2). This step occurred in the fourth quarter of 2012 with feedback from participants due in January 2013.

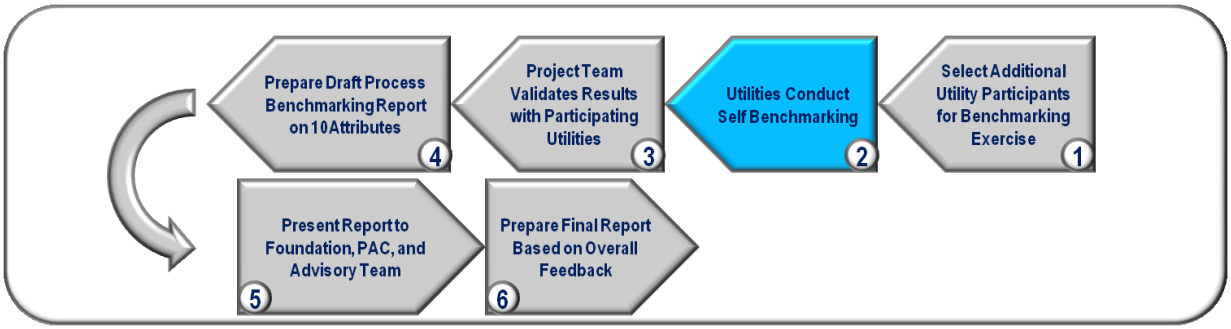


Figure 7.2 Phase 2 utility benchmarking and report development steps

SUMMARY OF ATTRIBUTES TESTED

While the testing process did not require utilities to disclose their customized self-assessment, 24 participants did agree to provide the list of attributes they included in their benchmarking process. Table 7.1 summarizes the attributes ranked in descending order by the number of times that attribute was selected by these participants.

Table 7.1
Summary of attributes tested

Ten Attributes	No. of Utilities Tested
Infrastructure Stability	13
Financial Viability	11
Customer Satisfaction	10
Operational Optimization	10
Employee Leadership and Development	9
Operational Resiliency	9
Product Quality	8
Community Sustainability	5
Water Resource Adequacy	5
Stakeholder Understanding and Support	5

FEEDBACK FROM PHASE 2 UTILITIES

> "Executive Management must sponsor or champion any benchmarking team. Delegation of this responsibility down from Executive Management can make internal benchmarking seem like busy work."
> —Tampa Bay Water

Of the Phase 2 participating utilities, 24 provided responses using the formal feedback questionnaire about the self-assessment process; another 4 utilities provided feedback in other forms and formats. This section summarizes the responses as follows: feedback on the overall benchmarking process, feedback on attributes and subcomponents of greatest interest, feedback on the framework, feedback on the benchmarking tool, and feedback on time requirements to conduct the self-assessment benchmarking. The section concludes with a summary of feedback on the usefulness of the process for others and a summary of changes made to the tool based on the feedback.

Feedback on the Overall Benchmarking Process

Participants commented that the benchmarking tool provides a much-needed methodology to subjectively assess the level of implementation and analyze performance in the ten attribute areas. Participants noted the connection of the EUM Ten Attributes as articulating the value proposition the utility seeks to deliver for its residents, its business and industries, rate payers, the watershed, and the environment, hence providing a strategic framework for utility management.

> "For a manager who is willing to invest the time to understand the Ten Attributes and help the staff understand how [they] can be helpful tools, this is an impressive tool. I believe any tool has a better chance of success if implemented by the 'inside' management team - that's why I appreciate this tool."
> —Covington Water District

The gaps in the level of performance achieved versus the degree of implementation could be reasonably identified using the tool. The tool identifies a desired future state as compared to the current state that could be used as part of goal setting for continuous improvement. Overall, the benchmarking tool is easy to use and understand.

Overall comments directed toward improvement or caution around the use of the benchmarking tool focused on the issue that a tool is not a substitute for strategy. The tool does not attempt to provide specific strategies, approaches, or tactics to close gaps. Some participants indicated a desire to address this need. Another comment was that determining the level of performance and degree of implementation requires some research and use of existing data, though much of the needed data required was available in existing performance plans or other related plans or status reports.

A suggestion was made to provide a tool resource tab for each performance measure that identifies standard strategies/tactics, basic steps, or best management practices that a utility can use to improve performance and align metrics with benchmarking sources (see Future Development in Chapter 9). Some ideas provided for additional resources include: AWWA manuals/ publications, WRF reports, federal agency reports, and QualServe; Florida Benchmarking Consortium; North Carolina Local Government Performance Measurement

Project; National Water and Wastewater Benchmarking Initiative - Canada; International Benchmarking Network Water and Sanitation Utilities; and European Benchmarking Co-operation.

Feedback on Attributes and Subcomponents of Greatest Interest

The attributes of greatest interest based on the quantity tested by the participants in this study are shown in Figure 7.3. This distribution may reflect areas of strategic importance to the utilities and areas where data were more available.

Comments on the attributes provided by the participating utilities that tested the tool are shown in Table 7.2. Please refer to Figure 5.3 for performance measures.

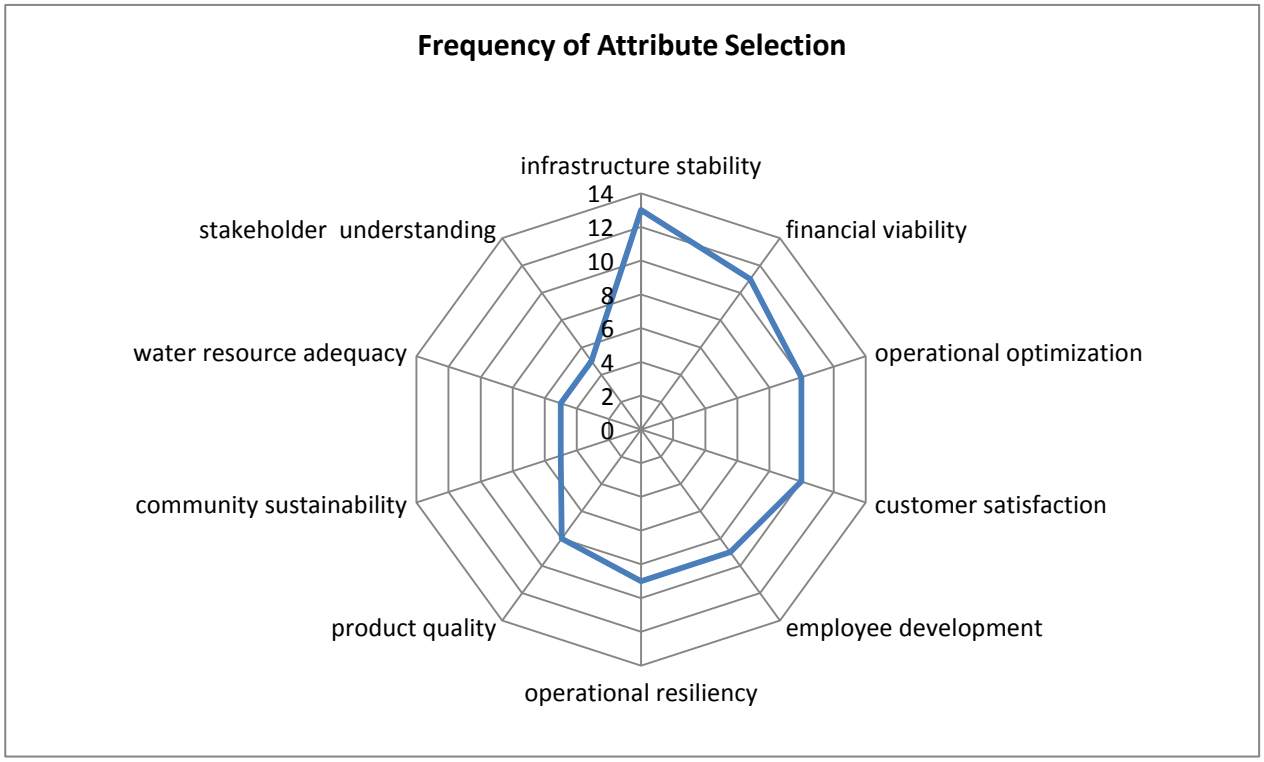


Figure 7.3 Frequency of attribute selection

Table 7.2
Comments on attributes and subcomponents

Attribute	Comments and Recommendations
1. Product Quality	*Degree of Success in Achieving Target Drinking Water Compliance Rate (percent).* "To ensure industry-wide (or at least regional) benchmarking capability, the number of days in full compliance should be based upon minimum Safe Drinking Water Act (SDWA) compliance testing and regulatory reporting requirements or equivalent." *Degree to Which Near Compliance Misses are Minimized.* "It may be helpful for utilities to split this PM [performance metric] into two PMs. Water and wastewater utilities should have been separated for this measure. This measure appears more appropriate for sewer than for water." *1.1.5: Meet National and Other Applicable Objectives for Residuals Quantity and Quality.* "…we had trouble with some of the more qualitative performance measures.…is hard to answer, as our agency always strives to meet dozens of supplemental goals aside from our regulatory requirements. It was difficult to quantify the exact number of goals established and goals met/exceeded under this framework." 1.2.1 through 1.2.4: "More direction on this measure is needed on how to measure flow and pressure. Some issues are related to the system design while other flow issues are temporary because of a water leak repair in an area." "…some of the performance measures that use percentage-based metrics were difficult to use for an agency of our size. Our responses for these would have placed us in the far right margin on each of these statistics. Since [we] serve a population of 8.3 million in-city residents, failing to provide adequate service to 5% of customers would be equivalent to 400,000 people without drinking water or with sewer backups. The performance measures could take this into account by using more logarithmic or exponential scales." "This measure may be more indicative of utility system performance if based upon number of sewer backups per miles of pipeline. Performance so measured would provide a much greater indication of collection system integrity and maintenance. As an example: a system having 75,000 customer accounts across 1,100 miles of pipeline would remain within the maximum performance level of the matrix while experiencing 3,750 sewer backups if based upon customer accounts; or alternatively, 55 sewer backups if based upon miles of pipeline. Which is more indicative of system performance? Total number of backups would have been more meaningful than a percentage."

(continued)

Table 7.2 (Continued)
Comments on attributes and subcomponents of greatest interest

Attribute	Comments and Recommendations
	"Align this measure to QualServe collection system failures (Collection System Integrity). We tied this measure specifically to our backups that caused property damage rather than all backups because it was impossible to determine the number of customers impacted by a single backup. Backups consist of 80% of staff's work, but 7% result in property damage. It would be better to track all system failures rather than just backups." *1.2.5: Extent to Which Sewer Overflows are Reduced to Target Levels.* "The goal seems too achievable." *1.2.6: Extent to Which SDWA Secondary Standards is Met/ Customer Complaints received.* "Linkage of this measure to the annual Consumer Confidence Report (CCR) is unclear. The stated purpose of the measure is the extent to which secondary standards are met. Yet the basis of the measure is customer complaints stemming from information provided through the annual CCR. The linkage to CCR data could inadvertently skew the measure as a result simply by how the information is conveyed in the CCR. If the measure is intended to capture customer concerns relating to secondary standards, then complaints/calls relating to such should not be specifically linked to an annual report. Rather, the customer data should be collected throughout the entire year. This would seem to provide a more consistent and thorough measure of product quality; however, it remains subject to customer acceptance. Alternatively, one could use a straight-forward analytical approach to measure compliance with secondary standards." "Align this measure to QualServe Technical Quality Complaints per 1,000 customer accounts. The range of 1 million population served does not make sense. The level of performance ranges seems too high." *1.3.1: Achievement of Water Reuse Targets (Percent).* "Total Water Supply metric associated with the calculation of this measure requires clarification. For combined water/wastewater systems, this may be taken to mean the combined total volume of water. In this case, achieving a minimum reclaimed water/reuse level of 60% of total water supplied may be unattainable simply due to the percentage of potable water deliveries by the utility, which are returned to the utility as wastewater. However, performance measured on the basis of total volume of wastewater received by the same utility could be completely attainable using the matrix provided." "This measure needs to define that the water supplied is for "consumptive use." [Our] state law only allows for reuse for non-residential turf. As such, we could never meet the lowest target of 60%."

(continued)

Table 7.2 (Continued)
Comments on attributes and subcomponents of greatest interest

Attribute	Comments and Recommendations
	1.3.2: Achievement of Beneficial Biosolids Usage Targets (Percent). "Instead of Biosolids, define as residuals (e.g., methane, lime, spoils, grease, etc.)."
2. Customer Satisfaction	*2.1.1: Extent to Which Customer Service Complaint Rates Fall within Target Levels.* "The multiplier transforms the result from a percentage to a number of complaints per 1,000 customers, which is not an option on the x-axis". "Since the ratio is multiplied by 1,000, is this really a percentage?"
	2.1.2: Same as above.
	2.2.1: Degree of Field Call Responsiveness. "Water and wastewater utilities have different call standards and/or service levels. It would have been helpful to distinguish between the two."
3. Employee and Leadership Development	*3.2.4: Degree of Success in Employee Engagement.* "Change the words "is about" in the definition to 'refers to' or 'measures' or 'includes.'"
	3.4.3: Level of Management Training Achieved. "The highest degree of implementation seems like a low bar. What about current management or potential supervisors?"
4. Operational Optimization	*4.1.1: Track Record in Providing for Ongoing Operational Improvements.* "It is important for organizations to have an agreed-on approach or process that they use to evaluate, prioritize, and implement improvements (not necessarily a "Plan"). This can be TQM, EMS, Lean, or a hybrid approach. Language on meeting goals should be under Level of Performance, not Implementation."
5. Financial Viability	"In performing the self-assessment for Financial Viability [we[2]] found that since we do not issue bonds, the team replaced the word "bond" with "credit strength." The same things done to maintain ability to borrow money is done to maintain good bond ratings. Also, consider that every 2 years is too frequent for a rate study, and perhaps 5 years might be a best practice (5.4.1)."
	"On the measurement scale (5.4.1) for "between no strategy/plan to develop a COS" and "COS study conducted," consider adding "COS study/update planned within next 12 months." Also explain abbreviations wherever they are used; e.g., OPEX, and define what is meant by "short-term capital revenues and expenses." [3]

(continued)

[2] Union Sanitary District

[3] Capital expenses are by definition long-term. Also, both capital revenues and expenditures vary from year to year, so this measure only makes sense if it is averaged over some period of time, such as 5 years.

Table 7.2 (Continued)
Comments on attributes and subcomponents of greatest interest

Attribute	Comments and Recommendations
	5.3.3: Balance Capital Spending between Debt & Equity Expenditures. "Combining operational and capital ratios doesn't add value." "For those that have not yet developed a risk-based budget but are beginning to identify risks and life cycle costs of assets, some of the financial metrics (5.3.4) may not yet be incorporated into this measure. Perhaps this should be a separate measure."
6. Infrastructure Stability	"…these performance measures were useful in providing gap analysis of where our program currently is and what we want to achieve in the next 2 years."[4] "More indicators are needed to assess the stability or integrity of the assets. The asset management-related measures offer no real strategies to address asset condition. The tool needs to consider some of the metrics from the EUM Primer such as renewal and replacement rates of the major asset groups, water leaks, collection failures, and planned maintenance targets for the major asset groups. For example, the inclusion of a planned maintenance program is key to infrastructure stability as these activities extend the life of an asset when there are few capital dollars to address all the critical needs." "Another example is to assess how and where a utility is spending its capital funds; maybe funds are appropriated but is the utility spending those dollars correctly or at all. Are those capital funds being re-appropriated to other needs? Lastly, the inclusion of a leak detection program and sewer televising targets would be helpful indicators for the integrity of the distribution and collection systems if the project team did not want to align Infrastructure Stability measures to the QualServe."
7. Operational Resiliency	*7.2.1: Emergency Response and Recovery Planning.* "It is important for organizations to have an agreed-on approach or process that they use to evaluate, prioritize, and implement improvements (not necessarily a "Plan")." *7.2.2: Business Continuity Planning/Continuity of Operations Planning.* "The measure mentions elements recommended by federal, state, or industry guidance, but doesn't say what guidance or what elements. If they are the same as in 7.2.1, then we don't need both measures." *7.2.4: Health and Safety Training* "What is meant by "treatment implementation plans?" Under Performance, there needs to be a place to record informal assessments that are done on an ad hoc basis or in reaction to a problem."

(continued)

[4] Albuquerque Bernalillo County Water Utility Authority

Table 7.2 (Continued)
Comments on attributes and subcomponents of greatest interest

Attribute	Comments and Recommendations
	7.3.1: "Under "Implementation," change the word "activities" to "risks." Performance should measure the effectiveness of the injury reduction program, using the measures listed: "No measures or targets developed for injury reduction," "Measures and targets developed but no evidence of improvement," "Evidence of improvement in one or more measures," "Evidence of improvement in most measures," and "Evidence of improvement in most measures sustained for more than 2 years." " *7.3.2:* "Dedicated safety instructors" is not the best measure of the effectiveness of your training program. Who cares where the instructors are from if they are qualified and effective? Recommend replacing the last two statements with: "A formal H&S [health and safety] training program exists, including curriculum presented by qualified instructors (external or internal)." "A formal H&S training program exists, including curriculum presented by qualified instructors." Feedback on the effectiveness of training is solicited and used to continuously improve the program. *7.3.3:* "What is the difference between an "Employee Injury Reduction Program" (7.3.1) and an "H&S Plan"? Do we need both measures?"
8. Community Sustainability	"Concern that most people define sustainability only in environmental terms. The questions in this section jump back and forth." *8.2.1:* "Only lists environmental criteria for projects. This is an issue within the EUM framework, which does not explain how "sustainability" differs from "good management." It makes responding to all the measures in this section confusing." "Sustainability is focused on the future and whether our organizations are improving or degrading the ability of future generations to thrive. This is a better definition, though it won't end the confusion. Suggested language: "A process by which organizations manage their financial, social, and environmental impacts to ensure meeting the needs of the present without compromising the ability of future generations to meet their own needs." " *8.1.1:* "The highest level of "performance" should include buy-in by the governing body." *8.1.2:* "Implementation: Mission/Vision statements and policies do not include initiatives. Sustainability principles can be incorporated into the mission, vision, and polices. Sustainability initiatives can be incorporated into the planning process."

(continued)

Table 7.2 (Continued)
Comments on attributes and subcomponents of greatest interest

Attribute	Comments and Recommendations
	8.1.3: Economic Strength -- Promote economic vitality of the community. "Are we asking specifically about environmental management plan? Elements of an effective management framework or system include periodic self-assessment, identification of improvement opportunities, implementation of improvements, evaluation of results, and standardization of business processes. A combination of strategic planning, goal setting, balanced-scorecard, and process improvement that includes environmental factors, but does not focus exclusively on them is required. For this measure, perhaps leave off the word "sustainability" and just say "management system." This is also a place where it would be better to talk about having an effective, systematic approach to sustainability and management, not necessarily a "management plan." It could be a plan, but doesn't have to be." *8.1.4: Sustainability Reporting* -- Degree of sustainability reporting performed, for internal and external stakeholders. "To whom are we disclosing? The general public? Governing body? The matrix starts with a first time report. We need a "no reporting at this time" choice to start with." *8.2.1: Project Planning, Design, and Engineering*. "Examples of criteria are environmental only." *8.2.2: Procurement*. "The definition seems to apply only to CIP [capital improvement program] projects. What about general procurement practices?" *8.3.4: Energy*. "Another measure where Implementation and Performance need to be reversed. The first option should be "No targets set," not "No Plan." " *8.3.5: Waste Reduction*. "Implementation and Performance need to be reversed. Also, when using the number of years targets have been met, we need to be more consistent throughout the document. We use 2 years as the best in some measures (8.3.5, 8.3.7), 5 in others (8.3.4)." *8.3.7: Pollution Prevention*. "Implementation and Performance need to be reversed. Instead of "No mechanism in place to track," just say "Not Tracking." " *8.3.8: Climate Change*. "Implementation and Performance need to be reversed. Instead of "No mechanism in place to track," just say "Not Tracking." "

(continued)

Table 7.2 (Continued)
Comments on attributes and subcomponents of greatest interest

Attribute	Comments and Recommendations
	8.4.3: Degree of Success in Keeping Customer Bills within Affordable Levels. This one was confusing. So "even though we have some of the most competitive rates in the area, we didn't know how to complete it. Both matrixes seem to be asking about developing a plan. Shouldn't the measure of performance say something about actually having competitive rates and fees?" *8.5.4:* "Implementation and Performance need to be reversed. Can you give some examples of "community goals?" Supporting 3-4 charity organizations a year seems pretty good (especially for small agencies), but even the midrange square asks for 3 programs AND 3 goals."
9. Water Resource Adequacy	*9.3.1: Degree of Success in Achieving Target per Capita Use.* "Need to change the performance areas because many Western utilities are already at or below 150 gpcd [gallons per capita per day]. Moreover, it is the Western utilities that would probably utilize this measure. Recommend having the lowest figure at <100 gpcd."

Feedback on the Framework

The feedback about the benchmarking framework asked participants to offer recommendations about the practice areas or performance measures, including the way the scales are formulated for specific performance measures.

Generally, comments are grouped into those directed to terms and definitions, specific performance measures, and usefulness of the tool.

Terms and Definitions

Respondents noted that the "word choice" used in several of the attributes indicated a bias in their interpretation toward a particular implementation methodology. In particular, the Infrastructure Stability section has a bias to deploy Asset Management using a particular protocol. Another example noted is where the "Cost of Service Analysis" is blended with the concept of "Full Cost Recovery."

These terms and definitions and the way they are used in the scales can lead a utility to implement a particular methodology or approach. Using words such as "all" or "rigorous" may also not be important or appropriate. Respondents urged a more careful evaluation and more thorough clarification and definition. Some respondents noted caution about the language that uses "rigorous criteria" versus language such as "agency-defined criteria," and the suggestion was made that terms and definitions should be reviewed throughout the framework.

Some participants noted issues with calling this work "Self-assessment Benchmarking," commenting that benchmarking implies a widely accepted "best in class" protocol or standard that all utilities desire to achieve. This particular work would be more accurate to be framed as a "Gap Assessment" (Figure 7.4).

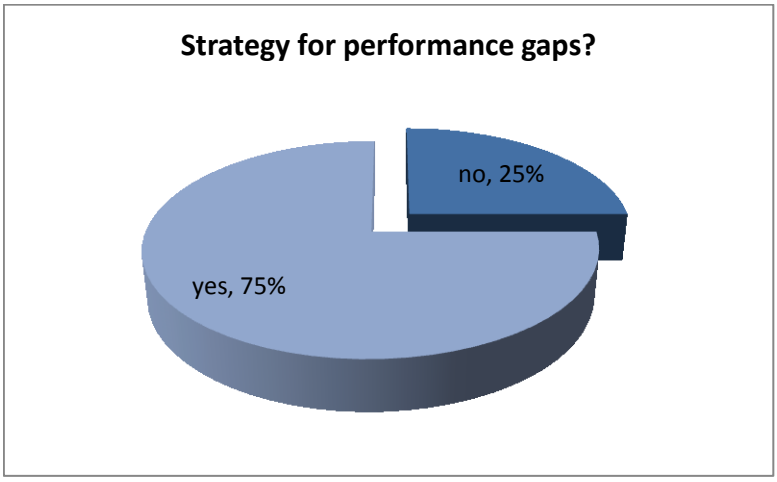


Figure 7.4 Usefulness of the process as a means to identify strategies around performance gaps

Some respondents noted that the use of the matrix was easy in some cases and difficult in others because of the language used on the scales. Some relevant choices were missing on the various scales. The scales seem to imply that being on the far bottom right quadrant was the "best in class." However, this was not always the case, and often was an agency-specific determination.

Participants specifically noted that several of the performance measures used terms not defined in the Primer or the benchmarking tool, although they noted that in some cases these terms might be defined in external documents that may not be easily accessible by all utilities. For example, the term "standard non-compliance day" is used in the calculation of performance measure 1.1.2 and is not defined in the benchmarking tool. Rather it is defined in separate reports by American Water Works Association Research Foundation. To ensure industry-wide standardization of performance measures, such terms should be defined in the benchmarking tool, such that the tool is complete and self-contained for the individual utility.

Specific Performance Measures

Participants noted that the tool generally provided useful performance measures and helpful assessment of current performance. Several participants indicated that it was less clear whether the tool would be effective at helping them pinpoint strategies to address performance shortfalls.

One participant noted that information not included in the spreadsheet, but available in the Primer, would be highly beneficial to users of the tool. For instance, specific definitions and detailed categorical explanations would increase efficiency when completing the self-assessment. Also, a uniform weighting scale for each attribute (for example, 1 to 100) and practice area would distinguish importance relative to other attributes and practice areas.

"The managers agreed that the value of the exercise is in the conversations, and that the measures help structure conversations they might not otherwise have had. …the discussion of community sustainability has led to us to learn more about the concept of sustainability and how it should be applied..."

—Union Sanitary District

Several areas of the scale for measuring performance need work. One respondent indicated "…one of the main challenges was determining the proper weighting factors for key attributes and performance areas in the setup portion of the tool. Where practice areas are compliance-related, they were given the maximum weight, but otherwise it was difficult to develop a proper process for weighting. It would be useful to add an additional category (aside from Y/N) when selecting performance measures to identify certain measures as "critical" (that is, having public health, safety, or regulatory impacts) or supplemental (with more nuanced impacts on a utility's operations)."[5]

Usefulness of the Tool

There was general agreement that the tool and the process to use it were helpful (Figure 7.5). One respondent noted that "…it requires a fair bit of engagement, motivation, training, and scheduling….as well as the follow-up of what to do with the model results. The actual functions of the tool work fairly well."[6]

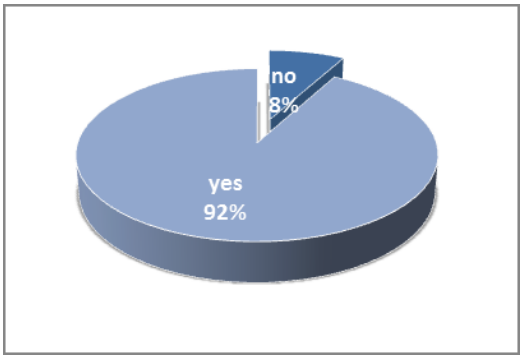


Figure 7.5 Usefulness of the tool as a method for conducting self-assessment benchmarking.

Another respondent noted some suggestions for process improvement around how the tool is used: "The Managers wanted to see the measures before they could decide whether it was relevant to our organization, so they selected all the measures in an area and then deleted them later if not relevant. I think this resulted in too many measures making it to the final report. If there were a way to preview the measures (besides printing them all out), so they could pick only the most relevant, it would save a step. It is not clear how or if the tool can inform benchmarking without some way to compare responses with other agencies."[7]

Usefulness of the tool as a next step going forward was a question for several participants, including the following: "I spent a considerable amount of time figuring out the logic behind the final numerical assignments of 'actual' and 'target.' Once I documented the

[5] New York City Department of Environmental Protection

[6] Toronto Water

[7] Union Sanitary District

effects of the weighting of the Attributes and the PAs [practice areas] and the value of the squares of the Matrix, I understood the logic behind the final numerical 'Gap Assessment' summary but didn't feel that the model offered any 'next step' actions (i.e., what steps do we take now and how do we measure or progress)?"[8]

Others found the tool helpful as a baseline that could be updated, expanded, and used as a 'living' kind of exercise. "This tool should be considered a living entity and an organization may well develop new or different attributes depending on its own circumstances."[9]

Feedback on the Benchmarking Tool

As a first time roll-out of this tool, users provided excellent feedback for improvements to navigation, functionality, customization, and design enhancements. Comments are included in the bullet points below.

> "When compared to our previous system, the tool appears to be a superior assessment of internal performance."
>
> — Louisville Water Company

- Navigation
  - "When reviewing the practice areas and determining the weighting factor, it would be helpful for the user to click on each practice area and it would provide a pop-up box (bubble) that would indicate a description of the practice area. Or provide this information on another tab that can be printed out. We had a difficult time with the weighting factor and I had to describe to the team what each practice area included in terms of performance. If the descriptions where available, everyone could be on the same page."
  - "I think the next part of the process button should be at the end of the page, not at the top; it's difficult to understand where you are and what is next."
  - "Report on level of effort for the testing process."
  - "[Add] Comments or drop-down examples/definitions within the performance measures that help define the measure."
- Customization
  - "While the instrument was useful, it is difficult to have a 'one size fits all' survey. If possible, it would be nice to allow some customization of the survey while remaining within the Ten Attributes of EUM."
  - "How does one add additional benchmarks? Maybe not for this project, but in general?"
  - "If the provided benchmarks are too limiting, how does one expand them? Provide more detailed information on how to customize the tool for the organization."
  - "Allow for some customization for utilities."
- Design
  - "The Excel note boxes are very distracting. They cannot be easily collapsed and were often in the way. However, the information in the note boxes was useful."
  - "Lighten the color of the headings to increase contrast and make it easier to read."

[8] WaterOne

[9] United Utilities (UK)

- "It was hard to read on a projector screen. I had to keep scrolling and adjusting the view percentage to get it all on one page, and then it was too small to read. When I clicked on a square, the view jumped back to the top and then I had to scroll down again."
- "When you select a target, the cursor jumps back to the top each time. Also, the use of the colored boxes may not be the best way…perhaps just use bubble shading…."
- "I can type pretty much anything into the performance measurement election piece; I think it should be just y/n."
- "When identifying the current and target status, the page constantly jumps back to the top of the page. Very annoying when one page takes up more than one computer screen."
- "Use a darker color for 'current' lines on spider [radar] graph. Yellow is pale & does not reproduce."
- "A 'delete all' option for the performance measures would be nice."
- "Correct typographical errors; blank categories."

- Ease of Use
  - "Individual attributes summary results worksheets are not retained upon saving the tool and re-entering the model. Individual attribute summary results must be regenerated each time the tool is opened by pressing the 'Create Framework' button on the Setup page."
- Enhanced Functionality
  - "The tool does not allow for the entry of data/information into the 'Footnotes:' section. This area may be particularly useful for including term definitions specific to a particular performance measure. The tool does not allow for editing (cut/copy/paste) in the User Comments section. This functionality would be particularly useful for related performance measures. When printing multiple individual performance measure worksheets within the tool, the User Comments sections associated with each of the performance measures would visually lay over the top of the matrix, and could not be reformatted or moved. Many of the performance measures could potentially be utilized for both internal and external benchmarking. To enhance tool functionality, those performance measures could be identified and standardized. Several of the performance measures lack a general description in the upper left cell of the matrix. While inferences can be made as to the general concept of the performance measure through reading the associated performance levels and degree of implementation descriptions, it is suggested that a general description be included for all performance measures."
  - "…recommend that the framework's documentation include a dictionary/glossary of the performance measures and associated levels of performance and degree of implementation. This dictionary/glossary could be included in the Summary of Benchmarking Framework. A dictionary/glossary would simplify aligning our organizational definitions with the Assessment's definitions. This would simplify benchmarking team discussion without the need to refer to the assessment tool for clarification."

- "… Make the tool web-based which could provide additional functionality to the user and could create a platform for utilities to more easily compare themselves with other utilities."
- "I found that I wanted to work off line to undertake some of the tasks - probably a techno-phobia but I had concern that I would be able to navigate and not lose the work already done. I created my own working crib sheet."
- "The web graphic is very useful to show the current state versus the target for the practice areas."
- "Wondered if using a set of multiple choice questions rather than the matrix (or a choice between formats) would be helpful. The use of questions would allow us to use our clicker technology to rapidly get answers from our District participants that then could be displayed in the matrix based on the responses. There may likely be differences in opinions on many of the matrices. This tool does not allow assessment from multiple people and account for the variability that may occur because if the subjectivity of many of the measures."

Feedback on Time Requirements to Conduct the Self-assessment Benchmarking

To understand how each participating utility approached responding to the self-assessment and to characterize how much time utilities devoted to conducting the self-assessment benchmarking, the team asked who was involved in the benchmarking test from the utility's staff: quantity of staff and the level of participation (job titles). Table 7.3 shows summary statistics on the time spent in conducting the self-assessment benchmarking tests. While an average of 32 hours and 6 people were reported, a variety of approaches can also be seen in the range of staff assigned (Table 7.4).

Table 7.3
Summary of time required

24 Respondents	Hours	Persons
Average	32.3	6.2
Minimum	6.0	1
Median	25.0	5
Maximum	100.0	20

It was common for participating utilities that provided feedback to note that the work of rating attributes was done largely by senior and executive-level staff. Data collection, where required, was primarily a managerial level or subject matter expert responsibility. Some participating utilities have established organizational structures where some of these responsibilities reside (for example, "Continuous Improvement," "Head of Innovation," "Performance Management," and "Quality Program Coordination.)"

Where a significant amount of time and extent of staff involvement were reported, the utility noted that "…the process of benchmarking is nearly as or perhaps more important than the actual benchmarking results."[10] Further, they noted their advice to other utilities specific to participation as "…the benchmarking team should involve a broad group of members. In future

[10] New York City Department of Environmental Protection

iterations, [we] would consider looking to frontline workers, regulators, customers, board members, and other stakeholders for input on the benchmarking process. Due to time and resource constraints, we did not take this approach to the pilot.[11]"

On the other end of the participation/time spent spectrum, Charlotte-Mecklenburg centralized their response through one person, a Continuous Improvement Officer. They further noted "…you need a good bit of information at your fingertips to make the use of the tool seamless. We… have quarterly metrics, maintain a balanced scorecard, and are ISO [International Organization for Standardization] certified in some divisions, and so we have a good bit of the information readily available. Also, we have undertaken management systems and continuous improvement as integral to the business philosophy so the questions are not foreign. I think this might not make a lot of sense if you have not undertaken at least some form of comparative analysis or performance management."

Table 7.4
Titles of utility team members involved in the benchmarking test

Senior and Executive-level staff (from top executives/CEO/COO to Deputy Directors)	Executive Director Executive Program Manager Executive assistant Chief Operating Officer (2) Chief Executive Officer Chief Finance Officer Chief Communications Officer Chief of Production Superintendent General Manager (4) Assistant Treatment Superintendent Human Resources Asst. Director (3) Billing and Finance Director (2) Customer Service Asst. Director Customer Service Director Director of City Utilities Director of Environmental Services Deputy General Manager Deputy Director of Utilities Capital Asset Management Deputy Director of Utilities Policy and Planning Deputy Directory of Utilities Engineering Deputy Director of Utilities Business Services

(continued)

[11] Ibid.

Table 7.4 (Continued)
Titles of utility team members involved in the benchmarking test

Division Manager-level staff	Strategic Systems Manager (2) Plant Manager (3) Manager Operations Efficiency Finance Manager IT Manager Water Resources Manager Engineering Manager Facility Ops Manager Manager Manager Business & Customer Support Manager Of Environmental Quality Public Relations Manager Budget Manager Business Operations Manager Assistant Manager Purchasing Manager Water Distribution Manager IT Manager (Lean Six Sigma Program Manager) Senior Policy Manager Manager of Operations Program Manager (3) Technical Service Workgroup Manager Maintenance Workgroup Manager Collection Services Workgroup Manager Water Treatment Manager Water Quality Regulatory Manager Business Services Workgroup Manager Treatment & Disposal Workgroup Manager Manager Major Capital Projects
Technical Supervisory level staff	Electrical And Instrumentation Supervisor Laboratory Supervisor Maintenance Supervisor Office Supervisor Operations Supervisor Program Supervisor Maintenance Reliability

(continued)

Table 7.4 (Continued)
Titles of utility team members involved in the benchmarking test

Technical Subject Matter Experts	Principal Engineer Engineer Water Resources Engineer Plant Engineer Designer Senior Environmental Specialist Staff attorney Water Systems Advisor Water Distribution Administrative Assistant Water Quality Coordinator Business Associate Water Supply Wastewater Treatment Water and Sewer Operations
Business and Financial Analysts, Quality Specialists	Senior Financial Analyst Senior Manager, Continuous Improvement Senior Business Strategist, Water Resources Continuous Improvement Officer Performance Management Specialist Quality Program Coordinator Head of Innovation Management and Budget Business Performance Analyst Water Resources Business Management Analysts Business Development Analyst Program Support Analyst
Customer Services, HR, and Public Relations	Customer Services/Relations (2) Public Affairs HR and human relations

Feedback on the Usefulness of the Process for Others

Generally utilities saw value in the process, and respondents provided list of peers and other industry groups that they thought could benefit from this tool.

Peers identified by respondents (either inside or outside the respective utilities) that might be interested in using or hearing more about this benchmarking process and tools were as follows:

- AWWA Rocky Mountain Section Utility Management Committee
- Any management consultants who assist utilities with strategic planning
- Association of Clean Water Utilities in Oregon

> "We believe that there would be other groups within our Utility (particularly, operational performance teams) that could benefit from this tool for self-assessment, and for discussing strategies and actions to close the gap."
>
> —Calgary

- Pacific Northwest Section of AWWA and the Washington Association of Sewer and Water Districts.
- Washington State Risk Management Pool and Enduris
- Louisville Metropolitan Sewer District and other regional water utilities of comparable size
- National Water and Wastewater Benchmarking Initiative and Ontario Municipal Benchmarking Initiative Water and Wastewater section (in Canada and Ontario), as well as other municipalities/regions.
- Other internal Trinity River staff, especially the managers

Use of Feedback to Refine the Benchmarking Framework and Tool

The research team reviewed the feedback provided by the utilities, which ranged from high-level suggestions on functionality of the tool to specific language and elements used in defining some of the practice areas and performance measures. The team considered the recommendations using several criteria including:

- Consistency with research and feedback by the full project team throughout the research project
- Frequency (i.e., similar comments made by several utilities)
- Applicability to multiple utility contexts (i.e., would the suggested revision decrease the usability of the tool by some utilities)
- Feasibility within the schedule/resource constraints of the current research project

Based on this review, a number of changes were made and are part of the tool delivered in this project. These include:

- The capability for utilities to edit the definition of the performance measures to meet their specific contexts
- Addition of several performance measures; and
- Revision of the definition of the scales for a number of performance measures.

A number of other potential modifications left for future revisions, such as the provision for cross-utility comparisons, are described in Chapter 9, Conclusions and Recommendations.

CHAPTER 8
RECOMMENDED APPROACH FOR CONDUCTING A SELF-ASSESSMENT

INTRODUCTION

This chapter identifies steps that a utility could follow to conduct a self-assessment using the benchmarking framework, benchmarking tool, and other resources developed for this project. The suggested approach is based on the experience of the project team in conducting benchmarking studies and suggestions from the utilities that used the benchmarking tool to conduct self-assessments during Phase 2.

The seven-step process described in this chapter provides a recommended approach that utilities can adapt to meet their specific needs:

1. Form a benchmarking team and develop an initial plan of action.
2. Select EUM attributes to assess.
3. Select associated practice areas and performance measures to assess.
4. Revise plan of action (if needed).
5. Conduct self-assessment benchmarking for selected attributes, practice areas, and performance areas.
6. Evaluate results and identify methods to narrow priority gaps.
7. Develop follow-up plans.

Each utility's context, however, is unique, including different goals for conducting self-assessments, varying histories with performance measurement, and varying availability of data, information and other resources to populate the assessment. As such, adaptation of the approach and the sequence of these steps may be needed to provide maximum efficiency and value. Smaller utility systems may find that they can streamline or combine some of the steps recommended below because they have fewer groups and staff members that need to be engaged to address the recommended activities, and because they may have fewer data sources to be reviewed in scoring performance for the selected metrics.

FORM A BENCHMARKING TEAM AND DEVELOP AN INITIAL ACTION PLAN

Because the elements of EUM cut across most major functions performed at a utility, it is important to form a team that includes representation of the key groups and functions within the utility. Feedback from the utilities that tested this process indicated that it is important to have executive sponsorship for the program for it to be given adequate priority within the organization.

The number of team members will vary. In large utilities with many divisions or departments (such as Planning, Engineering, Construction, Compliance, and Finance), at least one representative from each of these primary groups is recommended. In smaller utilities, several senior staff members may address multiple primary functions, and a relatively small core team of three or four people may address the primary stakeholder interests and functions within the organization.

As part of the initial effort a preliminary plan of action needs to be developed to include such elements as:

- **Identify team leader.** Identify someone within the utility who will be responsible for leading the effort. This person will be responsible for keeping the process moving despite the many other demands on staff time, organizing meetings when needed, and facilitating discussions on issues such as which attributes should be addressed and how identified performance gaps should be narrowed.
- **Prepare schedule for conducting the self-assessment.** Reasons to establish an initial schedule for the self-assessment include:
  - Connecting to other utility processes. The results of the self-assessment may be intended to inform strategic planning and budget development processes at the utility. As such, the benchmarking process should be scheduled so that the results can be used to identify resources and other inputs in the budget and strategic planning processes and documents.
  - Maintaining momentum. Because staff members who will be participating in the self-assessment process are likely to have multiple roles in the utility organization, it is important to establish specific schedules and milestone dates so that the process keeps moving forward.
- **Provide preliminary confirmation of resources (staff time plus expenses).** By developing a specific plan and schedule, staff time requirements can be established and balanced with other requirements for staff members whose participation is needed for the effort to be successful.
- **Charter the core team.** A chartering session should be conducted for the core team. Chartering should include executive endorsement and support, a review of the planned schedule and activities, and a team-developed set of program goals. For smaller utilities, where only a small number of staff members may comprise the full team, there may not be a need for a formal chartering session. In this case, a chartering session should be considered an optional activity if the core team has already achieved alignment on goals for the benchmarking and schedule through more informal team communications.

To provide an estimated level of effort regarding the schedule and staffing parameters, participating utilities were able to conduct a self-assessment within a 3-month schedule, and, as detailed in Chapter 7, on average they spent about 32 person-hours conducting the initial self-assessment.

SELECT EUM ATTRIBUTES

The first major activity for the self-assessment team, once formed and chartered, is to select which of the Ten EUM attributes identified in the Primer should be addressed in the initial assessment process. It is recommended that utilities not try to address all Ten Attributes at once. Just as utilities that have implemented Environmental Management Systems (EMSs) have found that it is useful to do so progressively, that is, by addressing initial priority elements and then branching out to address others (AWWA Research Foundation and EPA 2006); it is useful to

begin work on EUM issues by first addressing those attributes deemed of greatest interest/concern to a utility's stakeholders:

1. Product Quality
2. Customer Satisfaction
3. Employee and Leadership Development
4. Operational Optimization
5. Financial Viability
6. Infrastructure Stability
7. Operational Resiliency
8. Community Sustainability
9. Water Resource Adequacy
10. Stakeholder Understanding and Support

The process for identifying priority attributes to address will depend on a number of factors, including whether the utility has engaged in previous efforts related to EUM and the EUM Primer. Utilities that have previously worked with the EUM Primer may already have selected and prioritized attributes as part of those efforts. Utilities without prior EUM experience will need to start by familiarizing themselves with the basic principles of the EUM program. For utilities that fall into the latter category, it is recommended that they review the Primer, case study documents, and other related materials, which can be found on the website that was established at the time of publication of the Primer in 2008 (www.watereum.org/).

For utilities that have not previously identified priority EUM attributes through previous efforts, a useful tool is the self-assessment process identified in the Getting Started section of the interactive primer located on the EUM website at http://www.watereum.org/resources/interactive-primer/getting-started/. A downloadable spreadsheet file at this website can be used to help decide an organization's most important attributes.

Another aid for selecting appropriate attributes is to review the practice areas and performance measures that have been defined within each of the Ten Attributes, as summarized in Chapter 5 of this report (see Figure 5.3) and detailed within the benchmarking tool. Review of the performance measures in the tool provides access to the explanatory notes and more specific definition of how performance is measured, which in some cases may aid the decision of whether a specific attribute is of high priority to an organization. Several utilities that tested the process and tool during Phase 2 commented that they tended to gravitate toward attributes where they had information readily available or where they knew they would perform well. In retrospect, they indicated that perhaps they would have benefited more by focusing initially on attributes where they were more likely to have performance gaps.

The utility will then need to weigh the relative importance of the selected attributes. As detailed in the description of the benchmarking tool in Chapter 6, there is significant flexibility in the relative weighting of the attributes. For example, one attribute could be assigned most of the weighted value, or attributes could be assigned equal weight. It is recommended that the full EUM core team be engaged to help determine the relative weight assigned to the selected attributes. As the weights represent the relative importance of each attribute, the user can use any range of numbers, and the tool normalizes the weights by converting them into percentages. For practical purposes, the maximum range allowed is 1 to 100, however, based on user preference

the range can also be 1 to 5 or 1 to 10, etc. A weight of zero excludes the attribute from the framework.

SELECT PRACTICE AREAS AND PERFORMANCE MEASURES

Once a utility has identified the attributes to work with, the next step is to select the practice areas and performance measures within practice areas to include in the utility's customized EUM framework.

To provide some context on what practice areas are, consider "Product Quality", one of the Ten attributes. Per the EUM Primer, this attribute is described as "Produces potable water, treated effluent, and process residuals in full compliance with regulatory and reliability requirements and consistent with customer, public health, and ecological needs". Thus, for this attribute practice areas are processes or procedures that utilities develop, implement, and track to meet the goals described in the attribute. In the example above, they are processes that a utility employs to fully comply with regulatory requirements, to meet customer service levels, etc. For the purpose of the benchmarking tool developed for this project, the Product Quality attribute was defined to include three practice areas:

- Comply with regulatory and reliability requirements
- Address customer needs
- Address public health and ecological needs

The effectiveness and efficiency of these practice areas can be assessed by performance measures. Performance measures can be quantitative or qualitative. For example, in the case of Product Quality, "extent to which service interruptions are reduced to target levels" is one of the performance measures that assesses the effectiveness of the practice area called "addressing customer needs". This is an example of a quantitative performance measure.

Using the EUM Primer as a starting point, the practice areas and performance measures were developed based on a literature survey and research team experience, then enhanced during Phase 1 based on input and review by participating utilities. Once the benchmarking framework and tool were developed, the practice areas and performance measures were further refined based on feedback provided by the expanded group of utilities that tested the tool during Phase 2.

It is recommended that all members in the EUM core team be engaged in selecting the practice areas and performance measures. The sub-steps in this process, as described below, include:

- Identify practice areas within the selected attributes.
- Weigh the relative importance of selected practice areas.
- Select applicable performance measures within each selected practice area.

Identify Practice Areas within the Selected Attributes

For each attribute selected, the utility will need to select at least one practice area. When determining which practice areas to include, utilities are encouraged to review the performance measures within each practice area and consider:

- Relevance of the performance measures and aligned practice area to achieving the utility's key mission and goals.
- Consistency with other related tracking and reporting the utility may already have in place.
- Availability of information and data to make informed ratings of the current and target performance. [12]

Utilities are encouraged to include in their customized self-assessment all practice areas that are relevant to their utility's operation for which information to score is available.

Weight the Relative Importance of Selected Practice Areas

Utilities will need to assign a weight to the relative importance for each of the selected practice areas (Chapter 6). As was the case for attributes, the weights represent the relative importance of each practice area, the user can use any range of numbers, and the tool normalizes the weights by converting them into percentages. For practical purposes, the maximum range allowed is 1 to 100, however, based on user preference the range can also be 1 to 5 or 1 to 10, etc. A weight of zero excludes the practice area from the framework.

For example, one practice area could be assigned most of the weighted value within an attribute, or several practice areas could be assigned equal weight. It is recommended that the full EUM core team be engaged to help determine the relative weight assigned to the selected practice areas.

Select the Performance Measures within each Selected Practice Area

For each practice area that a utility has selected, the utility will need to select at least one performance measure to assess. Unlike the attributes and practice areas, the user does not assign relative weights to the selected performance measures. To illustrate, if a practice area has six performance measures and all selected performance measures are weighed equally, and only four of them are selected, then each is weighed 25%. During the scoring process, the current and target scores of that practice area become the arithmetic average (mean) of the four current and target scores of the performance measures. These are the scores that are illustrated in the radar graphic display of the attribute. On the other hand, the score of the attribute is the weighted average of the different practice areas.

The number of practice areas selected determines the number of dimensions of the radar diagram; for example, an attribute with 3 practice areas is displayed in a triangular shape, while another with 5 practice areas will be displayed in a pentagonal shape.

Utilities are encouraged to include all performance measures within selected practice areas that are relevant to their utility's operation and for which data to assign current and target performance scores are available. It should be noted that the performance measure scales and definitions of each "degree of implementation" and "level of performance achieved" criterion can be revised by a user of the tool, if the utility feels it needs to modify the definitions. This can

[12] If the utility determines that the practice area and aligned performance measures are useful but staff is not currently in a position to accurately score current or target performance, it is recommended that this measure be excluded from the utility's initial customized EUM framework. Instead a plan of action for developing information that would enable the utility to include the measures in future updates should be developed.

be done by double clicking on the appropriate cells of the matrix (i.e. the headers of the rows and columns).

Specific steps for creating the customized self-assessment within the tool are detailed in Chapter 6 of this report.

REVISE PLAN OF ACTION (IF NEEDED)

Once the utility's customized self-assessment has been developed, it is recommended that the initial plan of action be revisited and revised, if necessary, before scoring and other benchmarking activities begin. Reasons that revisions may be needed at this point include:

- **Benchmarking team composition.** Scoring the performance measures for the attributes and practice areas selected for inclusion in the utility's customized EUM framework may require input from staff with a different mix of technical expertise than the EUM core team envisioned when the initial plan of action was developed.
- **Benchmarking resource requirements.** The utility may need to gather or analyze more data for the selected performance measures than was anticipated at the time the initial plan of action was developed.
- **Schedule considerations.** Based on the time required to develop information and conduct scoring for the selected performance measures, the utility may need to revise the schedule for scoring and evaluating results.

CONDUCT SELF-ASSESSMENT BENCHMARKING FOR SELECTED ATTRIBUTES, PRACTICE AREAS, AND PERFORMANCE MEASURES

Based on the revised plan of action, the next step is to conduct the self-assessment benchmarking, which requires identifying current and target performance for all performance measures that have been included in the customized self-assessment.

The specific process for conducting the scoring will depend on such factors as the number of attributes and performance measures that are selected, the size of the utility organization, and the size of the benchmarking team. During Phase 2 when utilities tested the tool, several methods were used to conduct the scoring:

- Some utilities used a small core team to conduct the initial scoring and then provided an opportunity for the full team to review and provide input to the assignment of both current and target scores.
- Other utilities assigned scoring to specialists in the fields for each selected attribute and then provided the full team the opportunity to review and provide input on the assigned scores.
- Still other utilities did the scoring as a full team in a workshop setting.

Each of the approaches described above is a valid method for conducting the self-assessment, and other permutations and approaches are also likely. Regardless of the method employed by a utility, it is important that there be an opportunity for the full team to review and provide input to the scoring to ensure transparency in the process and to see that the assessment provides the best available knowledge base of the full organization. Providing the opportunity for

input on the scoring also will help to secure internal stakeholder support for results and findings of the process.

The benchmarking tool includes a validation check that ensures that utilities have scored all selected performance measures and that the framework is complete. The validation confirms that at least one practice area has been selected for each selected attribute, that at least one performance measure has been selected for each selected practice area, and that all selected performance measures include a score for both current and target performance.

EVALUATE RESULTS AND IDENTIFY METHODS TO NARROW PRIORITY GAPS

The next step is to review the performance results of the self-assessment. It is recommended that a staff workshop be used for this step. Many of the utilities that participated in testing this process indicated that the dialogue on findings and strategies to move forward was one of the most valuable parts of this self-benchmarking process. The review should include an analysis at a high level (for example, how close is the utility to meeting performance goals for the highest priority attributes?) and also at a detailed level (for example, why is the utility failing to achieve target performance for specific performance measures?). The graphic and tabular results summaries in the benchmarking tool facilitate higher level discussions of findings, and the detailed performance scoring sheets can be used for discussing gaps at the individual performance measure level.

Examples of questions that might be useful to frame the evaluation of results and development of strategies include:

1. Attribute and overall level
    a. How close is the utility in meeting its target performance levels overall and for the highest priority attributes?
    b. Are there any surprises in the findings at these high levels (for example, unexpected gaps or performance greater than target)?
    c. Are the gaps a result of external factors or factors that the utility could affect by increased focus or reallocation of resources?
2. Practice area and performance measure level
    a. Are there any surprises in the findings for specific performance measures for priority attributes?
    b. What specific strategies could the utility employ to address gaps in performance for priority attributes?
        i. What specific actions need to be taken and by whom?
        ii. What resources are needed to narrow the gaps?
        iii. What timeframe should be set to achieve the target levels of performance?
        iv. Who needs to act to approve the resources required to narrow the gaps?
    c. Are there any performance measures where current performance exceeds target performance for which resources could be reduced to assess gaps for other priority measures?
    d. Should the target levels of performance be adjusted for any performance measures, based on the results for that measure or overall priorities of the utility in light of the self-assessment results as a whole?

The specific strategies that should be considered and the development of a timeline for narrowing identified gaps will vary depending on a utility's context. Factors such as budget, staff availability, and other competing initiatives will influence the viability of specific strategies that might be considered. At a high level, examples of strategies that could be considered include to:

- Identify specific actions to address the level of performance, such as:
  - Devoting additional budget to the issue.
  - Consulting with appropriate internal and external stakeholders
  - Assigning specific staff members or groups with the utility to be responsible for improving performance in this area.
  - Identifying and securing additional data or other improvements that need to be made to achieve or track performance in this area.
- Identify specific actions that could address the degree of implementation, such as:
  - Revising policies to extend performance achieved from some groups/divisions within the utility to a larger number of groups/divisions within the utility.
  - Embedding performance goals into individual employee or group objectives related to achieving improvement in this area.
  - Encouraging supportive resource allocation decisions.
- Increase overall budgets/resources.
- Reallocate budgets/resources; for example, if current performance currently exceeds the target level for some practice areas, are there opportunities to reallocate some resources to address areas where there are priority gaps?

To illustrate, if a utility identifies a significant performance gap for the Financial Viability attribute measure related to the balance between debt and equity funding sources for capital programs (Figure 8.1), candidate strategies might include to:

- Raise rates to enable more direct equity expenditure for the capital program.
- Reduce the pace of the implementation of the utility's capital improvement program, which would allow the utility to reduce bonding programs and thus debt service requirements.
- Use more of available reserve funds to implement the utility's CIP to reduce reliance on debt.

Utilities should be creative when identifying the range of potential strategies to address priority gaps. Team members should be encouraged to consider both incremental steps that could be taken and bold, sweeping initiatives and new ways of doing business. Utilities might find it useful to conduct a scenario analysis, such as detailed in the Frame the Problem step in the *Capital Planning Strategy Manual* (AWWA Research Foundation 2000) to identify strategies most likely to address the range of internal and external future contexts the utility is likely to face.

The viability of the identified strategies will be utility-specific. For example, regarding the gap for the debt to equity expenditure balance shown in Figure 8.1, the opportunity to implement rate increases will depend on the level of current rates and the willingness of stakeholders and decision makers to support rate increases. Some utilities that are implementing compliance programs may not have much flexibility to reduce the pace of implementation of

their capital improvement programs. The ability to use reserve will depend on the level of reserves available and reserve requirements. This may be dictated by bond covenants or financial policies of the utility or a higher level governing body, such as a city council or regional authority.

Once a strategy has been selected, a utility should establish a timeline to narrow the gap. Where substantial gaps require significant resources, it could take a number of years to achieve the target level of performance. As shown in Figure 8.2, for the utility with the significant gap in debt to equity spending, after 5 years of concerted effort, the utility might still fall short of its target, although it would have made significant progress toward the target level of performance.

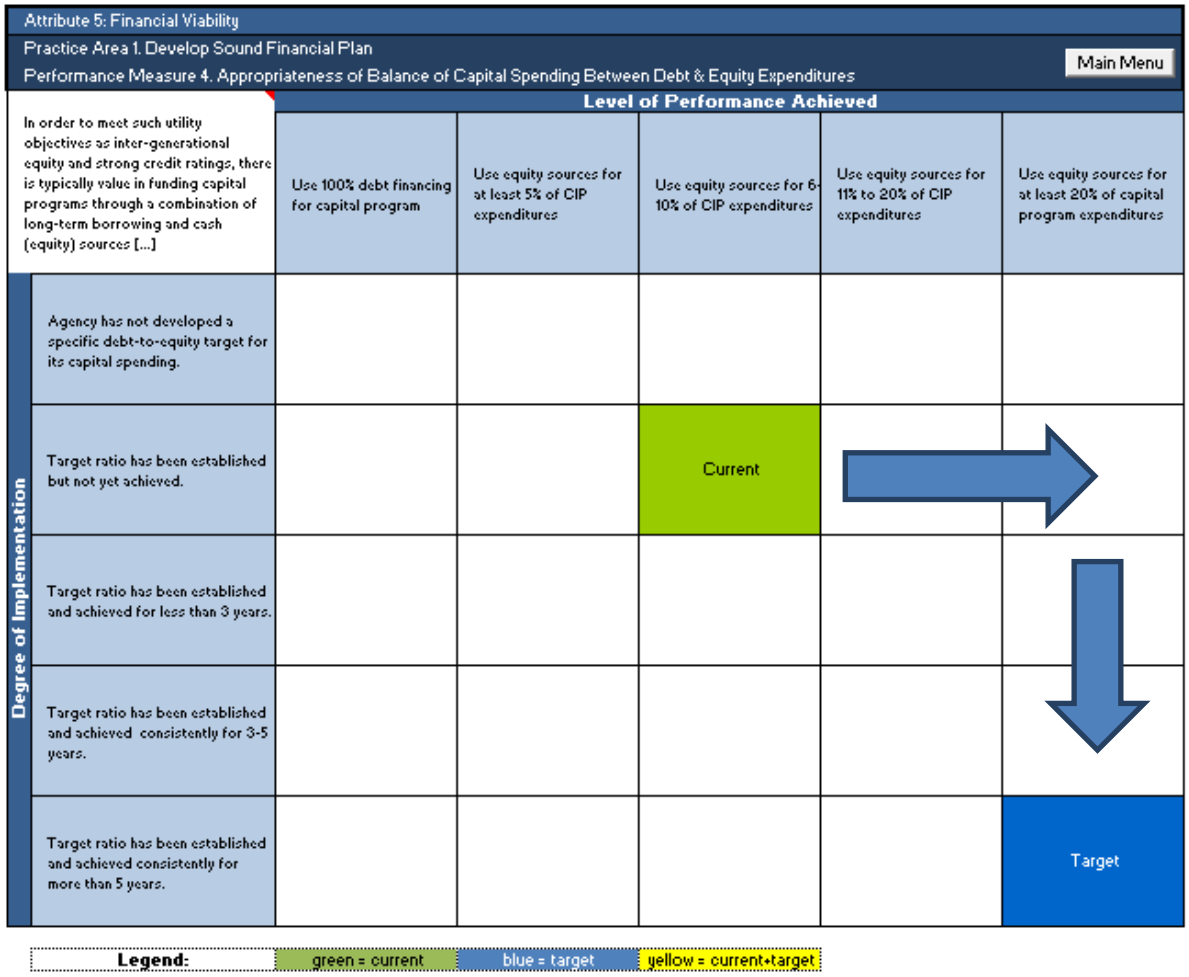


Figure 8.1 Example of path to narrow gap for one performance measure

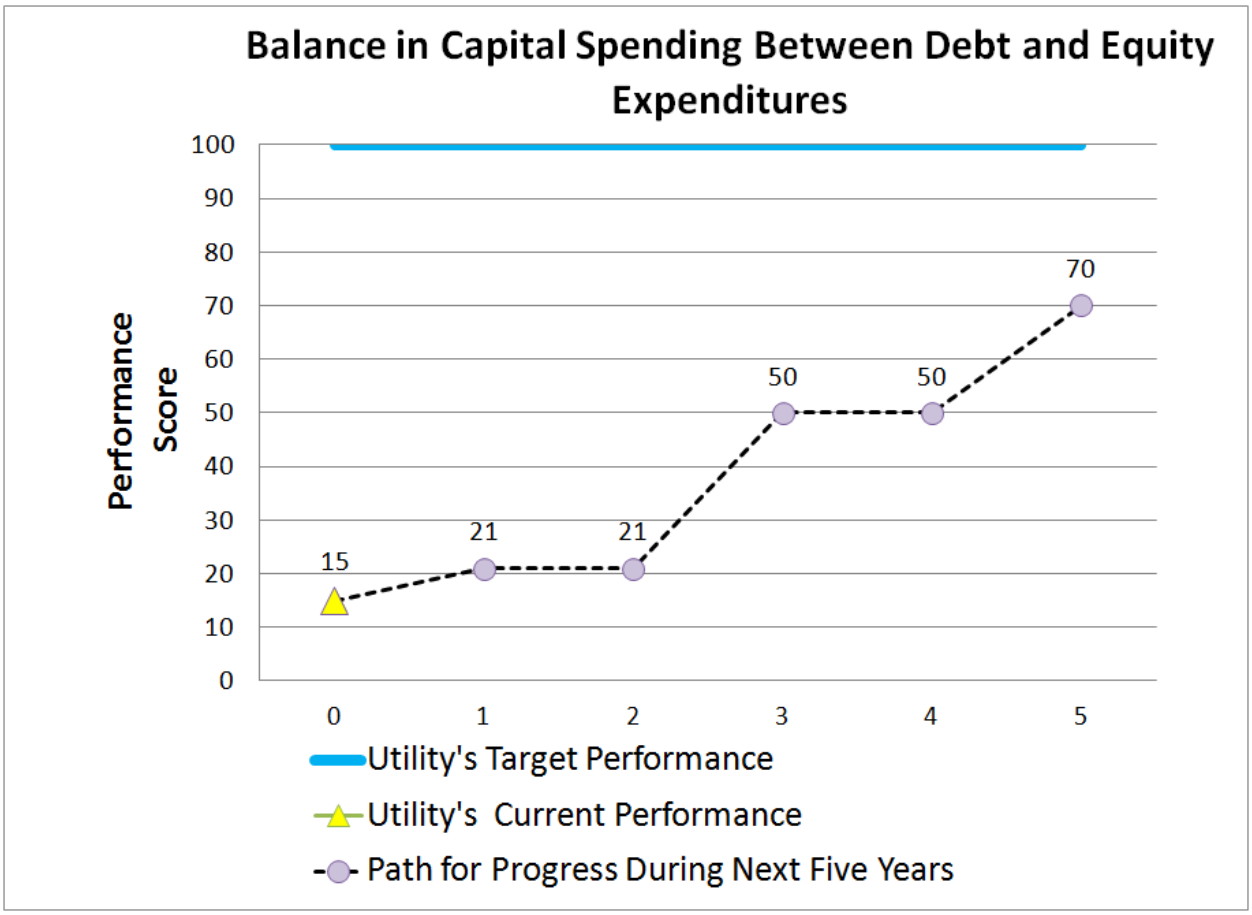


Figure 8.2 Example of timeline to narrow gap for one performance measure

DEVELOP FOLLOW-UP PLANS

The next step is to develop the following specific follow-up plans:

- Implementation plans for strategies
- Tracking of the implementation plans
- Future benchmarking plans

Implementation Plans for Strategies

For each of the priority gaps that were identified during the evaluation of results, a specific implementation plan should be developed. Specific resource requirements should be determined, and a responsible party or parties within the utility should be assigned so that these items are not overlooked. A schedule for completion and interim milestones should also be developed.

The actual activities to narrow the identified priority gaps will need to be sequenced in light of resource availability, including key staff resources and expenses for any outside services, equipment, or other such resource needs. The implementation plan should form the basis for

organizing these activities. It should be recognized, however, that revisions and updates to the plan may be needed as new insights are gained through the implementation period. These may be related to internal utility performance and, where appropriate, to insights gained through outreach or input from external stakeholders whose engagement may be critical to narrowing key gaps.

For example, for the Financial Viability gap illustrated earlier in this chapter, follow-up data-gathering, analysis, and review may provide key insights regarding the willingness of the utility's governing body and/or customers to implement rate and fee increases that would help to narrow the identified gap in the balance between debt and equity capital spending. Similarly, efforts to slow the pace of the capital program might identify greater than anticipated impacts on the operational efficiency of the system or ability to maintain compliance with key regulations. The utility's leadership team will need to ensure that there is sufficient flexibility in the tracking and implementation of the program to provide for mid-course corrections and revisions to the strategy as key insights are gained.

Tracking the Implementation Plans

There should be a periodic tracking of progress toward meeting the milestones identified in the implementation plan. It is recommended that an update be developed and a meeting held to discuss progress at least quarterly, or more frequently if needed.

Future Benchmarking Plans

By the close of the review of findings from the current self-assessment benchmarking, it is recommended that an interval for update be established. Many of the utilities that tested the tool and process during Phase 2 indicated plans to update their self-assessment annually. Others indicated plans to update the assessment more frequently, such as quarterly or semi-annually, due to the expected availability of information for many of the performance measures. In some cases, utilities might elect to update the self-assessment on a longer frequency, such as every 2 or 3 years.

The specific interval should be identified to fit data and resource availability and also to provide timely and updated input into planned updates for the utility's related planning processes, such as strategic plans and capital and operating budget development. It is recommended that the update process include a deliberate consideration of whether changes should be made to the selected framework (attributes, practice areas, and performance measures selected, and weights assigned to attributes and practice areas). Changes to the items included or weights could result from such factors as improved data availability, changing mission or priorities as a result of input from stakeholders or external factors affecting the utility.

CHAPTER 9:
CONCLUSIONS AND RECOMMENDATIONS

SIGNIFICANCE OF THE RESULTS FOR UTILITIES

Based on feedback provided by participating utilities, utilities that have used the process and tool developed for this project have found it useful in identifying gaps in performance and in helping to identify steps that they can take to reduce the priority gaps. The utilities reported that the dialogue about performance targets and current performance between colleagues from diverse sections within their utilities was useful in defining their path forward as an organization.

Utilities also reported that the findings on gaps and dialogue about targets provided useful input to other planning processes, including utility strategic plans, capital and operating budgets, and the development of internal initiatives to address priority gaps. Most of the utilities indicated plans to continue working with the process both through updates and enhancements to performance measures already assessed and by expanding their use of the process to address additional attributes beyond the three they were requested to assess during the Phase 2.

This feedback suggests that the process and tool is useful for water and wastewater utilities interested in assessing their performance in the arena of utility management. The fact that most utilities identified important usable insights based on a testing period of several months and an average time commitment of 32 person-hours suggests that utilities can enter this process progressively, conduct an initial self-assessment, and then build upon the process as useful insights and action steps are identified.

OTHER CONSIDERATIONS AND ADDITIONAL RESEARCH

A number of utilities expressed interest in further development and research related to identifying appropriate performance targets for some of the practice areas, and the possible need for additional performance measures within some of the practice areas. The framework embedded in the benchmarking tool represents the product of several rounds of development that included the project team, PAC, WRF staff, six industry associations, and participating utilities.

There is no doubt that technology and industry thinking in many of the management arenas addressed in EUM will continue to advance and evolve. For example, ongoing WRF projects are likely to produce findings that will advance thinking for Financial Viability, Operational Effectiveness, and all of the attributes. The results of such research efforts may produce recommendations and findings that could lead to suggestions for new practice areas within some attributes, new performance measures within existing defined practice areas, and refinements to some existing performance measures. The version of the benchmarking tool on the #4313 project page gives utilities the option to edit the phrasing of existing performance measures; additional programming work would be needed to add new practice areas within attributes or add new performance measures within existing practice areas.

FUTURE DEVELOPMENT

In addition to refinements and additions to the benchmarking framework discussed in the preceding section, three primary areas for future development have been identified for the process and tool developed in this project:

- Development of a library of strategies
- Provision for cross-utility comparisons
- Future updates to the tool and recommended process

Development of a Library of Strategies

The current project did not identify specific strategies to narrow gaps for each performance measure. The development of strategies depends to a great extent on the utility's context (for example, how wide the performance gap, availability of resources to address the gaps, size of the utility, and availability of staff members to address the gaps). Despite these factors that present challenges, a number of participating utilities expressed interest in having a starting-point list of candidate strategies to narrow gaps. A strategies library could be developed as a future effort, by gathering data from utilities that have used the benchmarking tool and process outlined in this report. The library could include strategies utilities have considered and/or implemented as they worked to narrow the priority gaps identified through their self-assessments.

Provision for Cross-Utility Comparisons

The process and tool developed in this research project were for helping utilities conduct benchmarking self-assessments for the Ten Attributes of EUM defined in the Primer. Several utilities have expressed interest in comparing their assessments with those of other utilities. Furthermore, some utilities wanted to explore the results of this benchmarking with other benchmarking efforts. These include efforts they undertook under AWWA's QualServe program and comparisons with benchmarking surveys currently published by AWWA. Similarly the PAC also expressed interest in exploring possibilities for cross-utility comparisons. Based on this input, the project team recommends continued discussions between AWWA and WRF staff to explore possibilities to integrate results from the self-assessments conducted using the tool for this project with AWWA's benchmarking surveys (such as QualServe) and other related data gathering conducted by the AWWA. Options to consider include:

- Complete integration of results of the two systems (AWWA benchmarking surveys and self-assessments using the tool from this project). This option is particularly challenging in the near-term, because of the significant number of performance measures in the self-assessment tool at a time when AWWA is seeking to concentrate its benchmarking efforts on a more focused group of measures. Also, there is an overlap of some measures in the two systems, such as Product Quality attribute measures that are in both the self-assessment tool and the AWWA benchmarking tool. Further, a number of the self-assessment performance measures have been

adapted from related QualServe measures, and they are also included in AWWA's benchmarking surveys.

- Supportive coordination between the two efforts - Even though complete integration of the systems and hosting of cross-utility data by AWWA is unlikely in the near-term, there are still avenues of cooperation between WRF and AWWA that could enhance a utility's understanding of its current performance and target performance goals, and how they compare with the performance of other utility systems. This enhanced understanding could be useful to a utility in its development of appropriate strategies to narrow priority performance gaps, such as development of realistic interim targets based on consideration of current performance of peer utilities. For example, utilities interested in addressing attributes or performance measures that are addressed in both systems, but with different dimensions, might be interested in participating in both efforts:
- Utilities that elect to use the benchmarking tool to identify gaps and set targets for the Product Quality attribute (that uses a number of QualServe measures) might also be interested in participating in AWWA's benchmarking survey. Participating in the survey would help advance industry understanding and would also likely provide additional insight in the utility's own assessment of its position for that attribute. This additional insight would derive from the capability the survey provides to compare a utility's current and target performance with current performance by the pool of responding utilities.
- Likewise, some utilities that have participated in the AWWA benchmarking survey may find it useful to also use the self-assessment tool, since it would allow them to compare their performance against targets. Because the AWWA benchmarking survey does not address utility targets for the measures that it tracks, use of the two systems may be complementary rather than overlapping for some utilities. If enough utilities use the self-assessment tool for performance measures that overlap with the metrics tracked by AWWA, at some point in the future it may be feasible and desirable to explore options for more formally integrating the two efforts.

Other associations, such as the other five involved in the development of the Primer, might also be interested in working with WRF to explore opportunities for cross-utility comparisons and encourage use of the benchmarking tool as a method for utilities to enrich their involvement in EUM. It is recommended that WRF convene a meeting that would include representatives from the six associations and EPA to identify follow-up actions to further benefit from the research findings and tools developed for this project.

WRF could also explore other opportunities for less structured cross-utility comparisons. These opportunities could include sponsoring joint workshops, conference sessions, webinars, or other communication modes. These could be used to provide opportunities to share results for utilities interested in comparing their current scoring, targets, and strategies undertaken with representatives from other interested utilities. For example, different organizations could sponsor the benchmarking effort at some of their member utilities and have joint information sharing workshops at selected conferences.

Another area where there might be value in sharing information across utilities relates to the relative weight to assign to the Ten Attributes and to the practice areas within the attributes. The Primer did not offer guidance on relative weight of the attributes. While the benchmarking

tool developed for the current study allows utilities flexibility to assign weights to selected attributes, the process for defining such relative weights is beyond the scope of the current research effort. Comparing how utilities have rated the relative importance of Ten Attributes and practice areas within the attributes, and the process to assign those weights to provide guidance to individual utilities and the industry as a whole is promising area for future research. Such future research could be informed by gathering information on the weights assigned by utilities employing the benchmarking tool developed for this report.

Future Updates to the Tool and Recommended Process

Based on use of the tool by more utilities and the continuing evolution of the state of EUM practices, it is recommended that WRF periodically review and update the tool and recommended processes for conducting self-assessments in light of findings from ongoing WRF research projects and additional information and insights provided by utilities using the tool.

USE OF THE FRAMEWORK/TOOL DEVELOPED FOR THIS PROJECT

Several products from this research project, including an early release of the benchmarking tool, a PowerPoint User Guide, and recommendations for conducting a self-assessment are available on the WRF Website. WRF sponsored a Webcast in conjunction with the release of the tool to publicize its availability and functionality. It is recommended that WRF work with EPA and the six associations that sponsored the development of the EUM Primer to develop additional outreach and publicity to encourage utilities to take advantage of the self-assessment benchmarking resources developed for this project. Such efforts could take a number of forms, including jointly sponsored meetings or webinars, sponsorship of additional publications, and publicity through newsletters, publications, or other communication channels available to these organizations.

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ABBREVIATIONS

AMWA	Association of Metropolitan Water Agencies
APWA	American Public Works Association
AWWA	American Water Works Association
CCR	Consumer Confidence Report
CIP	capital improvement program
Collaborating Organization	Effective Utility Management Collaborating Organization
COS	Cost of Service
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
EUM	Effective Utility Management
gpcd	gallons per capita per day
ISO	International Organization for Standardization
MSDGC	Metropolitan Sewer District of Greater Cincinnati
NACWA	National Association of Clean Water Agencies
NAWC	National Association of Water Companies
OPEX	Operating Expenditures
PA	performance assessment
PAC	Project Advisory Committee
PM	performance measure
Primer	*Effective Utility Management: A Primer for Water and Wastewater Utilities* (EPA et al. 2008)
QA	Quality Assurance
QC	Quality Control
SDWA	Safe Drinking Water Act
Steering Organization	Effective Utility Management Steering Committee
SW	Stormwater
TQM	Total Quality Management
W	Water
W&WW	Water and Wastewater

WEF	Water Environment Federation
WRF	Water Research Foundation
WSAA	Water Services Association of Australia
WW	Wastewater

APPENDIX A:
LITERATURE SURVEY OF THE PRACTICE AREAS AND ASSOCIATED METRICS FOR THE TEN ATTRIBUTES

PRODUCT QUALITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Regulatory Compliance (Water)				
United States Environmental Protection Agency (EPA). National Primary Drinking Water Regulations. [Online]. Available: <http://water.epa.gov/drink/contaminants/index.cfm#listmcl>.	List of primary drinking water contaminants and their maximum contaminant levels (MCLs). Description of regulation development and regulated contaminant timeline. Links to applicable laws, regulations, and publications.	Complete and consistent compliance with federal laws and regulations, state/provincial laws and regulations, local ordinances and regulations, and all general and specific permit conditions. No notices of violation and no enforcement action from any government agency.	Number of days in full compliance for the year divided by 365. Number, type, and frequency of "near (compliance) misses" per month.	Those not receiving notices of violation or enforcement action.
United States Environmental Protection Agency (EPA). 2011. Providing Safe Drinking Water in America: 2009 National Public Water Systems Report. EPA 305R11001, Washington, DC, EPA [Online]. Available: <http://www.epa.gov/compliance/resources/reports/accomplishments/sdwa/sdwacom2009.pdf>.	Summarizes and evaluates annual reports submitted by primacy agencies regarding compliance at public water systems (PWSs) of all types and sizes in the U.S. in calendar year. Summarizes PWS noncompliance with the National Primary Drinking Water Regulations at the national and state levels.			
United States Environmental Protection Agency (EPA). 2011. Unregulated Contaminant Monitoring Program. [Online]. Available: <http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/index.cfm>.	Provides information on EPA's Unregulated Contaminant Monitoring (UCM) program used to collect data for contaminants suspected to be present in drinking water, but that do not have health-based standards set under the Safe Drinking Water Act. Monitoring requirements for community water systems (CWSs) serving populations more than 10,000 and selected CWSs serving less than 10,000.	Monitoring of unregulated contaminants	Compliance with UCM monitoring program as applicable to the utility's service population.	

PRODUCT QUALITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Regulatory Compliance (Wastewater)				
United States Environmental Protection Agency (EPA). Clean Water Act Compliance Assistance. [Online]. Available: <http://www.epa.gov/Compliance/assistance/bystatute/cwa/>.	Overview of Clean Water Act and associated regulations with links to more detailed information	Complete and consistent compliance with federal laws and regulations, state/provincial laws and regulations, local ordinances and regulations, and all general and specific permit conditions. No notices of violation and no enforcement action from any government agency.	Number of days in full compliance for the year divided by 365. Number, type, and frequency of "near (compliance) misses" per month.	Those receiving Gold and Platinum Awards from NACWA. Those not receiving notices of violation or enforcement action.
National Association of Clean Water Agencies (NACWA). Peak Performance Award Information. [Online]. Available: <http://www.nacwa.org/index.php?option=com_content&view=article&id=457&atid=37&Itemid=63>.	Describes NACWA's program to recognize publicly owned treatment works (POTWs) with excellent compliance records. Gold Awards are presented to facilities with no National Pollutant Discharge Elimination System (NPDES) permit violations for the calendar year. Platinum Awards recognize 100 percent compliance with NPDES permits over a consecutive 5-year period.			
Adherence to Guidelines (Water)				
United States Environmental Protection Agency (EPA). Secondary Drinking Water Regulations: Guidance for Nuisance Chemicals. [Online]. Available: <http://water.epa.gov/drink/contaminants/secondarystandards.cfm>.	Explains secondary drinking water standards. Lists contaminants and their MCLs. Describes aesthetic, cosmetic and technical effects of secondary contaminants	Meeting secondary drinking water contaminant limits.	Number of days in a year that levels of secondary contaminants are under the MCL divided by 365.	

PRODUCT QUALITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
United States Environmental Protection Agency (EPA). Basic Information on Contaminant Candidate List (CCL) and Regulatory Determinations. [Online]. Available: <http://water.epa.gov/scitech/drinkingwater/dws/ccl/basicinformation.cfm#four>.	Provides Information on the contaminants in drinking water that have been identified by EPA as candidates for regulation, but are not yet regulated. Nevertheless, utilities may wish to monitor for the presence of these "candidate contaminants" in their drinking water.	Monitoring for contaminants on the CCL.		
World Health Organization (WHO). 2011. Guidelines for Drinking-water, Fourth Edition. Geneva, Switzerland: WHO. [Online]. Available: <http://whqlibdoc.who.int/publications/2011/9789241548151_eng.pdf>.	Comprehensive guidance for drinking-water quality to protect the public health. Addresses parameters that are both regulated and not regulated in the U.S.	Following guidelines when not in conflict with regulatory requirements.		
Great Lakes - Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. 2012. *Recommended Standards for Water Works*. Albany, NY: Health Research Inc., [Online]. Available: <http://10statesstandards.com/waterrev2012.pdf>.	Also known as Ten States Standards, this publication contains recommended design and operational practices for public water supply systems.	Following recommended standards (some states require following these standards).		
Booth. S.D.J. 2011. *Diagnosing Taste and Odor Problems Field Guide*. Denver: American Water Works Association (AWWA). [Online]. Available: <http://apps.awwa.org/EbusMain/Default.aspx?TabID=55&ProductId=6684>	Provides information to diagnose and remove objectionable tastes and odors at the tap, including determining the source, sampling, control, and treatment measures.	Monitoring and controlling taste and odor.	Number of taste and odor complaints per month.	

PRODUCT QUALITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Reiss, C.R. 2010. Unidirectional flushing enhance water quality and improve customer relations. *Opflow*, 10-14. March. [Online]. Available: <http://www.awwa.org/publications/OpFlowArticle.cfm?itemnumber=54032&showLogin=N&ct=505c2151a80b3ad3a69b4bd9bdb12b1369695c21466ac7897d4ca6d86ac7422947c2f70c559f03c4897d44a7af62b3087ae307f85d0b27a7e699104f0779ff65>.	Describes methodology and advantages to unidirectional flushing. Presents case study from Melbourne, Florida.	Unidirectional flushing.	Number of water quality complaints per month.	Melbourne, Florida, Public Works and Utilities Department.
National Fire Protection Association (NFPA) 2013. Recommended Practice for Fire Flow Testing and Marking of Hydrants. NFPA 291. [Online]. Available: <http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=291&cookie%5Ftest=1>.	Describes testing procedures to determine the rate of flow available at various locations for fire-fighting purposes, classification of hydrants in accordance with their rated capacities, and color coding of hydrants to indicate their class.	Adequate fire suppression water flow and pressure		
International Standards Organization (ISO). Public Protection Program Classification Program. [Online]. Available: <http://www.iso.com/Research-and-Analyses/Studies-and-Whitepapers/ISO-s-PPC-Program-Page-2.html>.	ISO's Public Protection Program (PPC) evaluates communities according to a uniform set of criteria, incorporating nationally recognized standards developed by the NFPA and the AWWA. Therefore, the PPC program provides a useful benchmark that helps fire departments and other public officials measure the effectiveness of their efforts and plan for improvements.	Adequate fire suppression water flow and pressure and accessibility to water.	Service area having an ISO Protection Classification of 1.	Those that have service areas that have achieved an ISO Protection Classification of 1.

PRODUCT QUALITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
American Water Works Association (AWWA). Partnership for Safe Water – Treatment Optimization Program. [Online]. Available: <http://www.awwa.org/resources-tools/water-utility-management/partnership-for-safe-water/treatment-program.aspx>.	Describes a self-evaluation program designed to assist in the optimization of treatment plant performance. The program uses the "Self-Assessment Guide for Surface Water Treatment Plant Optimization" (AWWA/AWWARF Publication 90736) as the basis for the self-assessment. Utilities chose to participate in this program, and they can achieve different "phases" of participation.	Phase IV certification by the Partnership.	Certification by the Partnership.	Approximately 220 utilities with more than 400 water treatment plants.
American Water Works Association (AWWA). Partnership for Safe Water – Distribution System Optimization Program. [Online]. Available: <http://www.awwa.org/resources-tools/water-utility-management/partnership-for-safe-water/distribution-program.aspx>.	Describes recently launched program for the self-assessment of distribution systems similar to that of treatment systems. Its goal is to help water suppliers improve the quality and reliability of water supplied to their customers through the pipe network.	Phase IV certification by the Partnership (proposed).	Certification by the Partnership (proposed).	Charter members (http://www.awwa.org/files/Partnership/CharterMbrList.pdf)

PRODUCT QUALITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
CH2M HILL. 2006. *Environmental Management Systems: A Tool to Help Water Utilities Manage More Effectively*. Denver, CO.: AwwaRF, AWWA and IWA	Evaluates the ISO 14001 approach for its applicability to water utility Environmental Management System (EMS). Provides guidelines to evaluate initial activities and programs and ongoing activities). Includes performance measures and proposes strategies to communicate environmental commitments, successes, and approaches to customers and upstream and downstream stakeholders.	Effective EMS Program; ISO 14001 Certification.		Charleston Water.
Adherence to Guidelines (Wastewater)				
Great Lakes - Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. 2004. *Recommended Standards for Wastewater Facilities*. [Online]. Available: <http://10statesstandards.com/wastewaterstandards.html>.	Also known as Ten States Standards, this publication contains recommended design and operational practices for wastewater treatment and collection systems.	Following recommended standards (some states require following these standards).		
Water Environment Federation (WEF). National Biosolids Partnership. [Online]. Available: <http://www.wef.org/biosolids/.	The National Biosolids Partnership (NBP) advances environmentally sound biosolids management practices. The NBP serves as the information clearinghouse on effective biosolids practices and offers an EMS-based certification program that requires participating organizations to go beyond regulatory requirements.	Certification of a biosolids EMS.	Passing NBP audit of program.	Those holding active certification from the NBP for an EMS-based Biosolids Management Program.

PRODUCT QUALITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
United States Environmental Protection Agency (EPA). 2005. Guide for Evaluating Capacity, Management, Operation, and Maintenance (CMOM) Programs at Sanitary Sewer Collection Systems. EPA 305-B-05-002. Washington, DC. EPA [Online]. Available: <http://yosemite.epa.gov/water/owrccatalog.nsf/1ffc8769fdecb48085256ad3006f39fa/d82306958283f25f85256fac0059d6a0!OpenDocument>.	Provides the guidance and self-assessment process for reducing sanitary sewer overflows (SSOs) through improved planning, management, and operations of wastewater conveyance and storage systems.	CMOM Self-Assessment report approved by EPA or State Regulatory Agency (may be a requirement for some utilities).	Approval of CMOM program.	
United States Environmental Protection Agency (EPA). 2004. Environmental Management Systems (EMS) *Handbook for Wastewater Utilities*.[Online]. Available: <http://water.epa.gov/learn/training/wwoperatortraining/upload/2004_08_ems_EMSWastewaterHandbook.pdf>.	Presents a process modeled after the ISO 14001 Standard (1996) as the EMS model for implementation and is designed to help systematically identify, control, and monitor environmental issues.	Effective EMS Program; ISO 14001 Certification.		Charleston Water.
California Department of Resources Recycling and Recovery. Criteria and Procedures for Model Home-Generated Pharmaceutical Waste Collection and Disposal Programs. [Online]. Available: <http://www.calrecycle.ca.gov/homehazwaste/Medications/ModelProgram/Criteria.pdf>.	Provides guidance on developing programs to mitigate pharmaceuticals and personal care products from entering the wastewater stream by educating the public and providing means and methods to safely dispose of the pharmaceuticals and personal care products.	Well-defined pharmaceutical and personal care product take-back program.		East Bay Municipal Utility District; Milwaukee Metropolitan Sewerage District, and others.

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Customer Service				
Olstein, M.A., M.J. Stanford, and C.E. Day. 2001. *Best Practices for a Continually Improving Customer Responsive Organization*. Denver, CO.: AwwaRF and AWWA	Demonstrates the common characteristics among five utilities for achieving improvements: 1) strong support from the top, 2) use of employee teams, 3) understanding and tracking the right performance measure, 4) shared sense of sense of strategic direction, and 5) use of selected specialty consultants.			
Buckstaff, K., D. Mclain and T. Szybalski. 2008. Benchmarking Customer Service. *Public Power*. June. pp.42-45. [Online]. Available: <http://www.publicpower.org/Media/magazine/ArchiveList.cfm>.	Report on 30 public power utilities that participated in the American Public Power Association's customer service benchmarking survey. Report presents a wide range of customer service metrics and policies. Participants from across the U.S. represented a range of size and service approaches.			
American Productivity and Quality Center (APQC). 2004. Customer Service Benchmarking Study. [Online]. Available: <http://www.apqc.org/sites/default/files/files/2.1%20Page%20Development/Pubs_catalog_2011.pd>.f	Provides a wide range of performance indicators and metrics for customer service activities including customer service representative duties, call center activities, and training.			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Morrow, P. 2000. Eight Keys to Creating a Customer Service Culture. *Inc. Magazine.* [Online]. Available: <http://www.inc.com/articles/2000/08/20028.html>.	Outlines eight key factors in creating a culture that promotes good customer service.			
Patrick, R. and C. Kozlosky. 2006. *Benchmarking Water Utility Customer Relations Best Practices*. Denver, CO.: AwwaRF, AWWA and IWA Publishing	Documents best practices for call centers, meter reading, billing, payment processing, credit and collections, and customer-related field and meter service. Provides associated metrics from both within and outside the water industry. The body of this work was developed into a comprehensive web-based toolkit for the industry.			
MacDonald, D. et al. 2005. Using a Choice Modeling Approach for Customer Service Standards in Urban Water. *Journal of the American Water Resources Association* (41) pp 719–728. [Online]. Available: <http://www.cmis.csiro.au/mary.barnes/PDF/HattonBarnesWTPpage%20proofs.pdf>.	Describes the series of reforms in the water industry in Australia that has created a demand from the industry and regulators for objective methodologies to evaluate incremental changes in the customer service standards. In this paper, the use of choice modeling for estimating implicit prices associated with urban water supply attributes is explored. Results show that increases in annual water bills and the frequency of future interruptions were the most important attributes.			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Olstein, M.A., M.J. Stanford, and C.E. Day. 2001. *Best Practices for a Continually Improving Customer Responsive Organization*. Denver, CO.: AwwaRF and AWWA	Provides case studies of five successful customer-driven water utilities that have used different approaches to achieving a continually improving customer-responsive organization. Presents out-of-industry input to the best practices and a toolkit for utilities that includes a self-assessment questionnaire, a technology identification matrix, and benchmarking data.			
International Organization for Standardization (ISO). 2007. Activities relating to drinking water and wastewater services–Guidelines for the assessment and for the improvement of the service to users. [Online]. Available: <http://www.iso.org/iso/catalogue_detail?csnumber=37246>.	Specifies the elements of drinking water and wastewater services of relevance and interest to users. It also provides guidance on how to identify users' needs and expectations and how to assess whether they are being met.			
Rambo, E., R. Baumgartner and C. Koenig. 2004. *Developing Customer Service Targets by Assessing Customer Perspectives*. Denver, CO.: AwwaRF	Develops customer-driven customer service performance targets and measures for drinking water utilities by assessing customer perspectives and soliciting customer input.			
Morrow, P. 2000. Eight Keys to Creating a Customer Service Culture. *Inc. Magazine.* [Online]. Available: <http://www.inc.com/articles/2000/08/20028.html>.	Outlines eight key factors in creating a culture that promotes good customer service.			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Sanders, G. 2010. "Best Practices Account Policies." Working with your Customers: Crafting Great Customer Service Policies." Workshop at UNC Environmental Finance Center in Greenville, North Carolina. [Online]. Available: <http://www.efc.unc.edu/training/2010/WorkWithYourCustomers.html>.	Discusses best practices of 56 surveyed water and wastewater utilities on finance management and policies on late fees, cut-off fees, and security deposits.			
Voss, C., et al. 1997. Service Competitiveness – An Anglo-US Study. *Business Strategy Review (8),* pp 7–22. [Online]. Available: <http://www.blackwellpublishing.com/backfiles/>.	Reports on the latest in a series of international comparisons of management practices and performance outcomes of industries in various countries. Here, it is the service industries in the UK and the US which are examined. Among the companies surveyed, there were more world-class performers in the US than the UK, but also more low performers. The concluding part of the article is diagnostic – the authors also suggest measures which could improve performance.			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Institute for Citizen-Centered Service. 2007. How to Guide for Service Improvement Initiatives. Canada. [Online]. Available: <http://www.iccs-isac.org/en/pubs/How%20To%20Guide%20for%20Service%20Improvement%20Initiatives%20-%20May%202007.pdf>.	Acts as a tool for the implementation of service improvement initiatives, and is written for use by program managers responsible for service delivery and service quality initiatives. Provides a detailed and holistic method for planning and implementing service improvement, based on the client's perspective.			
Canadian Treasury Board Secretariat. 1996. Quality and Affordable Service for Canadians: Establishing Service Standards in the Federal Government; Service Standards: A guide to the initiative; and A Guide to Costing Service Delivery for Service Standards. [Online]. Available: <http://www.tbs-sct.gc.ca/pubs_pol/opepubs/TB_D3/OQUA-eng.asp>.	Describes the five factors that explain over 75% of satisfaction or dissatisfaction in using a government service, including timeliness, fairness, courtesy/going the extra mile, competence, and outcome. Citizens' priorities for service improvements include improved telephone service, one-stop service, reduced red tape, and more mail and electronic service delivery.		Timeliness: knowledge of staff; exceptional effort; fairness: outcome.	Canadian federal government

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Billing and Payment				
The Ascent Group. 2011. Billing & Payment Profiles and Best Practices 2011. [Online]. Available: <http://ascentgroup.com/sda/bpp.html>.	Discusses a benchmarking project to evaluate billing and payment performance and practices conducted by The Ascent Group. Twenty-four companies participated and found that EBPP—as represented by Electronic Bill Presentment, Internet Payment, and Paperless Billing—remains the top billing and payment plan for the future.		Cycle time meter read to bill; cost per remittance; percent of bills collected; accuracy of meter reads; cost per meter read; cost per turn on/off.	
The Ascent Group. 2011. Credit and Collection Practices. [Online]. Available: <http://www.ascentgroup.com/sda/ccp.html>.	Discusses a credit and collection benchmarking research initiated by The Ascent Group in 2011 to uncover the most effective techniques and strategies for improving collection performance and reducing uncollectible debt.			
Vastis, E. 2010. "Tailoring Miscellaneous Fees to your Customers' Needs." NC AWWA-WEA Finance and Management Committee Workshop at UNC Environmental Finance Center in Greenville, NC. [Online]. Available: <http://www.efc.unc.edu/training/2010/WorkWithYourCustomers.html>.	Discusses various types of impact and other and miscellaneous fees and how they impact the utilities. Key findings suggest that there is a wide range of charges assessed for miscellaneous fees; also that utilities often overlook the value of miscellaneous fees as well as the expense associated with providing these services.			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Miller, S. 2010. "Customer Complaint and Service Issue Response Management." NC AWWA-WEA Finance and Management Committee Workshop at UNC Environmental Finance Center in Greenville, NC. [Online]. Available: <http://www.efc.unc.edu/training/2010/WorkWithYourCustomers.html>.	Discusses customer service policy choices and best practices for serving customers through policy structure, rate structure and bill assistance, customer service management, customer account management and customer communication.			
Customer Perception/Satisfaction				
National Science Foundation. 2011. Surveys: Tracking Opinion. [Online]. Available: <http://www.nsf.gov/news/special_reports/survey/index.jsp?id=overview>.	Presents the benefits of a scientific survey/poll to gauge opinions rather than other types of survey questionnaires. Discusses choosing a representative sample, the advantage of random sampling, and the phrasing of survey questions.	Scientific surveying/polling of customers.	Various satisfaction metrics.	Syracuse Water Department Clayton County Water Authority
Sanders, G. 2010. Best Practices Account Policies. Working with your Customers: Crafting Great Customer Service Policies. Workshop at UNC Environmental Finance Center in Greenville, North Carolina. [Online]. Available: <http://www.efc.unc.edu/training/2010/WorkWithYourCustomers.html>.	Discusses Best Practices of 56 surveyed water and wastewater utilities on finance management and policies on late fees, cut-off fees and security deposits.			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Canadian Treasury Board Secretariat. 1996. Quality and Affordable Service for Canadians: Establishing Service Standards in the Federal Government; Service Standards: A guide to the Initiative; and A Guide to Costing Service Delivery for Service Standards. [Online]. Available: <http://www.tbs-sct.gc.ca/pubs_pol/opepubs/TB_D3/OQUA-eng.asp>.	Describes the five factors that explain over 75% of satisfaction or dissatisfaction in using a government service, including: timeliness; fairness; courtesy/going the extra mile; competence; and outcome. Citizens' priorities for service improvements include improved telephone service, one-stop service, reduced red tape, and more mail and electronic service delivery.		Timeliness: Knowledge of staff; exceptional effort; fairness: outcome.	Canadian federal government
Institute for Citizen-Centered Customer Services. 2008. Citizens First: Summary Report and Full Report. [Online]. Available: <http://www.iccs-isac.org/en/cf/>.	Explains survey research conducted on citizens' expectations, priorities, and satisfaction with different services. Includes useful information about what they care about most.			Canadian federal government
Olstein, M.A., M.J. Stanford, and C.E. Day. 2001. *Best Practices for a Continually Improving Customer Responsive Organization*. Denver, CO.: AwwaRF and AWWA	Provides case studies of five successful customer-driven water utilities that have used different approaches to achieve a continually improving customer responsive organization. Presents out-of-industry input to the best practices and a toolkit for utilities that includes a self-assessment questionnaire, a technology identification matrix, and benchmarking data			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Rambo, E., R. Baumgartner and C. Koenig. 2004. *Developing Customer Service Targets by Assessing Customer Perspectives*. Denver, CO.: AwwaRF	Develops customer-driven customer service performance targets and measures for drinking water utilities by assessing customer perspectives and soliciting customer input			
Levine, M. 2011. Nine Steps Towards an Effective Survey. American Productivity and Quality Center (APQC). [Online]. Available: <http://www.apqc.org/knowledge-base/download/244617/a%3A1%3A%7Bi%3A1%3Bs%3A1%3A%222%22%3B%7D/K03211_HCM_SurveyConnect_final_version%5B1%5D.pdf?destination=node/244617>.	With a focus on online survey software, provides guidance on designing an effective survey. Provides information on developing an understandable objective, designing the survey without bias, reaching the right stakeholders, collecting enough data, and understanding the feedback.			
Council on Accreditation. 2010. Designing Actionable Consumer/Other Customers Surveys. [Online]. Available: <www.coanet.org/files/DesigningActionableSurveys.doc>.	Provides guidance on developing customer surveys, including when to use surveys, how to get the right information, preparing introductions, questions, and avoiding pitfalls. Discusses advantages and disadvantages to various questions.			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Hart, C. 1993. Extraordinary Guarantees. [Online]. Available: <http://www.spiregroup.biz/pdfs/06-04-07%20Extraordinary%20Guarantees%20-%20A%20Powerful%20Improvement%20Catalyst.pdf>.	Provides insights on private sector quality guarantees including guidance on how to consider the issues relevant to public sector organizations.			
Customer Outreach				
Johnson, B.B. 2003. Do Reports on Drinking Water Quality Affect Customers' Concerns? Experiments in Report Content. National Center for Biotechnology Information. [Online]. Available: <http://www.ncbi.nlm.nih.gov/pubmed/12969413>.	Describes generic risk beliefs and how they impact attitudes toward utility water quality or trustworthiness. Discusses the content and format of water quality reports in influencing concern about drinking water quality. Includes previous empirical and theoretical evidence for lack of change in public risk attitudes due to one-time or infrequent communications.			
Southern California Gas Company. 2010. Advanced Meter Project Customer Outreach and Conservation Support Plan. [Online]. Available: <http://www.socalgas.com/documents/ami/AdvancedMeterOutreachPlan.pdf>.	Describes a comprehensive communication plan for customer and stakeholder outreach and performance monitoring of the advanced meter project.			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Southern California Alliance of Publicly-Owned Treatment Works. 2008. Building the Wastewater Utility Brand: Practical Advice for Increasing Trust, Support and Investment [Online]. Available: <http://utilitybranding.net/pdfs/BrandingManualFINALPDF.pdf>.	Makes a strong case for utilities to adopt the proven marketing strategy of branding to establish the value of water and successfully compete for customers' investment dollars. Exploring the politics of investment in water, negative branding of water utilities, and opportunities provided by a strong positive brand. The article lists the steps of defining and implementing the utility brand. The manual clears up myths about the branding process and shows why branding does not require large expenditures.			
Wright, K. Do Utilities Need Social Media. *Electric Light and Power*, *88*(1). [Online]. Available: <http://www.elp.com/index/display/elp-article-tool-template/_printArticle/articles/electric-light-power/volume-88/issue-1/sections/do-utilities_need.html>.	A critical look at utilities using social media to reach out to their customers. Examines the pitfalls and liabilities and provides five conditions that should be met before embarking on the use of social media.			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Customer Service Improvement Projects				
Yorkshire Water. 2011. From Zero to Hero: Yorkshire Water Transforms its Customer Services. [Online]. Available: <http://www2.bt.com/static/i/media/pdf/yorkshire_water_cs.pdf> .	Describes a new system that provides the link between customer service experience and the activities of operational staff in the field. This has been achieved through the Integration Hub System (IHS) that is designed to provide a single, standardized integration mechanism to link different systems.		Overall cost savings resulting from the implementation of the new customer service system.	Yorkshire Water, UK
Southern Water. 2011. Southern Water eGain: Clear Information. [Online]. Available: <http://www.edgetec.de/fileadmin/user_upload/edgetec_pdf_download/case_studies/southern_water.pdf>.	Describes the integration of knowledge management within Southern Water's customer service management system, coupled with the existing geographical information system.			Southern Water, UK

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Convergys Smart Grid Executive Research. 2010. Utilities: Taking Smart-Grid Initiatives to the Next Level. [Online]. Available: <http://www.convergys.com/pdf/PV5-110N.pdf?TRID=1>.	Describes the barriers to change utilities face as they begin offering dynamic rates more strongly than they are promoting them. The research seeks to show that utilities develop and emphasize multiple rate structures as part of their smart grid approach. Utilities executives are interested in smart grids, but are worried that their organizations can't deliver. According to the article, utilities need systems that can support the entire meter-to-cash process—or more accurately, the customer-to-cash process.			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Call Center				
Olstein, M, E. Markus, S. Lin, C. Day, D. Schlenger and W. Lloyd. 2010. *Optimizing the Water Utility Customer Contact Center*. Denver, CO.: WaterRF	Defines an optimized model for the call center and includes a tool kit and specific case studies to aid in implementation.			
Oracle. 2009. Self-Service That Really Serves: Why traditional self-service fails and how to get it right. [Online]. Available: <http://www.oracle.com/us/products/applications/siebel/051273.pdf>.	Asserts that customers want a self-service system that quickly acknowledges their individual history and adjusts accordingly and a consistent experience with the company that saves precious time. At the same time, companies want self-service that dramatically reduces costs while preserving and growing customer relationships and enhancing their brand. These two objectives are at odds with most self-service systems today.			
Reynolds, P. 2003. The Top 20 Call Center Performance Measures. [Online]. Available: <http://searchcrm.techtarget.com/news/936366/The-top-20-call-center-performance-measures>.	Outlines top 20 best practice measures for call center performance management.			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
The Call Center School, LLC. 2002. Are Remote Agents in Your Staffing Future? [Online]. Available: <http://www.thecallcenterschool.com/articles/Are_Remote_Agents_in_Your_Staffing_Future.pdf>.	Specifies the advantages of remote agents, to include schedule flexibility, real estate savings, expanded labor pool, staff retention, increased productivity, disaster recovery, and environmental impact. Disadvantages include equipping the agent to work at home, delivery of private or confidential information to an agent's home, social considerations of isolation, and requirement for self-discipline.		Reduction in overall cost per customer for service support.	
Convergys Corporation. 2009. Managing Costs Without Impairing the Customer Experience. [Online]. Available: <http://www.convergys.com/pdf/PV5-093N.pdf?TRID=1>.	Discusses highest cost savings options with greatest customer experience such as self-service optimization, workforce management optimization, and segmentation-driven call routing.		Reduction in overall cost per customer for service support.	
The Call Center School. 2010. "A Practical Approach to Setting Service Goals." [Online]. Available: <http://www.thecallcenterschool.com/call-center-articles/a-practical-approach-to-setting-service-goals/>.	Explores the wisdom and/or risks of several service practices.			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
The Call Center School. 2002. Automating Workforce Management: A Guide to Acquisition and Implementation. [Online]. Available: <http://www.thecallcenterschool.com/articles/Automating_WFM_Acquisition_and_Implementation.pdf>.	Discusses need for automated tools and costs justifying workforce management tools.			
Gill, J. 2005. This call may be Monitored. *Inc. Magazine.* [Online]. Available: <http://www.inc.com/magazine/20050601/customer-service.html>.	Discusses benefits of call monitoring.			
eGain. 2005. 5 Web Self-Service Pitfalls: What Every Contact Center Manager Must Know. [Online]. Available: <http://www.egain.com/landingus/best_practice_self-service_5pitfalls.asp?id=CRMXchange_EmailBlast_Sep10&source=CRMXchange_EmailBlast_Sep10&trc=ndcser4526sadkse>.	Highlights five myths frequently encountered in the context of self-service strategies and implementations: Myth 1: Self-service is a foolproof way to reduce costs; Myth 2: Self-service means eliminating customer interactions; Myth 3: Self-service is a quick fix; Myth 4: One self-service method fits all my customers and their needs; Myth 5: We deployed self-service and contact center volume went down, so we succeeded. The lesson is that self-service must be set in the context of maximizing the value of interactions with customers.			

CUSTOMER SATISFACTION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
The Call Center School. 2002. Blueprint for Call Center Success: Building an Effective Organizational Structure and Team Environment. [Online]. Available: <http://www.thecallcenterschool.com/articles/Blueprint_for_Call_Center_Success.pdf>.	Discusses challenges in building a successful call center organization.		Growth expectations; quality of service; speed of service; client relationship management (CRM) Initiatives.	
The Call Center School. 2002. Unraveling the Mystery of Service Level Discrepancies. [Online]. Available: <http://www.thecallcenterschool.com/articles/Unraveling_the_Mysteries_of_Service_Level_Discrepancies.pdf>.	Discusses the reasons for differences in call forecast and actual call data.		Erlang-C alternatives; call abandonment rate	
Hash, S. 2009. Contact Center Performance Measures. [Online]. Available: <http://www.contactcenterpipeline.com/CcpViewIndex.aspx>.	Discusses shifting business priorities that are impacting call center KPIs. Encourages the use of metrics that balance variables.		First call resolution (FCR); cost per call resolution; agent utilization.	

EMPLOYEE LEADERSHIP AND DEVELOPMENT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Employee Recruitment, Retention and Satisfaction				
Grigg, N.S. and M. Zenzen. 2009. *The Water Workforce: Strategies for Recruiting and Retaining High-Performance Employees*. Denver, CO: AWWA	Examines the human resource challenges facing utilities and offers strategies to address them. Subjects include recruitment, training, and motivation with the goal of building a stable and productive workforce and retaining high-quality employees.	Recruiting and retaining talent.	Time to fill. Cost per hire. Percentage of applicants from a recruitment source that make it to the next stage of the selection process.	
Manning, A. B. T. Brueck, M. Isbell and P. Brink. 2008. *Workforce Planning for Water Utilities—Successful Recruiting, Training, and Retaining of Operators and Engineers*. Denver, CO: AwwaRF	Frames the issues of recruiting, training, and retaining drinking water utility operators and engineers. Identifies short-term and long-term strategies that can be implemented by individual utilities and by the industry to address the issues.			
National Aeronautics and Space Administration (NASA). 2009. Manager's Guide to Recruitment Best Practices. [Online]. Available: <http://nasapeople.nasa.gov/policies/Recruitment_Best_Practices_Guide.pdf>.	Recommendations on identifying and overcoming gaps, internal and external barriers to accomplishing strategic workforce goals, target hiring, and/or training to grow an existing capability, identifying risk for workforce misalignments.	Recruiting talent.		
Society for Human Resource Management (SHRM). 2008. Recruitment and Selection: Hiring the Right Person. [Online]. Available: <http://www.shrm.org/Education/hreducation/Documents/Recruitment%20and%20Selection%20IM.pdf>.	Provides guidelines and procedures for making effective and lawful hiring decisions.			

EMPLOYEE LEADERSHIP AND DEVELOPMENT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Society for Human Resource Management (SHRM). 2005. Selection Assessment Methods. [Online]. Available: <http://www.shrm.org/about/foundation/research/Documents/assessment_methods.pdf>.	Presents what is known from the research literature about the value of different types of formal assessment methods that are used to select employees in organizations. Provides a roadmap to help make decisions about what assessment methods are most useful and practical in different situations.	Use of assessment methods to help make hiring decisions.		
Anderson, L. 2008. Using Behavioral Interviewing Techniques to Select the Right Employees. Society for Human Resource Management (SHRM). [Online]. Available: <http://www.shrm.org/hrdisciplines/orgempdev/articles/Pages/UsingBehavioralTechniques.aspx>.	Guidance on using behavioral-based interviews (such as targeted selection and performance-based interviews) by incorporating questions that deal with specifics about an applicant's past work performance to help determine if that person will exhibit the agency's preferred workplace behavior.	Recruiting talent through performance-based interviews.		
Society for Human Resource Management (SHRM) 2008. Retaining Talent–A Guide to Analyzing and Managing Employee Turnover. [Online]. Available: <http://www.shrm.org/about/foundation/research/Documents/Retaining%20Talent-%20Final.pdf>.	Explores major themes related to retention management including why employees leave and why they stay and how to develop an effective retention management plan.	Reducing employee turnover through analysis and management.	Percentage of annual voluntary employee turnover.	
(SHRM). 2009. Managing for Employee Retention. [Online]. Available: <http://www.shrm.org/Research/Articles/Articles/Pages/ManagingforEmployeeRetention.aspx>	Provides overview on the impacts of employee turnover and offers effective practices in enabling an organization to achieve its retention goals.			

EMPLOYEE LEADERSHIP AND DEVELOPMENT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Society for Human Resource Management (SHRM). 2010. 2010 Employee Job Satisfaction–What Matters Most to Employees. [Online]. Available: <http://www.shrm.org/Research/SurveyFindings/Articles/Documents/10-0252%20JobSatSR_TextFNLlowrez.pdf>.	Reports on the key elements of job satisfaction, including job security, benefits, opportunities to use skills and abilities, organization's financial stability, the work Itself, and compensation.	Reducing employee turnover through maintenance of job satisfaction	Percentage of annual voluntary employee turnover.	
Succession Planning				
Brueck, T, M. Isbell, D. O'Berry and P.Brink. 2010. *Water Sector Workforce Sustainability Initiative*. Denver, CO: WaterRF	Addresses workforce challenges by providing a focused analysis of the mission-critical classification at risk in terms of both numbers and work preparedness; the organizational processes, such as recruitment, selection, technical training, and knowledge retention that need to be strengthened to address those risks; and strategies that should be implemented at the utility, regional, and national level to achieve workforce sustainability.	Effective succession planning.		
Myron A. Olstein, M. D. L. Marden, J. G. Voeller, J.D. Jennings, P. M. Hannan and D. Brinkman. 2005. *Succession Planning for a Vital Workforce in the Information Age.* Denver, CO: AwwaRF and AWWA	Provides guidance in Identifying gaps in current and future workload and workforce, Implementing a workforce planning model, documenting vital tacit knowledge owned by senior employees, upgrading training programs, making the utility an employer of choice			

EMPLOYEE LEADERSHIP AND DEVELOPMENT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Association of Metropolitan Water Agencies/National Association of Clean Water Agencies (AMWA/NACWA). 2006. *The Changing Workforce–Seizing the Opportunity: An AMWA/NACWA Handbook.* Washington, DC.: NACWA/AMWA	Presents strategies to assist utilities with developing and implementing a comprehensive succession management program aimed at attracting, developing, and retaining a new generation of workers while retaining institutional knowledge from retiring staff. Also presents tools and strategies proven to be effective in the utility industry, or applicable to the utility industry.			
Association of Metropolitan Water Agencies/National Association of Clean Water Agencies (AMWA/NACWA). 2004. *The Changing Workforce–Crisis and Opportunity: An AMWA/NACWA Checklist*. Washington, DC.: NACWA/AMWA	Presents an overview of how workforce demographics and trends are impacting water and wastewater utilities and provides a framework and checklist of actions to be taken to address the challenges.	Effective succession planning.		
American Water Works Association. 2011. *The Water Workforce Crisis* DVD., Denver, CO: AWWA	Address workforce risk, recruitment, and retention, and industry collaboration on these subjects. Presents ideas such as incentives to keep employees nearing retirement, recording of institutional knowledge, working with community colleges, job sharing among utilities, etc.	Recruitment, retention, and succession planning.		

EMPLOYEE LEADERSHIP AND DEVELOPMENT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
		Leadership		
Water Environment Federation. 2011. *Wastewater Treatment Operator Training Manual: Fundamentals of Utility Management*. Alexandria, VA.:WEF	Focuses on utility operations professionals who aspire to or have been promoted to management or leadership positions. Addresses the areas of personnel management, budgeting and financial management, communications, utility operations, safety and security, record keeping, and relevant laws and regulations.	Ensuring those promoted into management positions possess the appropriate knowledge and skills.		
WEF. 2004. *Managing the Water and Wastewater Utility*. Alexandria, VA.: WEF	Provides experience-based opinions in preparation of a successful management career, including leadership, budgeting and fiscal control, managing operations and maintenance, design and capital improvements, and the role of information technology.	Management efficacy.		
Charan, R. 2008. *Leadership in the Era of Economic Uncertainty: Managing in a Downturn.* New York: McGraw-Hill.	Addresses issues associated with the current economic crisis and how leaders should address cash and credit crunches, shrinking budgets, collapsing demand, disappearing suppliers, sinking employee morale, and nervous stakeholders.			
Sterling, W. 2010. Elements of Leadership. Kansas City: American Public Works Association (APWA). [Online]. Available: <https://classic.apwa.net/bookstore/detail.asp?PC=PB.A134>.	Provides guidance on the key characteristics of effective public works leaders.			

EMPLOYEE LEADERSHIP AND DEVELOPMENT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Seidenstat, P. M. Nadol, D. Kaplan and S. Hakim, Eds. 2005. *Management Innovation in U.S. Public Water and Wastewater Systems*. Wiley.	Addresses managerial and operational best practices currently used by numerous municipal water and wastewater utilities. Includes financial and customer issues, technology, and management strategies such as Six Sigma.			
Pollard, S.J.T. 2008. *Risk Management for Water and Wastewater Utilities*. London: IWA	Describes the process of identifying business risks and elements of managing risk in a water and wastewater utility. Provides a self-assessment questionnaire.	Managing risk.		
Bennet, D and A. Bennet. 2011. *Organizational Development for Knowledge Management at Water Utilities*. Denver, CO.: WaterRF	Identifies the benefits and costs of implementing a knowledge management initiative and the organizational characteristics and processes critical to the success of implementation. Provides an assessment tool for drinking water utilities to identify their organization's readiness to plan and implement a knowledge management strategy, and offers a toolkit for establishing or enhancing organizational readiness to support knowledge management strategy and initiatives	Effective knowledge management.		

EMPLOYEE LEADERSHIP AND DEVELOPMENT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Training				
American Society of Training & Development (ASTD). 2008. Adult Learning Basics. [Online]. Available: <http://store.astd.org/Default.aspx?tabid=167&ProductId=19291>.	Examines the principles of adult learning theory and how they relate to the training function—addressing individual learning competencies, organizational learning climate, and technology-related issues as they affect the adult learning process.	Maintaining a knowledgeable workforce.	Return on training investment.	
Stolovitch, H.D. 2011. Telling Ain't Training. American Society of Training & Development (ASTD). [Online]. Available: <http://www.astd.org/content/publications/ASTDPress/TellingAintTraining2nded.htm>.	Describes methods for learner-centered training, adult learning activities, and e-learning methods. Extensive new chapters covering technology and e-learning. Provides tools and methods.			

OPERATIONAL OPTIMIZATION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Benchmarking				
Crawford, G. 2010. *Best Practices for Sustainable Wastewater Treatment: Initial Case Study Incorporating European Experience and Evaluation Tool Concept*. Alexandria, VA.: WERF	Examines the European experience with energy reduction and best practices at wastewater treatment plants (WWTPs). The project team assessed European facilities with a history of process optimization that exemplify industry best practices. The report focuses on Strass im Zillertal WWTP near Innsbruck, Austria, a municipal facility that provides for nutrient removal.	Process and metric benchmarking.		
Cabrera, E. Jr., P. Dane, S. Haskins, H. Theuretzbacher-Fritz. 2011. *Benchmarking Water Services, Guiding Water Utilities to Excellence*. IWA Publishing. London, United Kingdom	Addresses both metric and process benchmarking. Provides guidance on how to organizing a practical benchmarking project, and identify participants. Offers experiences gathered from relevant benchmarking projects in the water industry			
Patrick, R. and C. Kozlosky. 2006. *Benchmarking Water Utility Customer Relations Best Practices*. Denver, CO.: AwwaRF, AWWA and IWA Publishing	Identifies customer relations best practices used by other relevant organizations and metrics that can be used for internal measurement and comparison. Provides tools to help utilities identify, evaluate, compare, and change existing customer relations practices to improve efficiency and customer satisfaction.			

OPERATIONAL OPTIMIZATION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
American Water Works Association (AWWA). 2007 *Benchmarking Performance Indicators for Water and Wastewater Utilities*. Denver, CO.: AWWA	Report of the Qualserve Benchmarking Program providing benchmarking data and analyses in key areas of water and wastewater utilities operations.	Metric benchmarking.		
Berg, V.S. 2008. Water Utility Benchmarking for Managerial and Policy Decisions: *Proceedings of the IWA Conference on Performance Assessment of Urban Infrastructure Services* Valencia: IWA.	Describes the metric benchmarking analysis of several Latin American utilities using data gathered from national regulators and the utilities. Relates the process for the data gathering, analysis of data and lessons learned. Presents information on identifying performance measures and other indicators.			
National Research Council Canada. 2010. National Water and Wastewater Benchmarking Initiative 2010 Public Report. [Online]. Available: <http://www.nationalbenchmarking.ca/public/docs/Public_Report_2010.pdf>.	Reports actual data on numerous performance measures identified in the Utility Management Model. Compares latest results with previous years. Data are verified through onsite visits.			

OPERATIONAL OPTIMIZATION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Operational Efficiency				
National Research Council Canada. 2003. *Wastewater Treatment Plant Optimization*. Ottawa, ON.: NRCC and Federation of Canadian Municipalities	Provides an overview of the approach that should be taken to optimize an existing WWTP. Describes a set of tools that can be used to achieve the specific objectives of an optimization program to achieve enhanced performance and reduced operations and maintenance (O&M) costs.	WWTP optimization.	O&M cost per volume treated.	
Friedman, M., G. Kirmeyer, J. Lemieux, M. LeChevallier, S. Seidl and J. Routt. 2010. *Criteria for Optimized Distribution Systems*. Denver, CO.: WaterRF	Defines and develops a continuous improvement program based on optimization principles for water distribution system operations. Also identifies metrics to aid in determining the degree of optimization of a given system and in identifying where optimization efforts can best be focused.	Distribution system optimization.	O&M cost per volume delivered.	
American Water Works Association (AWWA). 2005. *Water Distribution Operator Training Handbook*. 3rd Ed. Denver, CO.: AWWA.	Provides guidance and some detail on the operation and maintenance of distribution systems			

OPERATIONAL OPTIMIZATION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Raucher, R. and D. Garvey. 2007. *An Economic Framework for Evaluating the Benefits and Costs of Biosolids Management* Options. Alexandria, VA.: WERF	Provides a tool to identify and assess the benefits and costs of biosolids management options. Considers the benefits and costs-both internal and external. Describes the approaches, methods, and tools available to help utilities take a broad perspective and develop benefit-cost analysis of biosolids management options.	Cost-benefit analysis of biosolids options.	O&M cost per dry ton of biosolids managed.	
Resource Optimization				
Farley, M. G. Wyeth, Z. Bin Md. Ghazali, A. Istandar, S. Singh. 2008. *The Manager's Non-Revenue Water Handbook - A Guide to Understanding Water Losses*. U.S. Agency for International Development (USAID). [Online]. Available: <http://www.waterlinks.org/library/non-revenue-water/nrw-handbook>.	Comprehensive review of non-revenue water (NRW) issues focused on developing countries. Describes procedures for determining NRW and program design for reducing NRW.	NRW reduction.	Percentage of non-revenue water.	Philadelphia Water
American Water Works Association (AWWA). 2009. *Water Audits and Loss Control Programs* (M36). Denver, CO.: AWWA	Detailed guide to water-auditing methodology co-developed by the AWWA and IWA. The method provides true accountability of real losses (leaks) and apparent losses (billing errors, meter inaccuracy), so water utilities may quickly recover lost revenue.			

OPERATIONAL OPTIMIZATION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Ramon, Greg. 2005. Improving field operations and maintenance at Phoenix. *Proceedings of the Annual Conference and Exposition*, June 2005, San Francisco, Denver, CO.: AWWA.	Describes the development of mobile application system to deliver essential information to and from distribution and collection field crews to Improve operational efficiency, enhance customer service, and eliminate transcription anomalies.	Mobile applications.	Miles of pipeline per field employee.	Phoenix Water Services Department
Jentgen, LA, H. Kidder, R. Hill, and S. C. A. Papalexopoulos. 2007. *Water Consumption Forecasting to Improve Energy Efficiency of Pumping Operations*. Denver, CO.: AwwaRF, AWWA and IWA	Identifies, tests, and evaluates available methods and tools for making Short-Term Water Consumption Forecasts (STCF) to support the implementation of an Energy and Water Quality Management System (EWQMS). Describes STCF systems in operation at four water utilities. Also evaluates neural network, regression, similar day, and heuristic methodologies.	Energy efficiency.	Energy use per volume of water delivered (processed).	
M J Brandt, M J, R. A Middleton, and S Wang. 2011. *Energy Efficiency in the Water Industry: A Compendium of Best Practices and Case Studies*. London, UK.: UK Water Industry Research Limited and WaterRF	Offers a compendium of best practices in the energy-efficient design and operation of water industry assets. Identifies the promising developments and future opportunities to help deliver (1) incremental improvements in energy efficiency through optimization of existing assets and operations, and (2) more substantial improvements in energy efficiency from the adoption of novel technologies.			

OPERATIONAL OPTIMIZATION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Water Environment Federation. 2009. *Energy Conservation in Water and Wastewater Treatment Facilities*, MOP 32. Alexandria, VA.: WEF	Addresses water and wastewater treatment. Presents principles and concepts of energy requirements, potential sources of inefficiency, and recommended energy conservation measures for specific equipment and processes. Looks at utility billing procedures and incentives as well as energy considerations for electric motors and transformers, pumps, variable controls, aeration, blowers, and solids processes.			
Biehl, W.H. 2010. Energy optimization for water utilities. *Journal AWWA*, *102*(6), 50-55.	Addresses energy audits, power monitoring, equipment efficiency, and improved operational efficiency and valuable tools utilities can use to optimize energy use.			
Cantwell, J. 2011. *Overview of State Energy Reduction Programs and Guidelines for the Wastewater* Sector. Alexandria, VA.: WERF	Evaluates successful state programs that promote energy efficiency in the wastewater sector. Looks at the feasibility of establishing a national design standard for wastewater treatment plants that incorporates energy efficiency. Provides suggested language for incorporating energy efficiency into design guidelines or standards.			

OPERATIONAL OPTIMIZATION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Water Environment Research Foundation. 2011. California Utility Launches Fuel-Cell Technology to Generate Energy Savings. July 5, 2011. [Online]. Available: <http://www.werf.org/c/KnowledgeAreas/OperationsOptimization/LatestNews/California_Utility_L.aspx>.	Gives an overview of a fuel cell/hydrogen fueling station demonstration project. The project will produce electricity that will be fed back into their electrical grid to provide power to the treatment plant. The project is funded in part by the Department of Energy (DOE).	Energy recovery.		Orange County Sanitation District
Water Environment Federation. 2006. *Automation of Wastewater Treatment Facilities,* MOP 21. Alexandria, VA.: WEF	Examines the selection of instruments, controllers and computers, installation procedures, and sizing of final control elements for treatment facilities to improve plant productivity and efficiency.	Automation.	MGD processed per employee.	
Roberts, D., D. Kubel, A. Carrie, D. Schoeder, C. Sorensen. 2008. *Costs and Benefits of Complete Water Treatment Plant Automation*. Denver, CO.: AwwaRF	Includes information on the current levels of automation available, other industry experience, and cost information; utility case studies, and sample economic calculations to enhance understanding the issues and concepts; and tools that will allow tailored analysis to utility automation situations.			
Schoeder, D. 2008. Enhance Operations with SCADA Power. *Opflow* (14-19). March.	Serves as a primer for SCADA systems, describing characteristics, uses, and benefits. Provides information on equipment, processes, and maintainability.			

OPERATIONAL OPTIMIZATION

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Olstein, M, E. Markus, S. Lin, C. Day, D. Schlenger and W. Lloyd. 2010. *Optimizing the Water Utility Customer Contact Center*. Denver, CO.: WaterRF	Identifies best practices, processes, and technologies for water utility customer contact center operations to optimize the contact center as a utility-wide resource for communications, resulting in more efficient and effective utility operations and improved responsiveness to customer contacts. Also provides utilities with a vision of how contact centers will function in the future.	Customer contact center efficiency.	Numerous call center metrics.	
Schlenger, Don. 2010. *Water World Magazine.* September. [Online]. Available: <http://www.waterworld.com/index/display/article-display/1565259087/articles/waterworld/water-utility_management/amr-ami/ami-changing-the-face-of-water-utility-customer-service.html>.	Discusses interest in advanced metering infrastructure (AMI) among North American water utilities and the turn toward systems that can deliver short-interval consumption data. Examines interest driven by conservation requirements, the need to reduce non-revenue water, and efforts to improve customer service while reducing operating costs. This trend toward more detailed consumption information has enabled utilities to change their customer service relationships.	AMR/AMI.	Customer accounts per employee; Billing errors per 10,000 accounts; Customer service cost per account	Numerous

FINANCIAL VIABILITY

Document Referenced (Hyperlink to document)	Potential Leading Practice	Description of Practice	Utilities (using the referenced Leading Practice)	Metric (used to track effectiveness)
Financial Procedural Integrity				
Crotty, P. 2004. *Selection and Definition of Performance Indicators for Water and Wastewater Utilities*. Denver, CO.: AwwaRF and AWWA American Water Works Association (AWWA).2012. *Principles of Water Rates, Fees, and Charges: Manual M1*. Denver, CO.: AWWA	Establish and follow financial policies in key financial performance areas such as level of reserves, debt service coverage targets, and contingencies.	Work with the utility's internal financial team, management team, external financial advisors and other key stakeholders to establish appropriate protocols in these key financial management areas. Establish and maintain tracking systems (for example, spreadsheets, databases, dashboards) to monitor compliance with key financial targets, such as debt service coverage level of reserves, and contingencies. Routine update to these tracking systems, and dissemination of status updates to key decision-makers within the utility and interested external stakeholders.	Those with established sound financial policies and documentation of compliance.	Availability of financial procedures in the designated areas. Extent to which these procedures are consistently tracked and used to guide financial decisions, such as bonding and level of capital expenditures.
U.S. Environmental Protection Agency, (USEPA), Association of Metropolitan Sewerage Agencies (AMWA), American Public Works Association (APWA), American Water Works Association (AWWA), National Association of Clean Water Agencies (NACWA), National Association of Water Companies (NAWC), and Water Environment Federation (WEF). 2008. *Effective Utility Management: A Primer for Water and Wastewater Utilities*. Washington DC, EPA.	Implement financial audit and control program.	Establish tracking program to monitor compliance with key financial procedures. Identify audit and control procedures, with designated staff responsibilities, to monitor compliance with key financial targets, such as debt service coverage level of reserves, and contingencies.	Existence of financial audit and internal financial controls program.	Extent to which financial audit and internal controls programs are documented and communicated to staff. Extent to which these programs are enforced and compliance tracked.

FINANCIAL VIABILITY

Document Referenced (Hyperlink to document)	Potential Leading Practice	Description of Practice	Utilities (using the referenced Leading Practice)	Metric (used to track effectiveness)
Maintain Strong Bond Rating				
American Water Works Association (AWWA). 2004. *Avoiding Rate Shock: Making the Case for Water Rates*. Denver, CO.: AWWA CH2M HILL. 2006. *Environmental Management Systems: A Tool to Help Water Utilities Manage More Effectively*. Denver, CO.: AwwaRF, AWWA and IWA	Maximize opportunities for a strong bond rating based on the utility's context.	Having a strong credit rating helps utilities to secure access to low-cost borrowing for their capital programs through municipal bonds and other debt instruments. Utilities cannot directly control their ratings, and some elements of credit ratings are beyond a utility's control. For example, a utility may be faced with a large compliance capital program, and therefore be required to issue a substantial amount of debt. But utilities can take proactive steps to maintain an existing strong credit rating or to improve an existing credit rating. Examples of actions within a utility's control in this area include making certain there is a well-articulated utility mission statement, documenting that there is a track record for delivering capital projects on time and on budget, increasing the levels of reserves and debt service coverage, and developing a long-term risk reduction plan to show that the utility has a strong opportunity to meet its obligations by managing uncertainties.	Those with high credit ratings by rating agencies such as Moody's and Standard & Poor's, or with positive change in credit ratings.	Change in utility bond rating (increase or decrease) or stability in rating, related or linked to proactive utility action on elements of rating within the utility's control (management team, level of reserves, adequacy of rate program, long-term financial planning model, etc.).

FINANCIAL VIABILITY

Document Referenced (Hyperlink to document)	Potential Leading Practice	Description of Practice	Utilities (using the referenced Leading Practice)	Metric (used to track effectiveness)
Budget Management Effectiveness				
American Water Works Association (AWWA). 2000. *Principles of Water Rates, Fees, and Charges: Manual M1*. Denver, CO.: AWWA Water Environment Federation (WEF). 2005. *Financing and Charges for Wastewater Systems*: MOP 27. Alexandria, VA.: WEF	Manage short-term revenue to expenditure ratios (operating expenditures, capital expenditures, and overall).	Establish appropriate annual budget levels for future near-term fiscal years for operating capital costs and develop revenue programs that provide revenues from rates, fees, and other income sources (grants, bonding, interest income, etc.) to fully fund planned activities with adequate remaining reserves.	Utilities that achieve positive net cash flows and are able to fully fund planned activities in each fiscal year.	Historical performance in revenue to expenditures ratios for the utility's operating budget, capital budget, and for the system overall.
Matichich, M., R Booth, J. Rogers, E. Rothstein, E. Speranza, C. Stanger, E. Wagner and P. Gruenwald. . 2006. *Asset Management Planning and Reporting Options for Water Utilities*. Denver, CO.: AwwaRF AMWA, NACWA, WEF. 2007. *Implementing Asset Management–A Practical Guide*. AMWA, NACWA, WEF WEF. 2009. *Surviving or Thriving in Economic Recession: Strategies of Water Utility Leaders.* Report 4296. Alexandria, VA.: WEF Global Water Research Coalition, WEF, WERF, and Water Services Association of Australia. 2008. Tool for Risk Management of Water Utility Assets. AMSA (now NACWA), AMWA, AWWA, WEF. 2002. *Managing Public Infrastructure Assets to Minimize Costs and Maximize Performance*. AMSA, AMWA,	Address long-term life-cycle accounting issues.	Develop a risk-based financial plan that provides for the efficient long-term life-cycle costs of owning and maintaining a system's assets and uses that plan as the basis for establishing capital and operating budgets and rate plans. Securing support from stakeholders for rate plans consistent with providing the funding needs identified in these risk-based plans.	Utilities with adopted risk management plans that are linked to overall utility goals and used to develop rate plans and other financial planning documents.	Availability of risk-based funding plans, degree of endorsement of the plans by staff, decision-makers, and stakeholders, and percentage of funding needs identified in risk based plans that are actually funded in budgets and adopted rate programs.

FINANCIAL VIABILITY

Document Referenced (Hyperlink to document)	Potential Leading Practice	Description of Practice	Utilities (using the referenced Leading Practice)	Metric (used to track effectiveness)
AWWA, WEF				
Beaudet, B. B. Bellamy, M. Matichich, and J. Rogers. 2000. *Capital Planning Strategy Manual. CD-ROM.* Denver, CO.: AwwaRF Olstein, M. J. Jennings, R. Geist, R. King and P. Eisenhardt. 2009. *Improving Water Utility Capital Efficiency*. Denver, CO.: WaterRF Allen, Robert and Michael Matichich. 2002. Improving Implementation Performance for Capital Programs. Utility Management Conference, Charlotte, NC. AWWA and WEF.	Manage delivery of capital programs to meet program and financial objectives.	Develop prioritization framework to align utility capital programs to stakeholder values and the utility's mission. Develop the CIP to implement identified priority projects. Track progress in actual CIP expenditures and projects completed to confirm that planned projects are delivered on time and on budget.		Percentage of planned CIP projects scheduled for completion actually completed by fiscal year. Dollars spent on planned vs. unplanned CIP projects. Actual cost of completed CIP projects vs. budget and CIP document estimates for the projects.
AWWA. 2012. *Principles of Water Rates, Fees, and Charges: Manual M1*. Denver, CO.: AWWA WEF. 2005. *Financing and Charges for Wastewater Systems: Manual of Practice No. 27*. Alexandria, VA.: WEF	Maintain adequate operating reserves.	Providing for adequate reserves allows a utility to manage its expenditures within the inevitable cash flow cycles that result in uneven payment and revenue streams. Development of revenue requirements as part of the rate-setting and financial planning processes for a utility calls for setting aside funding to support such cash flow cycles.	Utilities that maintain reserves consistent with adopted polices and industry guidelines.	Reserve levels expressed in relation to number of days of O&M budgets.

FINANCIAL VIABILITY

Document Referenced (Hyperlink to document)	Potential Leading Practice	Description of Practice	Utilities (using the referenced Leading Practice)	Metric (used to track effectiveness)
		Rate Adequacy		
AWWA. 2012. *Principles of Water Rates, Fees, and Charges: Manual M1*. Denver, CO.: AWWA WEF. 2005. *Financing and Charges for Wastewater Systems: Manual of Practice No. 27*. Alexandria, VA.: WEF *Mayer, P., W. DeOreo, T. Chesnutt, D. Pekelney and L. Summers.* 2008. *Water Budgets and Rate Structures: Innovative Management Tools*. Report 91205. Denver, CO.: AwwaRF AWWA. 2004. *Avoiding Rate Shock: Making the Case for Water Rates*. Denver, CO.: AWWA	Establish rate increases in light of documented revenue requirements and cost of service studies.	A key consideration in the determination of appropriate utility rates and charges is the development of accurate projections of revenue requirements and projection of non-revenues. Another key consideration is the relationship of rates to the cost of providing service to the utility system's customer classes. Developing rate, financial, and cost of service projection models that provide accurate information to guide rate-setting, and updating those models on a routine basis is critical to supporting sound, adequate rate setting. Since customer bases can evolve over time, such as loss/gain of industrial bases or changes in the type of residential development in a community, sound practice also calls for periodically revisiting the customer classification and rate blocks to make certain that they remain appropriate to support the development of rates and charges in line with addressing cost of service and other goals for the system. Because customers and other stakeholders have an increased interest in participating in rate/financial decisions by utilities, aligning stakeholder communication and engagement programs with rate-setting processes is critical to ensuring	Utilities with frequent updates to financial and cost of service analyses that use the results to guide the rate-setting process.	Frequency and accuracy of updates to financial forecasting, cost of service, and rate-setting models. Relationship of rates and charges to results of these studies (for example, do adopted and projected rates fully recover the identified cost of providing service?) Periodic consideration of whether changes are needed to customer classification and rate blocks. Extent to which rate study and setting processes are connected to stakeholder education and engagement processes.

FINANCIAL VIABILITY

Document Referenced (Hyperlink to document)	Potential Leading Practice	Description of Practice	Utilities (using the referenced Leading Practice)	Metric (used to track effectiveness)
		that there will be endorsement and support for identified rate increases and in setting levels of service for the utility at levels that meet customer expectations.		
AWWA. 2012. *Principles of Water Rates, Fees, and Charges: Manual M1*. Denver, CO.: AWWA WEF. 2007. *Affordability of Wastewater Service*. Alexandria, VA.: WEF AWWA. 2004. *Thinking Outside the Bill: A Utility Manager's Guide to Assisting Low-Income Water Customers*. Denver, CO.: AWWA	Address financial needs of low-income, elderly, or other portions of service population requiring financial assistance.	Difficult economic times during the past several years have highlighted the need to address the challenges that elderly and low-income customers face in paying for utility service. In light of this, rate adequacy includes providing adequate provision for any affordability programs that may be needed, such as bill discounts for low-income or other heavily impacted groups that the utility has deemed it important to support.	Utilities that have considered the needs of low-income and other customers groups that may need financial assistance, and, if appropriate, established programs to provide support to those customer groups.	Extent to which needs of low-income and other groups that may need assistance in meeting financial obligations to utility systems have been evaluated and, where appropriate, affordability programs established. Degree of use for affordability programs that have been implementation.
Balance Debt and Equity Funding				
AWWA. 2000. *Principles of Water Rates, Fees, and Charges: Manual M1*. Denver, CO.: AWWA WEF. 2005. *Financing and Charges for Wastewater Systems: Manual of Practice No. 27*. Alexandria, VA.: WEF	Develop financial plan/strategy for debt/equity split in capital funding that is compatible with CIP needs, ability of existing and future customers to pay, and related financial goals.	Having a sound financing plan for capital programs in most cases calls for funding some of the local share of required expenditures from equity (cash) sources and some for borrowed funds, such as revenue bonds, general obligation bonds, and state revolving fund loans. Factors influencing the appropriate balance between debt and equity funding sources include the size of anticipated capital program, the financial capability of the current and anticipated future customer base to pay for required rates and charges to support financing options, the impact of various	Green Bay Metropolitan Sewerage District Region of Peel Regional Municipality of Durham Tualatin Valley Water District	Extent to which utilities have developed financial plans and financial policies that define an appropriate mix of debt and equity funding, given their expenditure needs, customer characteristics, and other considerations. For example, a number of utilities have found it prudent to fund at least 20% of their capital programs through equity sources. Extent to which target debt-to-equity funding targets for CIP programs are met.

FINANCIAL VIABILITY

Document Referenced (Hyperlink to document)	Potential Leading Practice	Description of Practice	Utilities (using the referenced Leading Practice)	Metric (used to track effectiveness)
		debt vs. equity expenditure plans on the utility's bond rating, and related interest rate for borrowing. Based on consideration of these and other relevant factors, such as the experience of other utilities with comparable facility and customer base profiles, it is prudent for leading utilities to define a target debt/equity funding ratios as part of the utility's financial planning process. Leading practice would also involve tracking actual to target levels of debt and equity expenditures.		

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Maintenance Management				
Napa Sanitation District. Undated. Performance Measurement Report–Performance Measurements for the Napa Sanitation District Using the "Effective Utility Management Framework." Napa Sanitation District.	"This report is the first of what is intended to be an annual report by the Napa Sanitation District regarding the performance of the District. It includes performance measures that, when taken as a whole, should give the reader a sense of how well the utility is performing and being managed. This report is prepared by management for use by the District's Board of Directors and by the general public."	Maintenance at the plant and in the collection system.	Ratio of planned maintenance in a year to total maintenance in that year.	Napa Sanitation District
		Cleaning sewer pipe in the collection system.	Ratio of sewer pipes in miles cleaned in a year to the total length of sewer pipe.	Napa Sanitation District
		Maintaining an up to date inventory of assets.	Percentage of critical assets inventoried in the past 5 to 10 years.	Napa Sanitation District
		Inspecting sewer pipe via CCTV for condition and maintenance requirement.	Ratio of sewer pipe inspected via CCTV in a year to the total length of sewer pipe.	Napa Sanitation District
"Advanced AM Tools and Techniques." NRCC/CPWA Seminar Canada. [Online]. Available at: <(http://www.nrc-cnrc.gc.ca/obj/irc/doc/pubs/nrcc44299.pdf)>.	(Intentionally left blank.)	Maintenance and repair expenditure should not include funds that would lengthen the life of asset beyond its original purpose.	Maintenance and repair budgets should be 2 to 4 percent of the current replacement value.	N/A
		Determination of deferred maintenance.	Calculate the past year's maintenance expenditure, which is then related to a 2 percent current replacement value, then multiply the number above by the number of years adequate.	N/A
"Water Infrastructure: Comprehensive Asset Management Has Potential to Help Utilities Better Identify Needs and Plan Future Investments." [Online]. Available at: <(http://www.gao.gov/new.items/d04461.pdf)>.	"Having invested billions of dollars in drinking water and wastewater infrastructure, the federal government has a major interest in protecting its investment and in ensuring that future assistance goes to utilities that are built and managed to meet key regulatory requirements. The Congress has	Optimized maintenance practices for treatment plant and utility officials.	Decrease in labor hours spent on preventative maintenance by x% from hours recommended by original equipment manufacturers.	Massachusetts Water Resources Authority

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
	been considering, among other things, requiring utilities to develop comprehensive asset management plans. Some utilities are already implementing asset management voluntarily. The asset management approach minimizes the total cost of buying, operating, maintaining, replacing, and disposing of capital assets during their life cycles, while achieving service goals. This report discusses (1) the benefits and challenges for water utilities in implementing comprehensive asset management and (2) the federal government's potential role in encouraging utilities to use it."			
United States Environmental Protection Agency, Association of Metropolitan Water Agencies, American Public Works Association, American Water Works Association, National Association of Clean Water Agencies, National Association of Water Companies, Water Environment Federation. 2008. *Effective Utility Management: A Primer for Water and Wastewater Utilities.* Washington, D.C.: EPA	"This Primer is designed to help water and wastewater utility managers make practical, systematic changes to achieve excellence in utility performance. It was produced by water and wastewater utility leaders who are committed to helping utility managers improve water and wastewater management. The Primer distills the expertise and experience of these utility leaders into a framework intended to help a utility manager identify and address their most pressing needs through a customized,	Optimizing planned vs. reactive maintenance.	Planned maintenance ratio by hours = 100 x ((hours of planned maintenance) ÷ (hours of planned + corrective maintenance)).	N/A
		Optimizing planned vs. reactive maintenance.	Planned maintenance ratio by cost = 100 x ((cost of planned maintenance) ÷ (cost of planned + corrective maintenance)).	N/A

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
	incremental approach that is relevant to the day-to-day challenges utilities face."			
Association of Local Government Engineering New Zealand, Inc., and the Institute of Public Works Engineering of Australia. 2006. Sydney, Australia: *International Infrastructure Management Manual*. IPWEA	"This Manual outlines a formal systematic process for infrastructure asset management. Asset Management is a generic discipline and the authors have sought to align the content of this Manual with the principles and expectations embodied in other international standards and guidelines, including the British Standard PAS 55. The Manual includes a tool-kit of approaches that can be used to undertake asset management activities. The Manual is not only oriented toward the asset managers within an organization which owns and/or operates one or more infrastructure networks. Because of the multi-disciplinary nature of asset management, executive management as well as financial, information technology, and planning specialists will also benefit greatly from this Manual."	Maintenance costs in relation to the value of the asset.	Responsive maintenance as a % of asset value.	N/A
		Maintenance costs in relation to the value of the asset.	Planned maintenance as a % of asset value.	N/A
		Cost of responsive and planned maintenance in relation to the units of service provided.	Total cost of responsive and planned maintenance per unit of service.	N/A
		Maintenance costs in relation to the total value of all assets.	Total cost of responsive and planned maintenance as a % of the total value of all assets.	N/A
		Backlog work orders.	The backlog of work orders expressed in terms of a measure of time (e.g. weeks).	Massachusetts Water Resources Authority
		Measuring the success of a maintenance program by measuring the resulting increased useful life of an asset and therefore the resulting increase in value of an asset.	Percentage increase in value of an asset related to an increased useful life.	Orion New Zealand Ltd

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Asset Reinvestment Planning				
Napa Sanitation District. Undated. Performance Measurement Report–Performance Measurements for the Napa Sanitation District Using the "Effective Utility Management Framework." Napa Sanitation District.	"This report is the first of what is intended to be an annual report by the Napa Sanitation District regarding the performance of the District. It includes performance measures that, when taken as a whole, should give the reader a sense of how well the utility is performing and being managed. This report is prepared by management for use by the District's Board of Directors and by the general public."	Investing in the renewal and replacement of capital assets	The ratio of $ invested in renewing capital assets in a year to the "total net worth of assets."	Napa Sanitation District
"Advanced AM Tools and Techniques." NRCC/CPWA Seminar Canada. [Online]. Available at: <http://www.nrc-cnrc.gc.ca/obj/irc/doc/pubs/nrcc44299.pdf>.	(Intentionally left blank.)	Understanding renewal and remaining life of assets.	Dividing total asset base (in $) by total service life for asset base.	N/A
United States Environmental Protection Agency, Association of Metropolitan Water Agencies, American Public Works Association, American Water Works Association, National Association of Clean Water Agencies, National Association of Water Companies, Water Environment Federation. 2008. *Effective Utility Management: A Primer for Water and Wastewater Utilities.* Washington, D.C.: EPA.	"This Primer is designed to help water and wastewater utility managers make practical, systematic changes to achieve excellence in utility performance. It was produced by water and wastewater utility leaders who are committed to helping utility managers improve water and wastewater management. The Primer distills the expertise and experience of these utility leaders into a framework intended to help a utility manager identify and address	Development of risk-based asset renewal plans	Asset renewal/replacement rate = 100 x ((total number of assets replaced per year for each asset class) ÷ (total number of assets in each asset class)).	N/A
		Development of risk-based asset renewal plans.	Asset renewal/replacement rate = 100 x ((total actual expenditure or total amount of funds reserved for renewal and replacement for each asset group) ÷ (total present worth for renewal and replacement needs for each asset group)).	N/A

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
	their most pressing needs through a customized, incremental approach that is relevant to the day-to-day challenges utilities face."			
Asset Management Techniques for CIP Planning and Validation. IWA.	Discusses the development of a confidence level rating to rate the quality of a capital improvement program. The approach covers a variety of asset management techniques, but does not provide the methodology used in the assessment.	Assessing the quality of the processes and practices used to develop a Capital Improvement Program by determining a confidence level rating for a proposed capital investment project.	15 elements/criteria mentioned, but no methodology provided.	Orange County Sanitation District
United States General Accounting Office. "Water Infrastructure: Comprehensive Asset Management Has Potential to Help Utilities Better Identify Needs and Plan Future Investments." [Online]. Available at: <http://www.gao.gov/new.items/d04461.pdf>.	"Having invested billions of dollars in drinking water and wastewater infrastructure, the federal government has a major interest in protecting its investment and in ensuring that future assistance goes to utilities that are built and managed to meet key regulatory requirements. The Congress has been considering, among other things, requiring utilities to develop comprehensive asset management plans. Some utilities are already implementing asset management voluntarily. The asset management approach minimizes the total cost of buying, operating, maintaining, replacing, and disposing of capital assets during their life cycles, while achieving service goals. This report discusses (1)	Sustainable asset reinvestment levels	User charges = full cost of service	N/A
		Developing an asset management plan; and, annually auditing progress in implementing the plan.	Asset management plan developed every 5 years. Asset management plan implementation audited annually.	United Kingdom water utilities

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
	the benefits and challenges for water utilities in implementing comprehensive asset management and (2) the federal government's potential role in encouraging utilities to use it."			
Bhagwan, J. Ed. 2009. *Compendium of Best Practices in Water Infrastructure Asset Management*. Global water Research Coalition	"This publication is based on best practice. The publication illustrates demonstrations of advancement and progress being made in applying innovative and novel techniques and processes in the management of water and sanitation infrastructure. The case studies highlight examples of different countries on strategic initiatives at the highest level, through the development of policy and legislation towards ensuring that asset management becomes a legal requirement for all water service providers, innovation techniques, and studies on the implementation of Asset management in utility practice, continuous leak detection and rehabilitation of infrastructure."	Built an asset management program from within the organization that is still thriving.	Build tables to show overall asset life; make sales pitch within organization; realization that departments are silo and doing their own thing and needed to be one unit; inform that if you do not speak up and get involved then others will make decisions without you; educate and train, telling a story.	City of Hamilton
APWA, ASCE, NACWA and WEF. 2010. *Core Attributes of Effectively Managed Wastewater Collection Systems*. Washington, DC. NACWA and WEF	"These core attributes are intended to provide guidance for wastewater agency collection system managers to evaluate their existing programs and confirm they are performing according to industry good engineering practices, or have practices that	Suggested a range of performance measures for collection systems.	• Number of SSOs per 100 miles of mainline sewer. • Number of backups per 100 miles of mainline sewer. • Number of system failures per 100 miles of mainline sewer.	N/A N/A

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
	are lacking and need enhancement."		• Customer service calls. • Odor complaints. • Ratio of peak wet weather flow to peak dry weather flow. • Rainfall derived infiltration and inflow (RDII) per acre. • RDII per linear foot of pipe. • RDII per inch of rain per linear foot of pipe. • RDII per inch of rain per inch-diameter. • Percentage of calls that are repeats. • Percentage of problems cleared per month. • Percentage of system cleaned annually. • Percentage system televised annually. • Percentage system inspected annually. • Percentage system renewed annually. • Percentage of corrective work orders. • Percentage of preventative work orders. • Collection systems maintenance cost per mile. • Percentage of work orders completed per month. • Fleet costs per total O&M	

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
			(by function). • Value of capital additions/net asset value. • Overtime costs.	
Ofwat process for assessing serviceability.	The annual serviceability assessment is carried out at the level of the 4 sub-services: above and below ground assets for water and sewerage services. The output of the analysis is a headline assessment of serviceability for each sub-service for each company, ranging from (best to worst), "improving," through "stable" to "marginal" and "deteriorating."	Number of mains bursts.	Burst/1000 km and total mains length.	UK water companies
		Number of sewer collapses.	Collapses/1000 km and total sewers length.	UK water companies
Cost of Service				
Public Sector Involvement: Practical Experience. Outsourcing Water and Wastewater Service Delivery in Adelaide, South Australia. International Water Association.	(Intentionally left blank.)	Tracking the annual operating costs of water and wastewater operations.	The intention appears to be to track this figure over time to demonstrate the benefits (or costs) of improvement initiatives (or lack thereof).	South Australian Water Corporation
Asset Management–A Holistic Approach, International Water Association.	(Intentionally left blank.)	Tracking the cost to rehabilitate water and sewer main pipe.	Costs of water or sewer main rehabilitation per mile of water or sewer main rehabilitated. Example provided indicated that a target measure can be set and current performance against that target assessed.	N/A
Office of Asset Management–Department of Transportation. "Life Cycle Cost Analysis Primer." [Online].	"Life-cycle cost analysis is an engineering economic analysis tool useful in comparing the relative merit of competing	Understanding how life cycle cost analysis is a part of an asset management program. Best practice for life cycle cost	Present value of asset investment options used to select the preferred option.	N/A

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Available at: <http://www.ce.cmu.edu/~hsm/im2004/readings/DOT-LCCA-Primer.pdf>.	project implementation alternatives. This Primer is intended to provide sufficient background for transportation officials to investigate the use of life-cycle cost analysis to evaluate alternative infrastructure investment options. Additionally, the Primer demonstrates the value of such analysis in making economically sound decisions."	analysis would include both costs accruing to the agency and cost incurred by resident users.		
"Overview of Water Utility Benchmarking Methodologies from Indicators to Incentives."	"Benchmarking is essential for developing and implementing water policy. Purpose of document is to illustrate the need for understanding the organization so that reasonable targets can be set for future performance within the organization."	Identification of historical trends, baseline performance, and quantify relative performance across utility and within asset,	Cost efficiency, number of complaints, performance targets, quality.	Public Utility Research Center
Risk Analysis				
International Water Association. "Asset Management Techniques for CIP Planning and Validation."	Discusses the development of a confidence level rating to rate the quality of a capital improvement program. The approach covers a variety of asset management techniques, but does not provide the methodology used in the assessment.	Measuring the economic risk to an organization of a capital investment project not proceeding. Further refinement of the capital project approval process to prioritize investments for those projects that pass the confidence level rating assessment.	Economic Project Risk = (Project Cost) x (Business Risk Exposure) x (100/Confidence Level Rating). The process is to rank the capital projects by their Economic Project Risk and, typically, select those with a higher score to invest in first.	Orange County Sanitation District
"PAS 55-1: 2008−Asset Management Specification for the optimized management of physical assets."	"This document was initially written in 2004 in response to demand from industry for a standard for asset management. The 2008 document revision reflects increasing international	Performance of risk of failure analysis for utility assets.	At a minimum computation of following risks: a. physical failure risks, such as functional failure, incidental damage, malicious damage or	N/A

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
	consensus about required good practices in the management of such physical assets."		terrorist action b. operational risks, control of the asset, human factor, performance, condition and safety c. natural environment events d. stakeholder risk e. risk associated with life cycle f. external factors of the organization	
International Water Association. Risk Assessment Model using GIS to Assess Critical Sewer and Drainage Assets.	(Intentionally left blank.)	Determining the annual risk cost of failure.	Risk Cost of Failure = (Consequence of Failure) x (Probability of Failure)	Seattle Public Utilities
Asset Inventory				
Napa Sanitation District. Undated. Performance Measurement Report–Performance Measurements for the Napa Sanitation District Using the "Effective Utility Management Framework." Napa Sanitation District.	"This report is the first of what is intended to be an annual report by the Napa Sanitation District regarding the performance of the District. It includes performance measures that, when taken as a whole, should give the reader a sense of how well the utility is performing and being managed. This report is prepared by management for use by the District's Board of Directors and by the general public."	Maintaining an up-to-date inventory of assets.	Percentage of critical assets inventoried in the past 5 to 10 years.	Napa Sanitation District
United States Environmental Protection Agency, Association of Metropolitan Water Agencies, American Public Works Association, American Water Works Association, National Association of Clean Water Agencies, National Association	"This Primer is designed to help water and wastewater utility managers make practical, systematic changes to achieve excellence in utility performance. It was produced by water and wastewater utility leaders who are committed to	Maintaining an up-to-date inventory of assets.	Percentage of critical assets inventoried within a reasonable period of time.	N/A

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
of Water Companies, Water Environment Federation. 2008. *Effective Utility Management: A Primer for Water and Wastewater Utilities.* Washington, D.C.: EPA	helping utility managers improve water and wastewater management. The Primer distills the expertise and experience of these utility leaders into a framework intended to help a utility manager identify and address their most pressing needs through a customized, incremental approach that is relevant to the day-to-day challenges utilities face."			
Kenway, S., C. Howe and S. Maheepala. 2007. *Triple Bottom Line Reporting of Sustainable Water Utility Performance*. Denver, CO.: AwwaRF, AWWA, IWA	"Report aims to assist US utilities on how to report on and manage their environmental, social and economic performance – their triple bottom line. This document provides practical knowledge regarding both the preparation of a triple bottom line report, as well as internal measures which will help improve triple bottom line performance."	Identification of service levels, condition of assets, decision models and repair versus replacement decisions and maintenance strategies.	Achieve water conservation goals; leakage loss of no more than 10 percent total supply; CSOs shall be limited to an average of one untreated discharge per CSO site per year.	Seattle Public Utilities
Levels of Service				
Getting the Most out of Your Infrastructure Assets–A Guide to Using Infrastructure Asset Management Systems. [Online]. Available at: <http://www.benjaminmedia.com/book-store/index.php?_a=viewProd&productId=52?>.	(Intentionally left blank.)	Measures of infrastructure effectiveness.	Output per unit time; output per unit input; output versus rated capacity per unit time	N/A

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Association of Local Government Engineering New Zealand, Inc., and the Institute of Public Works Engineering of Australia. 2006. Sydney, Australia: *International Infrastructure Management Manual*. IPWEA	"This Manual outlines a formal systematic process for infrastructure asset management. Asset Management is a generic discipline and the authors have sought to align the content of this Manual with the principles and expectations embodied in other international standards and guidelines, including the British Standard PAS 55. The Manual includes a tool-kit of approaches that can be used to undertake asset management activities. The Manual is not only oriented toward the asset managers within an organization which owns and/or operates one or more infrastructure networks. Because of the multi-disciplinary nature of asset management, executive management as well as financial, information technology, and planning specialists will also benefit greatly from this Manual."	Delivering services to customers in accordance with stated service delivery standards.	Measure of compliance with service delivery standards.	N/A
		Monitoring the costs of providing defined levels of service (community and technical).	The cost of maintaining an asset in a defined standard of condition per unit of that asset (e.g., mile of pipe). Maintenance costs/unit of measure for an asset for a defined acceptable condition.	City of Darebin, Australia
		Related to the goals of achieving service delivery standards and communication with customers.	Asset management plans issued to stakeholders by a specified date or frequency	N/A

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Managing Public Infrastructure Assets To Minimize Cost and Maximize Performance.	A well-designed and constructed infrastructure that achieves highly reliable services, quality drinking water, quality receiving water, and reduced localized flooding.	Technical service management.	Time to restore service for an unplanned water outage incident.	N/A
		Technical service management.	Water system leaks or breaks per month.	N/A
		Technical service management.	Mainline backups in drainage and wastewater.	N/A
		Technical service management.	Acute water quality public health incidents.	N/A
		Technical service management.	Technical service management.	N/A
Kenway, S., C. Howe and S. Maheepala. 2007. *Triple Bottom Line Reporting of Sustainable Water Utility Performance*. Denver, CO.: AwwaRF, AWWA, IWA	"Report aims to assist US utilities on how to report on and manage their environmental, social and economic performance – their triple bottom line. This document provides practical knowledge regarding both the preparation of a triple bottom line report, as well as internal measures which will help improve triple bottom line performance."	Improving performance level within the organization.	Service levels and indicators aligned to business units - • Within 10% of expectation of Better	Seattle Public Utilities
Condition Assessment				
United States Environmental Protection Agency, Association of Metropolitan Water Agencies, American Public Works Association, American Water Works Association, National Association of Clean Water Agencies, National Association of Water Companies, Water Environment Federation. 2008. *Effective Utility Management: A*	"This Primer is designed to help water and wastewater utility managers make practical, systematic changes to achieve excellence in utility performance. It was produced by water and wastewater utility leaders who are committed to helping utility managers improve water and wastewater management. The Primer	Knowing the condition of the critical assets in the utility asset inventory.	Total number of critical assets with condition assessed and categorized into condition categories within a reasonable period of time) ÷ (total number of critical assets)).	N/A
		Knowing the condition of the critical assets in the utility asset inventory	Leakage and breakage frequency rate = 100 x ((total number of leaks + total number of breaks) ÷ (total miles of distribution piping per year)).	N/A

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Primer for Water and Wastewater Utilities. Washington, D.C.: EPA	distills the expertise and experience of these utility leaders into a framework intended to help a utility manager identify and address their most pressing needs through a customized, incremental approach that is relevant to the day-to-day challenges utilities face."	Knowing the condition of the critical assets in the utility asset inventory.	Collection system failure rate = 100 x ((total number of collection system failures) ÷ (total miles of collection system piping per year)).	N/A
Bhagwan, J. Ed. 2009. *Compendium of Best Practices in Water Infrastructure Asset Management*. Global Water Research Coalition	"This publication is based on best practice. The publication illustrates demonstrations of advancement and progress being made in applying innovative and novel techniques and processes in the management of water and sanitation infrastructure. The case studies highlight examples of different countries on strategic initiatives at the highest level, through the development of policy and legislation towards ensuring that asset management becomes a legal requirement for all water service providers, innovation techniques, and studies on the implementation of Asset management in utility practice, continuous leak detection and rehabilitation of infrastructure."	Identifying critical assets and implementing predictive and reliability-centered maintenance.	Understand condition of asset and determine if properly maintained or out of service, want to make sure assets are in service at all times.	Massachusetts Water Resource Authority

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
"PAS 55-2: 2008–Asset Management–Guidelines for the Application of PAS 55."	"This section of PAS 55 contains guidelines for the application of PAS 55-1."	Development of condition and performance targets.	The following can be used to measure for performance/condition targets: service/supply standards; levels of service; reliability, functionality, survivability, capacity, safety, customer satisfaction, legislative/regulatory.	N/A
International Water Association. Risk Assessment Model using GIS to Assess Critical Sewer and Drainage Assets.	(Intentionally left blank.)	Determining the condition of wastewater and drainage collection system pipe using CCTV inspection technology.	Inspecting high-risk pipe assets using CCTV every 5 years.	Seattle Public Utilities
Association of Local Government Engineering New Zealand, Inc., and the Institute of Public Works Engineering of Australia. 2006. Sydney, Australia: *International Infrastructure Management Manual*. IPWEA	"This Manual outlines a formal systematic process for infrastructure asset management. Asset Management is a generic discipline and the authors have sought to align the content of this Manual with the principles and expectations embodied in other international standards and guidelines, including the British Standard PAS 55. The Manual includes a tool-kit of approaches that can be used to undertake asset management activities. The Manual is not only oriented toward the asset managers within an organization which owns and/or operates one or more infrastructure networks. Because of the multi-disciplinary nature of asset management, executive management as well as	Tracking gross averages over time.	Average condition grade by major asset type Average remaining life by major asset type	Hutt City Council, New Zealand
		Monitoring asset condition relative to technical standards (or, "Technical Level of Service").	The percentage of assets that meet technical standards in terms of their general condition (90%).	City of Darebin, Australia

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
	financial, information technology, and planning specialists will also benefit greatly from this Manual."			
"Advanced AM Tools and Techniques." NRCC/CPWA Seminar Canada. [Online]. Available at: <http://www.nrc-cnrc.gc.ca/obj/irc/doc/pubs/nrcc44299.pdf>.	"This presentation describes the six "What's" of asset management. These six levels of implementation can be used as a methodology for the implementation of an asset management plan in most organizations. An asset management plan provides a framework for collecting the data and information required to make decisions about the strategic plans of the fixed assets of an organization."	Determination of asset condition.	Financial condition index (i.e., amount of deferred maintenance divided by current replacement value).	N/A
International Water Association. Asset Management–A Holistic Approach.	(Intentionally left blank.)		Tracking the number of water main breaks and sewer blockages. Number of water main breaks or sewer blockages per 1,000 miles of pipe.	N/A
Napa Sanitation District. Undated. Performance Measurement Report–Performance Measurements for the Napa Sanitation District Using the "Effective Utility Management Framework." Napa Sanitation District.	"This report is the first of what is intended to be an annual report by the Napa Sanitation District regarding the performance of the District. It includes performance measures that, when taken as a whole, should give the reader a sense of how well the utility is performing and being managed. This report is prepared by management for use by the District's Board of Directors	Monitoring condition of pipe infrastructure over time.	The number of sewer pipe collapses that obstruct or cause uncontained flows. Presumably a target of zero.	Napa Sanitation District

INFRASTRUCTURE STABILITY

Document Referenced (Hyperlink to document)	Description of Reference	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
	and by the general public."			
Water UK Sustainability Indicators 2009/10	"The indicators provide detail about the industry as a whole. For each indicator, information is provided on why it is included, what the information tells us (including comparisons with previous years where appropriate) and the main issues related to performance."	The indicator shows the total amount of water that has been abstracted, treated and lost before reaching the customer.	Total leakage.	UK water companies
		Results for UK water companies have been standardized by considering the amount of water lost per 100 km of water mains length.	Total leakage per 100 km of supply main.	UK water companies

OPERATIONAL RESILIENCY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
American Water Works Association (AWWA). 2005. *Water Utility Management, M5.* Denver, CO.: AWWA	Document focuses on items utility managers must consider ranging from leading/managing; managing change; handling stakeholders, especially governing bodies (council, commission), but also including their own employees; financial viability; customer service; operation and maintenance (O&M) functions; environmental health and safety; security; human resource management; IT and information systems; and legal counsel.	Providing safety equipment and employee training.	• Total recordable rate (TRR) • Days away restricted time (DART)	
		Carrying insurance for claims, losses, damages; workers comp; employee benefits.		
		Maintaining and exercising emergency response plans.		
		Conducting vulnerability assessments to develop a roadmap for improvement.		
		Expending funds for security that include "Detect, Delay, Deter."		
		Developing and implementing an IT strategic plan.		
		Developing IT strategic plans.		
United States Environmental Protection Agency, Association of Metropolitan Water Agencies, American Public Works Association, American Water Works Association, National Association of Clean Water Agencies, National Association of Water Companies, Water Environment Federation. 2008. *Effective Utility Management: A Primer for Water and Wastewater Utilities*. Washington, D.C.: EPA		Risk assessment and response preparedness.	• Is there a process in place for identifying and addressing system deficiencies (yes/no)? • Emergency response plan in place? • Number and frequency of emergency response plan trainings per year • Frequency with which emergency response plan is reviewed and updated	
		Monitoring utility's operational reliability during ongoing/routine operations.	• Uptime for percentage of critical utility components on an ongoing basis.	

OPERATIONAL RESILIENCY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
		Monitoring utility's operational preparedness and expected responsiveness in critical areas under emergency conditions.	• Period of time for which backup power is available for critical operations • Period of time minimum daily demand can be met meeting Safe Drinking Water Act standards for acute contaminants without additional treatment chemical deliveries • Current longest lead time (e.g., hours or days) for repair or replacement of operationally critical parts or equipment • Average number of response-capable backup staff for critical operation and maintenance positions • Period of time (e.g., hours or days) minimum daily demand can be met with the primary raw water source unavailable	
Warren, L. and J. Moyer, 2008. Why Water And Wastewater Utilities Should Prepare Business Continuity Plans and How They Can Get Started. *Proceedings of the Water Environment Federation, The Utility Management Conference*, pp. 768-773(6), Tampa, FL, February 24-27, 2008, Alexandria, VA.: WEF	Addresses how utilities will keep operations in business during and after disasters. Provides an overview of a step-by-step approach to developing the core elements of a Business Continuity Plan (BCP) for a utility.	Developing, implementing, and exercising a BCP.	• Do you have a BCP? (yes/no) • How often is it exercised? • How often is it updated?	
Generally Accepted Practices for Business Continuity	Provides generally accepted practices to initiate, develop, and	Development and implementation of a business	• Do you have a BCP? (yes/no) • How often is it exercised?	

OPERATIONAL RESILIENCY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Practitioners. 2007. Disaster Recovery Journal and DRI International. [Online]. Available: <http://www.drj.com/resources/resources/generally-accepted-practices.html>. December 12, 2007	implement BCPs. These include program initiation and management, risk evaluation and control, business impact analysis, business continuity strategies, emergency response and operations, BCPs, awareness and training programs, BCP exercise, audit and maintenance, crisis communications, and coordination with external agencies.	continuity program.	• How often is it updated?	
Charles Herrick, C. J. Pratt, R. Raucher, N. Kalas-Adams, J. Cotruvo, K. Darr-Bornstein, T. Gablehouse, J. Mencer, R. Moser, D. Newkirk, M. Schnack, and K. Westby, 2006. *Emergency Response and Recovery Planning for Water Systems: A Kit of Tools*. Denver, CO.: AwwaRF	Provides detailed information that should be included in an emergency response and recovery plan (including specific items that should be answered in the plans). Also provides a kit of tools for self-assessment.	Maintaining and exercising emergency response plans.	• Do you have an emergency response plan? • How often is it exercised?	
ASCE and AWWA. 2004. Cyber Security Management, Operations, and Design Considerations. In *Interim Voluntary Security Guidance for Water Utilities*. Reston, VA.::ASCE	Document describes the components of a cyber system and identifies existing threats against the system. Management, O&M, and design guidance that applies specifically to cyber security is also included.	Understand utility cyber networks, including software applications and databases that facilitate enterprise business, scientific, and engineering processes.	Have you implemented cyber security measurements?	
		Identify cyber security threats, such as outsider hackers, outsider attackers, and insider attackers.		
		Implement cyber security policies and procedures especially for SCADA system		

OPERATIONAL RESILIENCY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
		access, passwords, and other IT interface points within the utility.		
		Institute preventive operational controls.		
		Design with cyber security in mind.		
AWWA Business Continuity Plan for Pandemic Influenza *Streamlines*, September 1, 2009, Volume 1, Number 18.	This AWWA pandemic influenza plan has been created to minimize exposure and absenteeism in the event that a pandemic influenza is a threat to AWWA employees, their families, and business. This document explains AWWA's pandemic response plan.	Create a plan to minimize exposure and absenteeism in the event that a pandemic influenza is a threat to employees, their families, and business.		
Sheehan, J., N. Grant, J. Flynn. 2009. Business Continuity Planning-Realize the benefits of being prepared even when disaster occurs, Government Engineering, November-December 2009. pg. 24-25 [Online]. Available: <http://www.govengr.com/ArticlesNov09/Business.pdf>.	Describes the need for business continuity plans and the steps to implement those at Utilities. The Regional Water Authority (RWA), New Haven, Connecticut, is cited as example.	Step 1: Conduct a Risk Assessment.		Florida Power and Light The South Central Connecticut RWA, New Haven, CT
		Step 2: Conduct a Business Impact Analysis.		
		Step 3: Identify Recovery Sites.		
		Step 4: Develop a Crisis Communication/Incident Command Model.		
		Steps 5 and 6: Prepare a Training Program and Test the Program.		
Business Continuity Management, Professional Practices. DRI-The Institute for Continuity	Presents Business Continuity Management practices, not in any particular order of importance or sequence, as it	Program Initiation and Management (i.e., establish the need for a BCM Program).		
		Evaluate risk and control to		

OPERATIONAL RESILIENCY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Management, July 23, 2008. [Online]. Available: <http://www.dri-caribbean.org/profprac.pdf>.	may be necessary to undertake or implement sections in parallel during the development of the Business Continuity Management (BCM) Program.	determine the risks that can adversely affect the organization and its resources.		
		Perform business impact analysis to identify impacts resulting from business interruptions that can affect the organization.		
		Develop business continuity strategies to leverage the outcome of the BIA and Risk Evaluation.		
		Develop and implement Emergency Response and Operations procedures.		
		Design, develop, and implement BCPs.		
		Prepare a program to create and maintain corporate awareness and enhance the skills required to develop and implement BCM.		
		Establish an exercise/testing program that documents plan exercise requirements.		
		Develop a crisis communications plan.		
		Establish applicable procedures and policies for coordinating continuity and restoration activities with external agencies.		
Massachusetts Department of Environmental Protection–Security Guidelines	Provides MassDEP's Security Guidelines for the Inspection of Emergency Bulk Water	Provide uniform security inspection requirements for all emergency bulk water deliveries		

OPERATIONAL RESILIENCY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
for the Inspection of Emergency Bulk Water Deliveries. [Online]. Available: <http://www.mass.gov/eea/agencies/massdep/water/drinking/security-guidelines-for-the-inspection-of-emergency-bul.html>.	Deliveries.	to water treatment facilities.		
EPA Office of Water. October 2008. Features of an Active and Effective Protective Program for Water and Wastewater Utilities. EPA 817-F-08-005, Washington, DC.: Office of Water, EPA.	Describes the 10 basic features of a "protective program" for owners/operators of utilities to consider as they develop utility-specific approaches. They address the physical, cyber, and human elements of prevention, detection, response, and recovery.	Feature 1. Encourage awareness and integration of a comprehensive protective posture into daily business operations to foster a protective culture throughout the organization and ensure continuity of utility services.		Seattle/King County, Chicago
		Feature 2. Annually identify protective program priorities and resources needed, support priorities with utility-specific measures, and self-assess using these measures to understand and document program progress.		
		Feature 3. Employ protocols to detect contamination while recognizing limitations in current contaminant detection, monitoring, and public health surveillance methods.		
		Feature 4. Assess risks and periodically review (and update) vulnerability assessments to reflect changes in potential threats, vulnerabilities, and consequences.		

OPERATIONAL RESILIENCY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
		Feature 5. Establish physical and procedural controls to restrict access only to authorized individuals and to detect unauthorized physical and cyber intrusions.		
		Feature 6. Incorporate protective program considerations into procurement, repair, maintenance, and replacement of physical infrastructure decisions.		
		Feature 7. Prepare emergency response, recovery, and BCP(s); test and review plan(s) regularly.		
		Feature 8. Forge reliable and collaborative partnerships with first responders, managers of critical interdependent infrastructure, other utilities, and response organizations.		
		Feature 9. Develop and implement strategies for regular, ongoing communication about protective programs with employees, customers, and the general public.		
		Feature 10. Monitor incidents and available threat-level information; escalate procedures in response to relevant threats and incidents.		
Einfeld, Wayne, Sean A. McKenna, and Mark P. Wilson. 2008. *A Simulation Tool to*	Describes testing CWS sensor configurations in combination with event detection software	Assessing online water quality sensor performance under various contamination scenarios.		

OPERATIONAL RESILIENCY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Assess Contaminant Warning System Sensor Performance Characteristics. Denver, CO.: AwwaRF.	through simulation methods.			
American Society of Civil Engineers (ASCE). 2004. *Interim Voluntary Guidelines for Designing an Online Contaminant Monitoring System*. Reston, VA.: ASCE	This document provides the water infrastructure community guidance based upon the current state of knowledge in applying standard engineering and analysis approaches to the design and implementation of an online contaminant monitoring system.	Identifying which contaminants to monitor in water distribution systems.		
		Selecting the appropriate online, real-time sensors for monitoring distribution system water quality (considers types of contaminants to monitor).		
		Selecting the optimal location for placing real-time sensors for monitoring distribution system water quality.		
		Selecting the appropriate communications and data management systems to support collect and use water quality data.		
McMahon, Kevin J. 2010. Pandemic Flu: Business Continuity Planning at a Water Utility. Presented at the Sixth Pandemic Influenza Preparedness Summit, New Brunswick, NJ, April 9, 2010.	Presentation given by Kevin J. McMahon, CIH Director, Operational Risk Management New Jersey American Water at the Sixth Pandemic Influenza Preparedness Summit April 9, 2010.	I. Assess the circumstances and nature of the outbreak by Operational Risk Management and Event Management Team.		New Jersey American Water
		II. Determine Response Level based on severity of sickness by Operational Risk Management and Event Management Team.		
		III. Identify and Implement Response Actions to Mitigate and/or Control Impact to Operations and Personnel at Operations and Functional		

OPERATIONAL RESILIENCY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
		Groups.		
		IV. Determine Impact to Critical Functions at the Operations and Functional Groups.		
		V. Determine Impact on Personnel and Staffing Levels.		
		VI. Implement Operational and Staffing Plans.		
McDonald, R. A, Approach to Business Continuity Planning as Part of Disaster Management, Natural Gas and Electricity (Monthly Journal), March 2007; Volume 23, Number 8; pages 7-11	Describes the need for BCP to be enhanced and integrated to ensure continued operations following a disaster.	Develop a comprehensive disaster management plan.	• Is there an emergency response plan? (yes/no) • Is there a BCP? (yes/no)	
ASCE and WEF. 2004. *Interim Voluntary Security Guidance for Wastewater /Stormwater Utilities*. Alexandria, VA.: WEF	Provides security guidance in the design, operation, and maintenance of wastewater and stormwater systems to help reduce the risks posed by malevolent threats. The systems include treatment plants, collection networks, and pump stations.	Integrate modern security practices in the design, operation, and maintenance, construction, or retrofit of wastewater and stormwater system components.		
ASCE and AWWA. 2004. *Interim Voluntary Security Guidance for Water Utilities*. Reston, VA.::ASCE	Provides security guidance in the design, operation, and management of water systems to help reduce the risks posed by malevolent threats. The systems include treatment plants, distribution networks, pump stations, storage tanks, and reservoirs.	Integrate modern security practices in the design, operation, maintenance, construction, or retrofit of water system components.		

OPERATIONAL RESILIENCY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
ASCE 2011. *Guidelines for the Physical Security of Water Utilities (ANSI/ASCE/EWRI 56), Standard No. 056-10*, 2011, Reston, VA.: ASCE	These water utility guidelines recommend physical and electronic security measures for physical protection systems to protect against identified adversaries, referred to as the design basis threats (DBTs).	Enhance the physical security of Raw Water Facilities.	See document for details.	
		Enhance the physical security of Wells and Pumping Stations.	See document for details	
		Enhance the physical security of Water Treatment Plants.	See document for details.	
		Enhance the physical security of Finished Water Storage Facilities.	See document for details.	
		Enhance the physical security of Distribution Systems.	See document for details.	
		Enhance the physical security of Water System Support Facilities.	See document for details.	
ASCE. 2011. *Guidelines for the Physical Security of Wastewater/Stormwater Utilities (ANSI/ASCE/EWRI 57) Standard No. 057-10, 2011*, Reston, VA.: ASCE	These wastewater/stormwater utilities guidelines recommend physical and electronic security measures for physical protection systems to protect against identified adversaries, referred to as the design basis threats (DBTs)	Enhance the physical security of Wastewater Treatment Plants.	See document for details.	
		Enhance the physical security of Collection Systems.	See document for details.	
		Enhance the physical security of Pumping Stations.	See document for details.	
		Enhance the physical security of Wastewater/Stormwater System Support Facilities.	See document for details.	
Risk Analysis and Management for Critical Asset Protection (RAMCAP®) Standard for Risk and Resilience Management for Water and Wastewater Systems. July 2010. ANSI/ASME-ITI/AWWA Standard J100-10, ASME and AWWA.	Addresses hazards ranging from terrorist attacks to natural disasters with the new RAMCAP methodology, which differs from others by guiding utilities in calculating the probability of a malevolent attack using an approach based on actual incidents, calculating the probability of a	Performance of water and wastewater system vulnerability assessment using the RAMCAP methodology.		

OPERATIONAL RESILIENCY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
	specific natural hazard occurring at a facility, and calculating asset and utility resilience capacity.			
Security Practices for Operations and Management. May 2009. ANSI/AWWA Standard G430-09, AWWA.	Defines minimum requirements for utility security programs. Requires updating VAs to address changes that have occurred.	Ensure minimum security requirements are met at water utilities.	See document for details.	

COMMUNITY SUSTAINABILITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Watershed Health				
S. Maheepala, J. Blackmore, C. Diaper, M. Moglia, A. Sharma and S. Kenway. 2010. *Integrated Urban Water Management Planning Manual*. Denver, CO.: WaterRF	Identifies and documents approaches for integrated urban water management that achieve sustainable urban water solutions balancing social, environmental/ecological, and economic criteria. Case studies are included.			
U.S. Environmental Protection Agency (EPA). 2008. *Handbook for Developing Watershed Plans to Restore and Protect Our Waters*. [Online]. Available: <http://water.epa.gov/polwaste/nps/upload/2008_04_18_NPS_watershed_handbook_handbook.pdf>.	Provides guidance on meeting water quality standards and protecting water resources and quantifying existing pollutant loads, developing estimates of the load reductions required to meet water quality standards, developing effective management measures, and tracking progress once the plan is implemented.			
Metropolitan Sewer District of Greater Cincinnati. 2009. *Sustainable Watershed Evaluation (SWEP) Process*. [Online]. Available: <http://projectgroundwork.org/sustainability/groundwork/swep.html>.	Offers a systematic process to create opportunities for innovative solutions that look beyond project borders to encompass more holistic watershed approaches. Identifies and analyzes the important relationships among the environment, infrastructure, economy, transportation, communities, and neighborhoods and attempts to develop integrated solutions to achieve a broader vision for the community as a whole.			Metropolitan Sewer District of Greater Cincinnati

COMMUNITY SUSTAINABILITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
EPA. Ecosystem Protection Research. [Online]. Available: <http://www.epa.gov/nerl/goals/ecosystem/>	Website for EPA's Ecosystem Protection Research Program, which is conducted to achieve long-term goals by providing tools and data to improve understanding of: (1) ecological condition and accountability (i.e., the impact of policy choices on condition); and (2) diagnostics and forecasting.			
World Resources Institute. 2008. *Ecosystem Services: A Guide for Decision Makers*. [Online]. Available: <http://pdf.wri.org/ecosystem_services_guide_for_decisionmakers.pdf>.	Explains how to improve the outcome of trade-offs in decision making with respect to watershed protection and other ecosystem protection goals. It builds on existing experience with multiple-use ecosystem management, ecosystem restoration, and conservation planning, Identifies ecosystem services.			
Postel, S.L. 2005. Watershed Protection: Capturing the Benefits of Nature's Water Supply Services. *Natural Resources Forum, 29*, 98-108. [Online]. Available: <http://www.conservation.ca.gov/dlrp/watershedportal/Documents/Watershed%20ProtectnNat%20Res%20Forum05.pdf>.	Summarizes key attributes of hydrological services and their economic benefits; presents a spectrum of institutional mechanisms for safeguarding those services; discusses programs in Quito, Costa Rica, and New York City; and offers some lessons learned and recommendations for achieving higher levels of watershed protection.			

COMMUNITY SUSTAINABILITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Shilling, F. 2005. *California Watershed Assessment Manual: Volume I and II.* [Online]. Available: <http://cwam.ucdavis.edu/>.	Provides information for watershed assessments and includes assessment approaches and methods that are compatible many funding programs. Addresses urban and agricultural issues, scale, data collection, management options etc.			
Community Health				
Maheepala, S. J. Blackmore, C. Diaper, M. Moglia, A. Sharma, and S. Kenway. 2007. *Triple Bottom Line Reporting of Sustainable Water Utility Performance.* Denver, CO.: AwwaRF	Refines and expands the triple bottom line approach to best suit water utilities and to help promote its broader application for sustainability decision-making.			
EPA. 2010. *Green Jobs Training: A Catalog of Training Opportunities for Green Infrastructure Technologies*. [Online]. Available: <http://www.epa.gov/npdes/pubs/greenjobscatalog2010.pdf>.	A compendium of resources that offer education and training in careers and skills in the areas of green infrastructure and technology, recognizing that the demand for such will increase over time and that the potential economic benefits of green infrastructure implementation can be substantial.			
Welch, C. 2011.*The Green Utility: A Practical Guide to Sustainability.* Denver, CO.: AWWA	Provides ideas, plans, and tools to make it easy for water utilities to reduce negative effects on the environment, maximize positive impact in the community, and keep delivering water at a cost that reflects its value and allows everyone to receive all they need. Presents important steps to "go green" and become a champion of sustainability in the community.			

COMMUNITY SUSTAINABILITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Stockholm International Water Institute. 2005. *Making Water A Part of Economic Development: the Economic Benefits of Improved Water Management and Services.* [Online]. Available: <http://www.who.int/water_sanitation_health/waterandmacroecon.pdf>.	Focuses on the economic benefits of actions that address the insufficient supply of water and sanitation services and inadequate water resources management. Also brings attention to the direct and indirect costs related to inaction and the costs of action and cost-benefit comparisons.			
Green/Sustainable Infrastructure Planning				
Institute for Sustainable Infrastructure. 2011. *envision™ Sustainability Rating System*. [Online]. Available: <http://www.sustainableinfrastructure.org/rating/index.cfm.>.	Offers a rating system based on a set of objective-based goals to guide more effective levels of reliability, resilience, efficiency, organizational adaptability, and overall performance of an infrastructure project. The rating system considers the challenges faced by stakeholders such as limited resources.			
EPA. *Managing Wet Weather with Green Infrastructure*. [Online]. Available: <http://cfpub.epa.gov/npdes/home.cfm?program_id=298.>.	Website that presents an overview of green infrastructure as an approach to wet weather management such as management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies. Provides several links.	Green infrastructure for wet weather controls.		

COMMUNITY SUSTAINABILITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
EPA. 2010. *Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater with Green Infrastructure*. [Online]. Available: <http://www.epa.gov/owow/NPS/lid/gi_case_studies_2010.pdf>.	Presents the common trends in how 12 local governments developed and implemented stormwater policies to support green infrastructure. The local policies examined interagency cooperation, enforcement and management issues and integration with state and federal regulations. Offers an overview of most common and influential green infrastructure policies, a brief background on how each approach works, and provides examples from relevant case studies about results, barriers, and processes for implementation.	Green infrastructure for stormwater infrastructure.		Emeryville, CA San Jose, CA Santa Monica, CA Lenexa, KA Alachua Co., FL Onondaga Co., NY Portland, OR Wilsonville, OR Stafford Co., VA Seattle, WA
U.S. Green Building Council. 2011 *LEED for New Construction and Major Renovations.* May. [Online]. Available: <http://www.usgbc.org/ShowFile.aspx?DocumentID=8868>.	Provides detailed information on rating system for the LEED® green building certification program, designed to guide and distinguish high-performance commercial and institutional projects, including office buildings, high-rise residential buildings, government buildings, recreational facilities, manufacturing plants, and laboratories.	LEED® green building certification.		

COMMUNITY SUSTAINABILITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Greenhouse Gas Emissions				
Douglas E. Huxley, D. W. Bellamy, P. Sathyanarayan, M. Ridens, and J. Mack. 2009. *Greenhouse Gas Emission Inventory and Management Strategy Guidelines for Water Utilities*. Denver, CO.: WaterRF	Provides guidance to assist water utilities across the United States and Canada in preparing greenhouse gas emission inventories using a systematic and consistent methodology. Assists utilities in evaluating greenhouse gas emissions for proposed projects or alternatives and highlights emission-reduction strategies that can be incorporated into utility business and operations.			
U.K. Environmental Agency. 2008. *Greenhouse Gas Emissions of Water Supply and Demand Management Options*. Science Report – SC070010. [Online]. Available: <www.cost.esf.org/download/5354>.	Examines the difference in greenhouse gas emissions associated with a variety of options for supplying water and using it more efficiently. Assesses options for new supplies of water, working with an existing water supply network, plus methods and products to reduce and manage households' water demand.			

COMMUNITY SUSTAINABILITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Chandran, K. 2010. *Greenhouse Nitrogen Emission from Wastewater Treatment Operations – Interim Report*. Alexandria, VA.: WERF	Characterizes nitrogenous emissions from the activated sludge portion of wastewater treatment plants. Attempts to develop a methodology for collection of full-scale plant data from a range of nutrient removal facilities in the United States with a goal to develop a mechanistic model to allow the development of a tool that will aid in the prediction and therefore, mitigation of N_2O, NO, and NO_2 emissions from wastewater treatment plants.			
Climate Change				
EPA. *Climate Resilience Evaluation & Awareness Tool (CREAT).* [Online]. Available: <http://water.epa.gov/infrastructure/watersecurity/climate/creat.cfm>.	Website links to a software tool (CREAT) that allows users to evaluate potential impacts of climate change on their utility and to evaluate adaptation options to address these impacts using both traditional risk assessment and scenario-based decision making. CREAT provides libraries of drinking water and wastewater utility assets that could be impacted by climate change and adaptive measures that can be implemented to reduce the impacts of climate change.	Planning and implementing adaptation strategies.		

COMMUNITY SUSTAINABILITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Stratus Consulting. 2010. *Implications of Climate Change for Adaptation by Wastewater and Stormwater Agencies.* Alexandria, VA.: WERF	Offers a way to move toward adaptation to climate change using a risk management approach consisting of three steps: risk identification, risk characterization, and risk management (adaptation). The problem is examined by its pieces to perform a thorough risk identification analysis. The "deconstruction" of the problem is accomplished with the aid of cause-effect impact tree diagrams.	Planning and implementing adaptation strategies.		
National Association of Clean Water Agencies/Association of Metropolitan Water Agencies (NACWA/AMWA). 2009. *Confronting Climate Change: An Early Analysis of Water and Wastewater Adaptation Costs.* [Online]. Available: <http://www.nacwa.org/index.php?option=com_content&view=article&id=939&catid=8&Itemid=7>.	Defines the challenges of climate change adaptation on drinking water and wastewater services through 2050 and the role of utilities to address them. Includes expected climate change impacts and identifies the adaptations that can be employed and presents potential costs.			New York City Dept. of Environmental Protection Southern Nevada Water Authority

COMMUNITY SUSTAINABILITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Service Affordability				
CH2MHILL. 2005. *Financial Capability and Affordability in Wet Weather Negotiations.* Washington, DC: NACWA. [Online]. Available: <http://www.nacwa.org/images/stories/public/2005-10NACWAWhitePprFinCapAff.pdf?phpMyAdmin=PM8UfvMmlxx8xqqtLrO9xEOmDg0>.	White paper that reviews and suggests modifications to existing policy and practice on wet weather compliance and its financial impacts, provides negotiations guidance for clean water agencies through a body of case studies, and suggests approaches to reducing the financial impacts of wet weather projects on low-income households.			
NACWA. 2011. Money Matters–Smarter Investment to Advance Clean Water–Public Agency Case Studies. [Online]. Available: <http://www.nacwa.org/images/stories/public/2010-11-10fcs.pdf>.	Provides key examples of municipal agencies' challenges with Clean Water Act financing and some of the innovative efforts they are undertaking to address them such as: 1) pursuing a watershed approach to solve water quality challenges; 2) recommitting to new technology and pioneering innovation; 3) entrusting local experts and leaders to use limited dollars to maximize community benefit; and 4) developing a rational integrated approach to assessing community affordability.			
Baird, G.M. 2010. Water affordability: who. *Journal American Water Works Association*, *102*(12), 16-23.	Presents the issue of full-cost pricing of water and the impact on customer affordability. Addresses EPA's affordability threshold and issues in Canada. Provides strategies and practices for minimizing rising water costs.			

COMMUNITY SUSTAINABILITY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Saunders, M., Kimmel, P., Spade, M., and Brockway, N. 1998. *Water Affordability Programs.* Denver, CO.: AwwaRF	Reports a comprehensive survey of affordability rates/programs now being offered by U.S. water utilities. Provides case studies and evaluates the rates/programs against a set of criteria for measuring the viability and value of such efforts.	Programs to assist low income customers and other disadvantaged customers pay their water/sewer bills.		Detroit Water and Sewerage Department San Antonio Water System Numerous other utilities
National Association of Regulatory Utility Commissioners. 2007. Memorandum on Water Affordability Programs. [Online]. Available: <http://nrri.org/pubs/water/07-stanford.pdf>.	Contains the results of two surveys regarding bill payment and water service termination activity and the availability and types of water affordability programs. Data collected from state commissions with jurisdiction over water, and from selected water utilities regulated by state commissions.			
EPA. 2002. *Rate Options to Address Affordability Concerns for Consideration by DCWASA*. [Online]. Available: <http://water.epa.gov/infrastructure/sustain/upload/2009_05_26_waterinfrastructure_pricings_AffordOptions.pdf>.	Description of EPA's recommendations on differential rates and affordability programs including various approaches and evaluation of eligible customers, type of assistance, and alternatives. Also includes a discussion of issues associated with differential rates and affordability programs.	Programs to assist low-income customers and other disadvantaged customers pay their water/sewer bills		

WATER RESOURCE ADEQUACY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Water Supply Adequacy				
United States Environmental Protection Agency, Association of Metropolitan Water Agencies, American Public Works Association, American Water Works Association, National Association of Clean Water Agencies, National Association of Water Companies, Water Environment Federation. 2008. *Effective Utility Management: A Primer for Water and Wastewater Utilities.* Appendix C. Washington, D.C.: EPA.		Consideration of short-term water supply adequacy and related long-term supply impacts.	Period of time for which existing supply sources are adequate. Ratio of projected short-term (e.g., 12-month rolling average) monthly supply to projected short-term monthly demand.	
		Consideration of long-term water supply adequacy and related long-term supply impacts.	Projected future annual supply relative to projected future annual demand for at least the next 50 years (some utilities project as far as 70-80 years).	
Supply & Demand Management				
United States Environmental Protection Agency, Association of Metropolitan Water Agencies, American Public Works Association, American Water Works Association, National Association of Clean Water Agencies, National Association of Water Companies, Water Environment Federation. 2008. *Effective Utility Management: A Primer for Water and Wastewater Utilities.* Appendix C. Washington, D.C.: EPA.		Having a strategy for proactive supply and demand management in the short and long terms.	• Existence of a source water protection plan (yes/no) • Existence of a demand management /reduction plan (yes/no) • Do demand scenarios account for changes in rates and conservation-oriented demand management pricing structures (yes/no)	

WATER RESOURCE ADEQUACY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
California Department of Water Resources. 2005. California 2005 Urban Water Management Plan. Sacramento, CA.: California Department of Water Resources	Includes requirements for system-wide measures of water loss within utility.	Reduction of Non-Revenue Water (NRW) using AWWA/IWA methodology.	AWWA/IWA NRW reporting metrics, such as annual NRW, apparent Loss (AL), current annual real loss (CARL).	All California utilities as part of state Urban Water Management Plans.
United States Environmental Protection Agency, Association of Metropolitan Water Agencies, American Public Works Association, American Water Works Association, National Association of Clean Water Agencies, National Association of Water Companies, Water Environment Federation. 2008. *Effective Utility Management: A Primer for Water and Wastewater Utilities.* Appendix C. Washington, D.C.: EPA. The Primer, Appendix C		Processes to determine supply to new service area.	• Policies in place that address dry year availability prior to committing to new service areas (yes/no) • A commitment to denying service commitments unless reliable drought-year supply is available (yes/no)	
		Processes to reduce household water use.	Percentage decrease in household water use.	Gwinnet County Department of Water Resources
Dziegielewski, B. and Kiefer, J. 2010. Water Conservation Measurement Metrics Guidance Report. January 2010. Denver, CO.: AWWA	Covers conservation metrics recommendations and surveys of seven major water utilities.	Water conservation.	Water use or production per capita estimates.	Otay Water District, California; Irvine Ranch Water District, California; Phoenix Water Services, Arizona; City of Rancho, New Mexico; Seattle Public Utilities; Philadelphia Water Department; Tampa Water Department.

WATER RESOURCE ADEQUACY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Florida Department of Environmental Protection. 2005. Water Conservation Performance Measuring System.	Summarizes Florida utility and water management districts conservation goals, practices, and performance metrics.	Implementing water conservation programs.	Suite of recommended metrics relating to overall demand reductions, per capita and sector-based reductions, and peak demand reductions, cost, and deferment of infrastructure investment. For example, utility-wide demand reduction goals (acre-feet per year) or per capita reduction goals (gpcd).	Most Florida utilities
California Urban Water Conservation Council (CUWCC). 2009. Best Management Practices for Urban Water Conservation.	Best practices for implementing and reporting urban water conservation programs.	Implementing urban water conservation programs.	Measured as reporting and compliance in multiple components at utility level: (1) assignment of conservation coordinator, (2) water waste prevention programs (including ordinances, regulations), (3) wholesale agency assistance.	Most major utilities in California.
Water Supply Reliability				
Water Management Strategy Evaluation Framework. 1999. CalFed Bay-Delta Program.	Covers approaches to reducing mismatch between supply and demand to beneficial uses.	Ensuring water supply reliability.	Frequency and magnitude of delivery or shortage to end user delivery. Difference between demand and supply measured on annual, monthly, and sometime daily timescales to assess reliability. Often reported as frequency of shortage, or frequency of full satisfaction of demand.	Most utilities in California use some form of this leading practice.
California Department of Water Resources. 2005. California 2005 Urban Water Management Plan. Sacramento, CA.: California Department of	Guidance on reliability of supply and mitigation for vulnerability to seasonal and climatic shortage.	Ensuring water supply reliability.	Volume of available supply in average/normal years, and 1-, 2-, 3-, and 4- year dry periods. Compared to projected demand for same conditions.	All California utilities as part of state Urban Water Management Plans.

WATER RESOURCE ADEQUACY

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metrics (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Water Resources	Water shortage contingency plans that trigger actions for rationing or other demand reduction measures.	Development of Shortage Contingency Plans.	• Shortage contingency plan developed (yes/no) • Specific rationing measures identified. (yes/no)	All California utilities as part of state Urban Water Management Plans.
	Reporting of historical, current, and future water use in single-family, multi-family, commercial, industrial, landscape, and agriculture sectors.	Reporting of past, current, and future water use by sector	Historical and projected deliveries to these sectors. Although not explicitly described, % reduction in water use by sector is the quantitative	All California utilities as part of state Urban Water Management Plans.
San Diego County Water Authority Engineering Department. 2002. San Diego Regional Facilities Master Plan. San Diego, CA.: San Diego County Water Authority	A set of measures used to assess the performance of the system in meeting annual, monthly, and daily demands.	Ensuring system reliability by meeting set demands.	Magnitude and frequency of shortage (demand minus delivery) over stated future period. Deliveries could be less than demand due to supply or local system limitations. Can be measured as x% shortage for Y days over Z year period.	San Diego County Water Authority.

STAKEHOLDER UNDERSTANDING AND SUPPORT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Stakeholder Outreach				
Tetra Tech. 2010. *Getting in Step: A Guide for Conducting Watershed Outreach Campaigns*.3rd Ed. EPA 841-B-10-002. Washington, DC: EPA, Office of Water.	Offers advice on how watershed groups, local governments, and others can maximize the effectiveness of public outreach campaigns to reduce nonpoint source pollution and protect treasured lakes, rivers, streams, and coasts. Provides information from the growing field of community-based social marketing, and contains principles, techniques, and information for effective watershed outreach into a single, user-friendly source.	Identifying and proactively communicating with stakeholders.		
Tetra Tech. 2003. Getting in Step: Engaging and Involving Stakeholders in Your Watershed. Washington, DC.: EPA [Online]. Available: <http://water.epa.gov/type/watersheds/outreach/upload/2003_02_05_watershed_outreachuments_stakeholderguide.pdf>.	Provides tools to effectively engage stakeholders to restore and maintain healthy environmental conditions through community support and cooperative action. Includes resource information, case studies, websites, and other how-to guides related to watershed protection. Case studies are included throughout the guide to highlight success stories to share some of the challenges and help define who the stakeholders are.			

STAKEHOLDER UNDERSTANDING AND SUPPORT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Tetra Tech. 2010. *Getting in Step: A Guide for Conducting Watershed Outreach Campaigns*.3rd Ed. EPA 841-B-10-002. Washington, DC: EPA, Office of Water.	Web-based module that offers advice on how local governments, watershed organizations, and others can maximize the effectiveness of public outreach campaigns to reduce nonpoint source pollution and protect waterways. The module is based on EPA's free, downloadable outreach guide Getting in Step: A Guide for Conducting Watershed Outreach Campaigns. A companion video is available. The video includes four case studies of watershed outreach campaigns that use the principles presented in the module and guide.	Identifying and proactively communicating with stakeholders.		
Raucher, R. 2003. *Guidance to Utilities on Building Alliances with Watershed Stakeholders*. Denver, CO.: AwwaRF and AWWA	Identifies typical watershed stakeholders and their objectives in basin planning. Develops procedures for building win-win alliances between water utilities and stakeholders for the purpose of overcoming constraints to planning, managing, and developing long-term sustainable drinking water supplies.			

STAKEHOLDER UNDERSTANDING AND SUPPORT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
CH2M HILL. 2002. *Public Involvement ...Making it Work*. Denver, CO.: AwwaRF and AWWA	Provides an easy-to-follow process for developing project-specific public involvement programs, integrating them into a utility's decision-making process, and sustaining them for the project duration. Presents a streamlined public involvement process for gaining stakeholder support and producing viable water resource solutions.			
South Africa Department of Water Affairs and Forestry. 2004. Guidelines for Stakeholder Participation in Integrated Water Resources Management Areas in South Africa. [Online]. Available: <http://www.pacificwater.org/userfiles/file/IWRM/Toolboxes/STAKEHOLDER%20Engagement/GUIDELINES%2520FOR%2520STAKEHOLDER%2520PARTICIPATION%2520SUMMARY%2520LEVEL%25202.pdf>.	Focuses on stakeholder participation in integrated water resource management (IWRM). Proposes a framework for stakeholder participation in IWRM, formulates a procedure to give effect to this at a water management area level, and identifies the awareness and training material needs with respect to this procedure.	Identifying and proactively communicating with stakeholders.		

STAKEHOLDER UNDERSTANDING AND SUPPORT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
United Nations Environment Programme (UNEP). 2006. International Waters Experience Notes--Lessons learned reporting on stakeholder involvement: WIO-LaB. [Online]. Available: <http://iwlearn.net/iw-projects/Fsp_11279946939/experience-notes-lessons-learned/lessons-learned-reporting-on-stakeholder-involvement-wio-lab>.	The WIO-LaB strategy distinguishes between different levels of stakeholder involvement: (1) participation-represents core group of stakeholders involved in the actual implementation of the project activities; (2) consultation-constituted by regional Project Steering Committee that involves UN agencies, collaborating projects, regional/national non-governmental organizations, and the private sector. The project is also developing a web-based clearinghouse mechanism for information dissemination on the WIO coastal/marine environment. Reports/other documents are disseminated as widely as possible.			
United Nations Development Program/Global Environment Facility (UNDP/GEF). 2008. Distance Learning and Information Sharing Tool (DLIST Benguela). [Online]. Available: <www.erc.undp.org/evaluationadmin/downloaddocument.html?docid=2422>.	Describes a plan for increasing stakeholder participation and engagement through the use of online tools. The overall aim of the project is to increase access of local communities to information that is critical to environmental management and sustainable livelihood creation. The project promotes the sharing of ideas between coastal interest groups, different tiers of government, and local communities and the private sector.			

STAKEHOLDER UNDERSTANDING AND SUPPORT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Evans, A.E.V. 2010. Multi-stakeholder Processes for Managing Wastewater Use. In A. Drechsel (Ed.), *Wastewater Irrigation and Health* (pp. 355-377). Sri Lanka: IWMI. [Online]. Available: <http://publications.iwmi.org/pdf/H042618.pdf>.	Presents three case studies in which multi-stakeholder processes used to improve wastewater management for urban agriculture. Describes how it is essential to consider that project priorities are commensurate with local priorities and that finding an institutional home and anchor agency can improve long-term sustainability but care must be taken in considering how this impacts on existing power structures.			
Stakeholder Perception/Satisfaction				
Tatham, C., R. Cicerone. and E. Tatham. 2006. *Stakeholder Perceptions of Utility Role in Environmental Leadership*. Denver, CO.: AwwaRF, AWWA and IWA Publishing	Evaluates stakeholder perceptions (global level) of environmental leadership and the role of their drinking water utility in providing environmental leadership. Also develops guidance for use by utilities in assessing their stakeholders' perceptions and expectations (local level) of their role in environmental leadership and in increasing stakeholder awareness of environmental leadership.	Understanding stakeholder perceptions and levels of satisfaction.	Percentage of stakeholders having a positive perception of utility.	
National Science Foundation. 2011. Surveys: Tracking Opinion. [Online]. Available: <http://www.nsf.gov/news/special_reports/survey/index.jsp?id=overview>.	Presents the benefits of a scientific survey/poll to gauge opinions rather than other types of survey questionnaires. Discusses choosing a representative sample, the advantage of random sampling, and the phrasing of survey questions.	Scientific surveying/polling of stakeholders.	Various satisfaction metrics.	Syracuse Water Department Clayton County Water Authority

STAKEHOLDER UNDERSTANDING AND SUPPORT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Massachusetts Department of Elementary and Secondary Education. 2010. Stakeholder Perception Survey Resource Guide. [Online]. Available: <www.doe.mass.edu/sda/framework/level4/MAG_StakeholderPerception.doc>.	Although focused on perceptions associated with education, this document provides valuable guidelines and procedures for developing a process for gaining information on stakeholder perceptions of public services.	Understanding stakeholder perceptions and levels of satisfaction.	Percentage of stakeholders having a positive perception of utility.	
Tillman, D.E. 2001. Stakeholder Analysis in Water Supply Systems. Swiss Federal Institute of Technology. [Online]. Available: <http://e-collection.library.ethz.ch/eserv/eth:23910/eth-23910-02.pdf>.	Examines the influence and effects of stakeholders on water supply systems and the prevailing interests, strategies of action, and interactions among the relevant stakeholders. Points out existing risks of current stakeholder behavior and identifies possible ways of designing and operating water supply systems which increase flexibility and adaptability.			
Abu-Taleb, M.F. 1999. Use of Focus Groups and Surveys to Evaluate Water Conservation. *Journal of Water Resources Planning and Management*, *125*(2), 94-99. [Online]. Available: <http://cedb.asce.org/cgi/WWWdisplay.cgi?115983>.	Presents an evaluation of the impacts of a 3-year water conservation campaign conducted in Jordan by the Ministry of Water and Irrigation. The campaign, which reached almost 45,000 individuals, was designed to create interest and promote information on the need to use water more efficiently in a country facing water demand and supply imbalances.			

STAKEHOLDER UNDERSTANDING AND SUPPORT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Levine, M. 2011. Nine Steps Towards an Effective Survey. APQC. [Online]. Available: <http://www.apqc.org/knowledge-base/download/244617/a%3A1%3A%7Bi%3A1%3Bs%3A1%3A%222%22%3B%7D/K03211_HCM_SurveyConnect_final_version%5B1%5D.pdf?destination=node/244617>.	With a focus on online survey software, provides guidance on designing an effective survey. Provides information on developing an understandable objective, designing the survey without bias, reaching the right stakeholders, collecting enough data, and understanding the feedback.	Understanding stakeholder perceptions and levels of satisfaction.	Percentage of stakeholders having a positive perception of utility.	
Council on Accreditation. 2010. Designing Actionable Consumer/Other Customers Surveys. [Online]. Available: <www.coanet.org/files/DesigningActionableSurveys.doc>.	Provides guidance on developing customer surveys, including when to use surveys, how to get the right information, preparing introductions, questions and avoiding pitfalls. Discusses advantages and disadvantages to various questions.			
Media/Press Coverage				
American Water Works Association (AWWA). 2005. Crisis, *Conflict and Communication: Working with the Media* (DVD). [Online]. Available: <http://apps.awwa.org/EbusMain/Default.aspx?TabID=55&ProductId=7126>.	Provides guidance to utilities on how to deal with the news media during an important event. Shows how a utility can ensure the message that reaches the public is the message the utility wants the public to hear. Describes information the media wants and why, how the media machine works, and how reporters approach their stories in this age of sensationalized news.	Positive media relations.	Positive media coverage as a percentage of total coverage. Proactive media communications as a percentage of total media communications.	

STAKEHOLDER UNDERSTANDING AND SUPPORT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Lomax, T.L. Undated. Communicating with the Press and Public. Presentation. Raleigh, NC.: North Carolina State University. [Online]. Available: <http://www.ncsu.edu/grad/preparing-future-leaders/docs/lomax-communicating.pdf>.	Provides guidance on communicating with the media including preparation, communication styles, what the media is looking for, preparing compelling messages, and other tips.			
Comparative Rates				
AWWA. 2011. *2010 Water and Wastewater Rate Survey.* [Online]. Available: <http://apps.awwa.org/EbusMain/Default.aspx?TabID=55&ProductId=25831>.	The survey includes data from utilities that serve from 1,000 to 9 million customers. Covers many diverse aspects of water and wastewater operations in the sample communities. Survey data are shown in a series of spreadsheets for detailed analyses and comparisons. Data are organized by system size.	Maintaining awareness and communicating how rates compare with those of similar utilities.	Binary.	Miami-Dade Water and Sewer Department Numerous others
National Association of Clean Water Agencies (NACWA). 2009. 2008 Financial Survey. [Online]. Available: <http://www.nacwa.org/index.php?option=com_content&view=article&id=543%3A2008-financial-survey&catid=8%3Apublications&Itemid=7>.	The survey presents industry statistics and trend data on utility revenues, expenses, debt financing, capital needs, sewer service charges, residential and industrial rates and rate structures, staffing levels, and salaries. Also presents information on the status of asset management programs, financial statement data, the status of security-related programs, staff licensing requirements, and energy use and costs.			

STAKEHOLDER UNDERSTANDING AND SUPPORT

Document Referenced (Hyperlink to document)	Description of Document	Potential Leading Practice	Metric (used to track effectiveness)	Utilities (using the referenced Leading Practice)
Association of Metropolitan Water Agencies (AMWA). 2011. 2010 Utility Financial Information Survey. [Online]. Available: <http://www.amwa.net/cs/ceo_resources/ufi>.	The survey results reflect input from the nation's largest water systems and provides data that can be used for useful and meaningful comparisons. Presented in Excel format, the databases allow comparisons by criteria including geographic location, population served, water source and many others.			

APPENDIX B.1 AND B.2:
PARTICIPATING UTILITY PRACTICE AREAS
AND RELATED METRICS FOR THE TEN ATTRIBUTES

Appendix B-1
Operational resiliency

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
Reduction of Recordable Incidents of Work-Related Injury or Illnesses	No of Lost Time Accidents	Accidents that cause the absence of an employee from work for X number of days. Different utilities use variations of this metric and its computation	Toronto Water Region of Durham
	Lost hours	Measures the year-to-date number of hours lost due to sick leave and FMLA for a department vs. total number of available sick leave hours based on the 45 hr/employee county maximum requirement.	Gwinnett County DWR
	Lost hours due to accidents (hrs)	Total number of hours that field staff were not at work due to accidents. Exclude accidents incurred during capital construction.	Region of Durham
	Total Recordable Incident Rate (ratio)		Region of Peel Green Bay MSD
	Preventable Vehicular Accident Rate (per 100,000 miles driven)		Louisville
	No of Insurance Claims per year	The scope of insurance claims vary by utility	Region of Peel
	Total Days Lost Due to worker's compensation claims per year	Track the number of days that employees are on Worker's Compensation Board (WCB) absence due to work-related illness or injury.	Region of Peel City of Calgary
	Lost Time Injury Rate	LTI Rate (Lost Time Injury Rate) is the number of lost time injuries standardized by the size of the workforce, and is calculated by dividing the number of lost time injuries by the number of employees in the department, multiplied by 100.	Region of Peel
	OSHA Recordable (or Incident) Rate	Computation varies by Utility	Louisville ABCWUA Charleston Water
	OSHA Days Away Restricted Time (DART) Rate (# per 100 employees)	# of accidents that incur time away from work, restricted duty, or job transfer per 100 employees.	Charleston Water
Maintenance of Sufficient staffing levels	Staffing level (FTEs) per unit asset	For example, per 100 km of pipe, per 1000 meters, per pump station, etc.	Region of Durham
	Ratio of Total Overtime Hours worked over total hours paid	Indicates Additional Staff Resource Requirements	Region of Durham
	Ratio of total hours worked over total hours paid		Region of Durham
	Ratio of total hours not available for work over total hours paid	Not available Hours include training, sick, vacation, stat, union, long term, other	Region of Durham

Appendix B-1
Operational resiliency

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
Emergency Response Readiness	Total number of training hours on emergency response readiness training for all employees (Hrs/employee)		ABCWUA
Use of SOPs		Standard operating procedures developed for each of the plants, for Engineering & Construction, and for CIP prioritization.	Gwinnett County DWR
Energy co-generation	kwh/day generated		Union Sanitary District
Solid waste Recycling/Composting	% solid waste diverted to recycling or composting	Tons diverted/total tons generated	Union Sanitary District
Class A Biosolids disposal	Average % biosolids disposed of as Class A		Union Sanitary District
Risk Management Program			Tualatin Valley

Appendix B-1
Employee and leadership development

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
Succession Planning	Positions that require external competition	Competitiveness of interested internal candidates. Ensuring internal staff interested in positions are prepared to compete with external candidates	Green Bay MSD
	Number of positions that have an identified internal successor versus total number of positions	Identifying successors for positions within the organization and ensuring staff identified have adequate training	Region of Peel
	# of field staff eligible to retire in X to X years	The calculations for these measures are based on assuming that staff are eligible to retire after either Y years of service or Z years old, whichever condition comes first. To report the number of staff that are eligible to retire in X years, you need to calculate for each field staff their age (z), years of service (y) and number of years until eligible for retirement (x).	Region of Durham
	Number of regular employees eligible for retirement within the next five years, divided by the average number of regular employees	Rate of employees eligible for retirement within the next five years, as a percentage	ABCWUA
	# of field employees in a given age bracket	Number of field staff employees that are within the given age bracket in the current year when the data sheets are being completed.	Region of Durham
	% key management positions with candidates	Number of key management positions that have an identified internal successor (3) versus total number of positions (13).	Gwinnett County DWR
	Percent Associates with Career Development Plans	Levels measure the number of associates who have career development plans in place in support of the CWS Succession Plan.	Charleston Water
	Number of Promotions within Career Paths	Levels measure the number of promotions within associates' career path.	Charleston Water
Leadership Development	Number of candidates successfully completing GBMSD leadership development program		Green Bay MSD
	No metrics	Combination of community college courses and internal training designed to prepare employees for promotion to mgmt and develop leaders within the organization.	Union Sanitary District
	Total Leadership Training Hours Delivered	Levels reflect the stratification of total CWS training by hours devoted solely to developing leaders in the organization.	Charleston Water
	Number of internal promotions divided by total number of positions filled	Rate of internal employee promotions per year as a percentage	ABCWUA
High performing workforce	Training hours per employee	Gwinnett balanced scorecard metric - see supporting documentation	Gwinnett County DWR
	Total # of other training hours per employee	The total number of other training hours taken for all field staff employees that excludes safety training hours but includes conferences, seminars etc. Actual employees refers to the number of field FTEs as entered in the section previous.	Region of Durham Charleston Water
	Skills Training Hours Delivered	Levels measure the amount of training devoted to skilled workers in CWS.	Charleston Water
	Individual Development Plans	All employees have documented individual development plans	Union Sanitary District Louisville
	% Associates meeting "Fully Meets High Expectations" or better	CWS use associate performance analyses to continuously improve our work environment toward high associate engagement, motivation and satisfaction, along with a focus on high continually improving performance.	Charleston Water

Appendix B-1
Employee and leadership development

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
	Training Evaluations 1 to 5 Scale (5 best)	Levels measure CWS training ranking scores on an annual basis.	Charleston Water
	# of safety training hours per employee	The total number of safety training hours taken for all field staff employees that includes confined space entry, safety meetings, hazardous chemical training, WHMIS etc. Actual employees refers to the number of field FTEs as entered in the section previous.	Region of Durham Charleston Water
Retaining Talent Through Employee Satisfaction	Number of voluntary exits/ Total number of Budgeted Positions	Measures high performing workforce retention	Toronto Water
	Percent satisfied overall	Levels measure associate satisfaction with their employment derived from the bi-annual CWS Associate Survey. The associate survey is a critical component in measuring associate satisfaction, and all CWS employees are encouraged to participate.	Charleston Water
	Percent participation in employee survey	Levels measure the percentage of CWS associates who participated in the bi-annual CWS associate survey	
	# grievances filed by associates per year	Levels reflect the number of formal grievances filed by associates each year. Coupled with the associate survey, this is another measure of associate satisfaction.	
	Number of Resignations	Data is presented as quarterly total for the reporting period. The data only includes core workforce (defined by HR as permanent, probationary or permanent/trial employees) who resigned and have permanently departed The City as of the reporting period. For this definition, retirements are NOT included. Also, movements between Water Resources and Water Services are NOT included.	City of Calgary
	% First-year turnover	First-Year Turnover stratifies annual turnover, measuring the percent of new employees who leave the company during their first year of employment regardless of reason.	Charleston Water
	Number of voluntary exits/ Total number of Budgeted Positions	Measures high performing workforce retention	Toronto Water Charleston Water
	Number of regular employee departures divided by average number of regular employees	Rate of employee departures (voluntary, involuntary, retirement) per year as a percentage	ABCWUA Region of Durham
	% associates exit interviews completed on	Levels measure the percentage of exit interviews completed on associates leaving the organization.	Charleston Water
	# of sick days taken per field employee	Average number of sick days taken per field employee (days taken because of sick kids or sick spouses not included). Excludes long term disability and any time paid by WCB. Also record total # of sick hours taken for field employees for use in the availability calculations.	Region of Durham
	# sick days used annually per full time employee (FTE)	Levels measure the number of sick days used annually per full time employee (FTE).	Charleston Water
	% of associates who answered survey question with "I am recognized for my work"	Levels measure the amount of positive associate responses to the statement “I am Recognized for my work.” in recent associate surveys.	Charleston Water
	Number of employees that go through onboarding process	Onboarding program includes: onboarding home page, onboarding checklist, new employee e-book, new employee orientation, welcome email and new employee survey.	MSDGC

Appendix B-1
Employee and leadership development

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
Recruiting Talent	Number of new hires	Data is presented as quarterly total or quarterly average for the reporting period. The data only includes core workforce hired (defined by HR as permanent, probationary or permanent/trial employees) hired from outside the City. Transfers from other business units are not included in the count. Contingent employees (Temporary, Seasonal, etc.) transitioning to Core employees are not included in the count. To track the actual number of new hires and ascertain the effectiveness of recruitment efforts and the existing and emerging challenges of recruitments.	City of Calgary
	Percent of key positions that have core competencies assigned	The core competency model has been integrated into the interviewing process. A diverse team is selected for the interview panel. This panel is responsible for identifying the essential compentencies for selecting a candidate to succeed in this position, developing questions based on the identified competencies which are approved by the HR section, and rating candidate for selection purposes.	MSDGC
Other	Percent of performance plans aligned with strategic plan	Levels measure integration of the Strategic Plan into individual performance goals and associate development plans.	Charleston Water
	% team incentives completed per year	Levels measure the percentage of team incentives completed on an annual basis. Team Incentives involve large groups of individuals within a department working together to accomplish a series of action items (action plan) with a major end-goal established.	Charleston Water
	None	Cross-functional teams formed to tackle District-wide issues build leadership skills	Tualatin Valley
	Number associates with certification	Levels show the total number of certifications held versus the total number required to meet environmental operating permit requirements.	Charleston Water
	% Total budget devoted to HR	Expenditures devoted to HR infer direct support of associate programs toward associate satisfaction and well-being. Measures the percent of total annual CWS budget applied toward the HR budget.	Charleston Water
	% Associates agreeing that management and company establishes and maintains high ethical standards	Levels reflect the percentage of CWS associates who agree or strongly agree that management and the company establishes and maintains high ethical standards.	Charleston Water

Appendix B-1
Product quality

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
Air Quality	Days per year in full compliance		Green Bay MSD
Wastewater Treatment Effectiveness/Compliance	Days per year in full compliance		Green Bay MSD
	Percent of time in full compliance		City of Calgary Gwinnett County DWR Charleston Water ABCWUA Toronto Water
	# incidents of Plant NPDES violations, pass-through, interference		Union Sanitary District
	Number of non-compliances		Region of Durham
Drinking Water Quality/Compliance	Days per year in full compliance		ABCWUA Louisville Gwinnet County DWR Region of Durham
	Percent per year		Charleston Water Toronto Water Region of Durham Louisville Gwinnett County DWR Region of Peel City of Calgary
Biosolids Beneficial Use	Biosolids diverted to compost	Beneficially reuse biosolids by diverting 20% of the biosolids to compost	ABCWUA
Reduce Water Service Interruptions	Number of customers experiencing disruption of water service per 1,000 customer accounts per year		ABCWUA Region of Durham
	Reported as a total for the quarter or as a quarterly average for the previous quarters and years. The numerator is the number of services without unplanned water interruption caused by a water main break.		City of Calgary
Minimize Wastewater Treatment Toxicity Events	# Events		Charleston Water
Preventing Sanitary Sewer Overflows	Number of sewer overflows per 100 miles of collection piping		ABCWUA
	Number of SSOs		Union Sanitary District
Reduce Wastewater Service Interruptions (blockages)	Reported as a total for the quarter or as a quarterly average for the previous quarters and years. The numerator is the number of services (commercial and residential) that experienced blockages caused by the city's assets.		City of Calgary Region of Durham
Provide Safe High Quality Water	Number of Violations reported		Louisville
	Water Quality CSI	Index of customer surveyed for water quality	Louisville
	Number of discolored water complaints		Louisville
	Average Value of THMs (mg/L)		Region of Durham
	Average Value for Turbidity (NTU)		Region of Durham
	Average Annual Treated Water Turbidity (NTU)		Region of Durham
Protect Public Health	Boil water advisories	Weighted number of days when a Boil Water Advisory issued by the Ministry	Toronto Water
	Number of days when a boil water advisory issued by the Medical Officer	Weighted number of days when a boil water advisory issued by the Medical Officer of Health, applicable to a municipal water supply, was in effect	Region of Durham
	# of days when a boil water advisory was in effect - Actual Risk	# of days when a boil water advisory issued by the regulatory authorities was in effect because of detected contaminants in the water supply.	Region of Durham
	# of Household Days with Boil Water Advisories	# of days boil water advisory in effect multiplied by # of households affected	Region of Durham
	# of days when a water advisory was in effect	# of days when a water advisory (other than boil water) issued by the regulatory authorities was in effect.	Region of Durham

Appendix B-1
Product quality

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
	Raw Water Turbidity (% of days in Turbidity Range)	Both the annual maximum and average of raw water turbidity supplied to the treatment plant	Region of Durham
Preventative Maintenance of the Water Distribution System	Cumulative Length Cleaned as % of System Length	This is the length of main cleaned on at least one occasion during the year using flushing, swabbing and/or pigging methods to remove biofilms, sediment, and corrosion by-products from water main interiors.	Region of Durham
Enhance and protect the environment	Number of reported environmental and regulatory contraventions	Total sum of reported incidences on actual environmental and regulatory incidences.	City of Calgary
	# of Raw Sewage Plant Bypasses	The number of occurrences that raw sewage bypasses the wastewater treatment plant even if it is not out of compliance with the plant's permit to operate (excludes secondary plant bypasses).	Region of Durham
	# of reported surcharges or unregulated flows	The number of times a surcharge from the wastewater treatment plant has to be reported to the regulatory agency. Surcharges which do not have to be reported to the regulatory agency should not be included. (Excludes CSOs and SSOs, which are reported in the wastewater collection datasheets, and Plant Bypasses which should be recorded separately).	Region of Durham
	kg of BOD Discharged to Environment per capita	The environmental discharge limits specified in the plant's permit to operate (Certificate of Approval) for Total BOD.	
	Percentage of wastewater estimated to have by-passed treatment		Region of Durham
Systematic Process Compliance (Findings per Internal Audits)	% (Findings divided by Audits)	Levels reflect the number of findings discovered by the CWS Internal Auditing Department each year as compared to the number of audits conducted.	Charleston Water
Enforcement of Industrial Pretreatment Program	# flagged uncited violations	Database flags violations and enforcment action is tracked	MSDGC
	Permits issued on time	Database creates permit tasks that must be completed prior to permit finalization and approval	MSDGC
	Required count versus completed	Database creates inspection tasks that must be scheduled and completed within the calendar year	MSDGC
	# sample events completed versus required	Each industry has sample requirements per their permit that must be scheduled and sampled within the required timeframe (annually, semi-annually etc)	MSDGC

Appendix B-1
Water resource adequacy

Leading practice (edited to provide uniformity among different utilities)	Metrics		
	Metric (used to track effectiveness)	Comments	Participating utilities reporting use
Long-term water supply adequacy	Projected years of sufficient water supply in the future		Region of Peel ABCWUA
	% of Demand (from a specific source)		Gwinnett County DWR
	Completion of basin supply plan		Tualatin Valley
Tracking current water demand	Last five-year average water demand/ average available water supply (%)		ABCWUA Region of Durham
Reduce water consumption	Per capita consumption (gpcd, lpcd)		City of Calgary Gwinnett County DWR ABCWUA Toronto Water Region of Durham
	Number of water meters installed in flat rate residences annually	Universal metering has been proven effective at reducing water consumption because it allows us to track the amount of water customers use each month. Customers on a water meter use up to 60% less water on a flat rate account.	City of Calgary
Long-term ambient water quality	Measure of discharged water quality parameters	Sechi disk, phosphorus, nitrogen measurements to measure quality of the surface water the WWTP discharges into to determine our impact and overall improvements	Green Bay MSD Region of Durham
	% of Wastewater estimated to have bypassed treatment		Toronto Water Region of Durham
	% basin returns	for Chattahoochee basin	Gwinnett County DWR
Minimize real water losses	% real water loss		Gwinnett County DWR
Provide adequate capacity	# of Hours of Treated Water Storage Capacity at Average Day Demand	Sum of treated water storage capacity (owned and operated) within pipe system, i.e. sum of all reservoir capacities within transmission/integrated/distribution system (units ML).	Region of Durham
	# of days that plant operated at > x % capacity	Number of days that the treatment plant operated at greater than x% of its maximum rated treatment capacity	Region of Durham
	Average Day Demand (ML/day) / Existing Water License Capacity	Existing maximum capacity of the water license, measured in daily flow (ML/day).	Region of Durham
	# of connections with sanitary flooding/ 1000 connections	Total # of connections with sanitary flooding caused by a backup of sewage in the collection system or other non-rainfall related failure, for which the municipality was responsible .	Region of Durham
	# of connections with sanitary flooding by cause/ 1000 connections	see above	Region of Durham
	# of SSOs that have to be reported/ 100 km pipe	Sum of all reported overflows due to internal blockage, external blockage, capacity limitations, pump station failures and other.	Region of Durham
	# of SSOs by cause that have to be reported/ 100 km pipe	see above	Region of Durham
	% of Design AAF Utilized	Related to wastewater collection capacity	Region of Durham
	% of time WWTP operates with no remaining system redundancy		Region of Durham
Joint water commission			Tualatin Valley

Appendix B-1
Infrastructure stability

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
Capital program delivery	Capital delivery effectiveness	Total CIP actual expenditures/ CIP budgeted expenditures	Toronto Water Region of Durham
	Dollars expended	Total dollars expended to continue renewal in treatment and delivery systems	Louisville Region of Durham
	% of projects in planning that follow the standardized business case evaluation process	The nomination, planning, and implementation of projects is based on a standardized business case evaluation process.	MSDGC
Rehabilitation & Replacement (R&R) Rate	Rate of replacement based on need	Levels measure the degree to which a wastewater utility is replacing its infrastructure based on target lives for asset groups.	Charleston Water
	Asset/renewal/replacement rate (percent)	Total number of assets replaced per year for each asset class divided by total number of assets in each asset class	Region of Peel
	Total actual expenditures reserved for renewal and replacement and total present worth for renewal and replacement needs	Reduce corrective maintenance by investing in infrastructure improvements to the system	ABCWUA
	Backlog of renewal	Total present worth of renewal and replacement needs	Toronto Water
Planned maintenance effectiveness	% Work orders for preventive maintenance		Gwinnett County DWR
	Urgent Maintenance Hours = Total of Unscheduled Maintenance Work/ Total Maintenance Work	Urgent maintenance hours = # of hours spent by maintenance staff on maintenance work that causes interruptions in daily schedule but is not captured under emergency work.	Region of Durham
	Unplanned Maintenance Hours = Unplanned Maintenance Hours/ Total Maintenance Hours	Several detailed calculations including unplanned maintenance hours were offered. Please refer to Attachment 2.	Region of Durham
	Cost of planned maintenance compared to cost of corrective maintenance		ABCWUA
	Hours of planned maintenance compared to hours of corrective maintenance		ABCWUA
Condition assessment/system integrity	% Critical assets condition-assessed		Gwinnett County DWR
	Weighted Avg age of wastewater pipe		Toronto Water Region of Durham
	Weighted Avg age of water pipe		Toronto Water Region of Durham
	# collection system failures each year/year/100 miles (or 100 km) of collection system piping	The type failure (breaks, backups, blocked, system interruptions) and pipes depends on the utility. Some have different metrics for each type of failure	ABCWUA Region of Durham
	# of breaks leaks/ year/ 100 miles (or 100 km) of distribution piping	The types of pipes (transmission vs. service, etc) vary from utility to utility	ABCWUA Region of Durham
	# of Unplanned hours that Plant could not operate at Rated Capacity		Region of Durham
	Unit Filter Run Volume	This is an indicator of filter performance. If the value is > 200 m^3/m^2, then the filters are typically performing well.	Region of Durham
	Main breaks by material type / 100 km length	# of occurrences of distribution or transmission main breaks (include all breaks whether in the pipe or joints), includes pinholes and major breaks.	Region of Durham
	# of Valves Cycled - Total	Total number of valve cycling occurrences, which includes valves cycled more than once per year.	Region of Durham
	# of inoperable or leaking valves	# of occurrences that mainline valves are known to be inoperable or leaking.	Region of Durham
	% of Hydrants Inspected (Level B) and (Level A)	Winter checks can be limited to checking access, evidence of leakage and using a string test to determine if there is water leakage. (Previously called a "Level A Check").	Region of Durham
	Breakdown of Hydrants Checked Level A	Number of hydrants checked in the winter from October to April. See also "# of hydrants checked". The sum of summer hydrant checks and winter hydrant checks should equal the # of Hydrants Checked.	Region of Durham
	# of emergency Service Connection Repairs or Replacements/# of Service Connections		Region of Durham
	% of Blocked sewers that were repeat occurrences	Includes all blocked sewer main locations where more than one blockage occurred during the year (count each location).	Region of Durham
	% of length sewer pipe cleaned/ Total length of sewer pipe that can be cleaned		Region of Durham
	% of length of sewer cleaned Hydraulically and/or Mechanically		Region of Durham

Appendix B-1
Infrastructure stability

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
Condition assessment/system integrity	% of manholes visually inspected	Report the total number of manholes where zoom camera technologies have been used to survey either the manhole or sewer pipes associated with it.	Region of Durham
	# of pump station failures/ # of pump stations	# of pump station failures reported to a regulatory body due to mechanical faults rather than capacity or design issues (the metric is used to measure the mechanical reliability of stations).	Region of Durham
	5 year average # of sewer Repairs (planned & Emergency)/ 100 km pipe		Region of Durham
	% of Length of pipe CCTV Inspected	Total length inspected by CCTV, which does not include length inspected by zoom camera.	Region of Durham
	Breakdown of Length CCTV Inspected/ Length that can be inspected		Region of Durham
	# of planned and emergency service Connection repairs/ 1000 service connections		Region of Durham
	# of Blocked Service Connections/ 1000 Service Connections	Number of blockages within the service connections for which the municipality is responsible.	Region of Durham
	Unscheduled Maintenance Hours/Total Maintenance Hours	Total Maintenance hours = Preventative maintenance hours + Planned (scheduled) hours + Unplanned (breakdown) hours + Other hours. Additional detail included in Attachment 2.	Region of Durham
	Cost of CCTV/ Length of pipe CCTV Inspected		Region of Durham
	Cost of Cleaning Hydraulically/ Length Cleaned		Region of Durham
Minimize water loss	Total non-revenue water volume in m3/km/day	NRW= Total volume delivered from the treatment plants – Billed authorized consumption.	Region of Durham
	Infrastructure Leakage Index (ILI)	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL).	Region of Durham Toronto Water
Development and Implementation of strategic asset management plan	A balanced asset management plan which is affordable and meeting/approaching risk and levels of service targets.		Gwinnett County DWR Region of Peel
	Customer satisfaction with services	Defined parameters which assets are required to meet in order to perform the necessary functions to support municipal services to the customers.	Region of Peel
	Number/percent of asset classes achieving risk and levels of service targets	Long term capital plans identifying asset needs and costs to maintain sustainability of the organization's finances and services. Risk targets set by senior management & Council according to organizational risk tolerances.	Region of Peel
	Supportable infrastructure needs, priorities and asset management plans	Corporate Asset Management Strategy (non-growth infrastructure): A framework that outlines how an organization will manage its assets to meet strategic objectives.	Region of Peel
	Number of asset achieving or closing in on risk and levels of service targets.	Various tools are used to assess and prioritize infrastructure needs according asset levels of service and achieving risk targets.	Region of Peel
	Growth portion of the infrastructure costs are fully recovered through the DC charge.	Development Charge Background Study and By-law (growth-related asset management plan): Outlines the infrastructure needs and costs to meet the levels of service and growth forecasts and calculates a charge paid by developers to subsidize the infrastructure costs. The framework and document is structured to meet the requirements of the Provincial Development Charges Act.	Region of Peel
	% Asset funding matches asset needs. % assets meeting expected performance and condition requirements over the lifespan.	Methodologies by which to predict and optimize the asset life-cycle including points of rehabilitation and replacement and the associated costs.	Region of Peel
Risk management plan/program	Prioritized assets	Consistent methodologies which establish risk tolerances and assess inherent, residual and current risk of assets and to prioritize infrastructure needs.	Tualatin Valley Region of Peel MSDGC
	Basement flooding	Total number of incidents of water in the basement in the reporting period	Toronto Water Region of Durham
Efficiency of Infrastructure Processes	% residuals	Total volume of all liquid wastes disposed of annually in ML, this number should include all individual and combined waste streams, take care not to double count wastes.	Region of Durham
	% of Backwash Waste Treated	Volume of Filter Backwash Waste that goes for further treatment prior to disposal. Annual figure in ML	Region of Durham
	% of Filter-to-waste Treated	Volume of Filter to Waste that goes for further treatment prior to disposal. Annual figure in ML	Region of Durham

Appendix B-1
Financial viability

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
Set Appropriate Balance Between Debt and Equity Funding for Capital Program	Fund an appropriate level of capital programs through equity sources. Set target level and keep to it.	Maintain low debt burden and communicate fiscally responsible to our customers	ABCWUA Gwinnett County DWR Region of Peel
	Annual debt service as a percent of total expense	Examines amount of annual long term debt as a percentage of total utility expenses. NACWA has a benchmark for this.	Green Bay MSD
	Cash financing/year	Increasing annual cash financed expenditures each year for next 5 years	MSDGC
Return on Assets	Net income and total assets, used to improve a utility' financial health.	Utilities commented that some systems currently in use to track this have insufficient functionality.	ABCWUA
	5 year Running Average Capital Reinvestment/ Replacement Value	5 year Running Average Capital Reinvestment/ Replacement Value	
Maintain Adequate Cash Reserves, Working Capital, and Margins	Days of reserve available is based on undesignated cash reserves and continued cost of ongoing operations	Some utilities indicated that they are still working on establishing appropriate targets for this metric.	ABCWUA Charleston Water Toronto Water
	Free Cash as a Percent of Depreciation	This ratio looks at how the cash created in the current year from operations meets the needs of maintaining the system.	Charleston Water
	% Margin (net income + interest divided by sales)	The larger the percentage the better. This measure does not include any influence from depreciation or contributions and simply measures the amount of operating revenues remaining after paying operating expenses.	Charleston Water
	Cash flow reported monthly	Cash flow updated monthly based on updated budgets and project schedules by activity	MSDGC
Maintain Efficient O&M Costs in Relation to Customers and Volume of Sales	$ per customer or sales units.	Typically tracked in financial management software systems.	Charleston Water
	Wastewater operating cost to wastewater treated volumes	Operating cost of wastewater treated, disposed and collected/ ML of wastewater treated	Toronto Water
	Water operating cost to water volume demand ratio	Operating cost of water treated, supplied, and distributed/ ML of water delivered	Toronto Water
Maintain Strong Bond Rating	Standard bond rating scales utilized by the three major rating agencies.	Key Performance Indicator (KPI) - Bond rating agencies periodically review the organizations audited financial statements and CAFR and this has resulted in upgrades in bond ratings for some of the participating utilities due to strong financial performance.	Charleston Water
Debt Service Coverage Ratio	Typically ratio of net operating revenues to annual or maximum annual debt service payments.	Viewed as a key indicator by many utilities. Varying target levels reported based on financial situation and goals. Targets often set higher than minimum requirements set by bond covenants (e.g., 1.4 target vs. 1.2 minimum required for one participating utility.	Charleston Water Gwinnett County DWR
Recognize and support the stockholders interest	% Profit on sales (This measure looks at how much of every dollar of revenue a company actually keeps in earnings.)	A higher profit margin indicates a more profitable company that has better control over its costs compared to its competitors.	Charleston Water
	Degree to which rates recover cost of service (%)	Cost of service study is used to identify target revenue requirements to be collected.	Louisville
	Return on Equity	Financial ratios measuring profitability, dividend, liquidity, capitalization and coverage	Louisville
Rate Comparisons	Rates for a typical customer, cumulative percentage change over time		Charleston Water Green Bay MSD Region of Durham Union Sanitary District
Budget Management Effectiveness: capital budget	Data presented as a cumulative % spending year-to-date. Numerator: Value of actual capital spent YTD. Denominator: Total capital budget for the year	Annually there is an approved budget for capital projects. This performance measure will allow the WMT to track the YTD spending of this capital budget to ensure we are not overspending or even significantly under spending the capital budget allocated for the year.	City of Calgary
Budget Management Effectiveness: operating budget	Operating Budget Variance (%)	There is an approved operating budget each year. This includes revenue and expenditure targets for the year. Reporting on the operating budget variance will provide information on how the two business units are doing vis-à-vis their operating budget forecast.	City of Calgary

Appendix B-1
Financial viability

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
	Overtime hours ratio	Measure overtime hours for implementing viable service delivery	Toronto Water
Set Rates and Financial Forecasts for Annual or Multi-Year Period	Successfully establish rates for at least a 5-year rate setting window.		Gwinnett County DWR
	Cash flow projections simple enough to do scenario planning and sensitivity analysis		Tualatin Valley
	Annual revenue requirment analysis	Fund balances do not reflect rate is too low (or too high)	MSDGC
Minimize uncollected bills	Non-receivables as a percent of annual budget.		Gwinnett County DWR
Vet Major Investments through Rigorous Process	Percentage of major investments for which a rigorous business case evaluation process is used prior to committing funds.	Significant capital, operating, and strategic decisions are vetted through a rigorous multi-disciplinary evaluation.	Gwinnett County DWR MSDGC
Develop Funding Plans that Account for Growth	% of funding provided to support growth identified in Master Plan updates.	Identify projected growth and subsequent infrastructure requirement	Region of Peel

Appendix B-1
Stakeholder understanding and support

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
Actively Engage Stakeholders in Decisions that Affect Them	Stakeholder Outreach Index	Based on a self-assessment checklist, a stakeholder outreach index is calculated	ABCWUA
	Frequency of meetings with stakeholder groups.	Target of quarterly meetings indicated by one utility.	Louisville
Secure Support and Understanding from Stakeholders	Demonstration of stakeholder support in Customer Opinion Survey	Random surveys and other polling/survey techniques were mentioned by participating utilities.	ABCWUA Green Bay MSD Toronto Water
	Client Satisfaction Index (based on a scale of 0 to 10)	An external client satisfaction survey was completed for 1200 residents for 2008 and 2009. The survey is for all Peel services and there only a few questions specific to water. Residents are asked about the taste, odor and pressure of their water and about their water bill.	Region of Peel

Appendix B-1
Customer satisfaction

Leading practice (edited to provide uniformity among different utilities)	Metrics			Participating utilities reporting use
	Metric (used to track effectiveness)		Comments	
Understanding Overall Customer Satisfaction	Quantifiable Level of Satisfaction		Survey of customers by mail, web, telephone or in person. May include other stakeholders and general public.	Green Bay MSD Charleston Water Union Sanitary District Louisville Charleston Water
Tracking Complaints	# of water quality complaints	Total	Includes complaints related to water quality, i.e., taste and odor, color and temperature and other or unknown quality related issues.	Region of Durham
	# of water pressure complaints	by reason		
		High pressure		
		Low pressure		
		Total		
	Number of customer service complaints / 1,000 customer			ABCWUA Charleston Water Toronto Water
	Number of technical quality complaints / 1,000 customer			
	# of wastewater related customer complaints			
Accurate Meter Reading and Billing	Percent of customers reporting billing problems		Levels quantify billing problems as reported by customers in the biannual customer survey.	Charleston Water
	# Adjustments per 10,000 customer accounts			
	% Bills accurate per 10,000 bills			
	Number of error-driven billing adjustments per 10,000 bills generated during the year			ABCWUA
	Number of meters accurately read divided by total active meters			
Customer Contact Center Efficiency and Responsiveness	Maintain call wait time for all call centers to less than 1			ABCWUA
	Number of calls handled divided by total number of calls			
	Average speed to answer		Average speed to answer is the monthly average number of minutes customers calling Customer Service and Billing must wait before they get a service representative on the line.	Gwinnett County DWR
	% of abandoned calls			Louisville
Service Reliability	Unplanned outages per 1000 accounts		Customer outages of any duration are counted as one each.	Gwinnett County DWR
	# of customer days without service		Sum of (# of service connections affected by any service interruption X # of hours affected / 24 hours) for each service interruption occurrence. Distribution systems only.	Region of Durham
	% of Calls for service resolved within defined levels of service			
	Number of all service requests from 311 contact center		This measures the monthly average volume of service requests that Water receives over the reporting period.	City of Calgary
	Percent of overdue service request close-outs		Percentage overdue service requests.	
	Number of trouble calls responded to within X hour / total number of trouble calls.		The response time is measured from the time the call is activated to the time the crew arrives on site. Water, wastewater and total	City of Calgary Gwinnett County DWR Union Sanitary District
	Escalated complaints tracking		Registry of customer complaints that have not been completed by internal processes and customer has submitted formal complaint doc.	Toronto Water
Use of Social Media	Followers per 1,000 Customer Accounts		Levels quantify the number of people following CWS on Twitter, a popular social media site used to engage customers.	Charleston Water

Appendix B-1
Customer satisfaction

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
Other	Number of community events, speaking engagements, etc	Number of events such as community festivals, career fairs, talks to civic and business groups, and other events in which CWS Speakers Bureau members engage with stakeholders and customers to educate them about CWS services.	Charleston Water
	Average Monthly visits to Website		
	Percent of customers reading newsletter	Levels show how frequently retail customers read CWS's quarterly customer newsletter, which is mailed with water bills.	
	Customer contact type by percent of all contacts	Levels reflect service received for the primary modes of contact: phone, office visit, field visit, and website (includes e-mail).	
	Number of recognition submissions from public	Pat on the Back program - public recognition for excellent customer service. When customer or coworker finds employee going above and beyond, their name is submitted for a 'Pat on the Back'	Tualatin Valley
	Water rate changes at or below CPI +1		Louisville
	Number of e-transactions	Measures the monthly number of water and sewer customers who conduct transactions through any of several e:business modules.	Gwinnett County DWR

Appendix B-1
Operational optimization

Leading practice (edited to provide uniformity among different utilities)	Metrics			
	Metric (used to track effectiveness)		Comments	Participating utilities reporting use
Energy Optimization	kWh /	volume of water treated		ABCWUA
		volume of water delivered		Region of Durham
		volume of wastewater treated		Gwinnett County
		volume of wastewater collected and treated		Green Bay MSD
	Energy use, total and amount generated on-site		Energy conservation (LED lighting pilot), co-gen, solar	Union Sanitary District
Resource Optimization (Cost metrics)	Total O&M costs /	population served (water)		Region of Durham
		population served (wastewater)		Green Bay MSD
		total number of active customer accounts (water)		City of Calgary
		total number of active customer accounts (wastewater)		Gwinnett County
		total volume of water treated		Louisville
		total volume of water sold		Charleston Water
		volume of wastewater collected and treated		ABCWUA
		total volume of wastewater treated		City of Calgary
		length of pipe (water)		
		length of pipe (wastewater)		
	Collection system O&M cost / length of pipe			Region of Durham
	Distribution system O&M cost / length of pipe			
	Metering O&M costs / # of meters			
	O&M cost / groundwater Well			
	Chemical cost / volume treated			
	Pump station O&M cost/ pump station horsepower			
	Biosolids thickening and dewatering costs / dry tonnes dewatered			
	Biosolids Storage & Disposal Costs / Dry tonnes Remaining after Processing			
	Biosolids management cost / mass delivered for processing			
	Avg cost of cleaning / length of pipe			Union Sanitary District
	Total customer service cost / number of active accounts			ABCWUA
	Cost of customer communication / population served			Region of Durham
	Cost of customer billing / service connection			
	Cost of water quality monitoring / population served			
	Cost of water conservation program / population served			
	Total operating cost with actual indirect chargeback		Indirect Chargeback	
	O&M cost + actual indirect chargeback /	volume treated (water)		
		length of pipe (water)		
		volume treated (wastewater)		
		length of pipe (wastewater)		
	Indirect costs as a % of total operating costs			
	O&M cost + capital reinvestment cost /	volume treated (water)		
		volume treated (wastewater)		
	O & M cost as % of	replacement value (water)		
		replacement value (wastewater)		
	O&M costs for plant as a % of	plant replacement value (water)		
		plant replacement value (wastewater)		
	Avg cost of televising per mile		Effective maintenance of the CS as evidenced by cost of cleaning and TVing, balanced by # of SSOs and other problems	Union Sanitary District
	Avg cost of cleaning per mile			
Resource Optimization (Human Resources)	Number of total utility staff /population served		Examines total utility staff based on population served	Green Bay MSD
	Number of operations staff per volume of wastewater treated		Examines number of operations staff (Treatment, maintenance, conveyance) based on volume of wastewater treated	
	% craft utilization - water		Measure utilization of maintenance resources in Water Production Division. The numerator sums up technicians' work hour reported in CMMS work orders. The denominator is total technicians' time worked. Six-month rolling average.	Gwinnett County
	Number of active water accounts /	water employees	Measure employee efficiency	ABCWUA
	Volume of water delivered /			Region of Peel
				Region of Durham
	Number of active wastewater accounts /	wastewater employees		

Appendix B-1
Operational optimization

Leading practice (edited to provide uniformity among different utilities)	Metrics		
	Metric (used to track effectiveness)	Comments	Participating utilities reporting use
	Volume of wastewater collected and treated /		
Resource Optimization (Other)	Avg Water Capacity Utilization	Measures the average capacity utilization of the water treatment plants	
	Avg Wastewater Capacity Utilization	Measures the average capacity utilization of the wastewater treatment plants	
	Weight of chemicals used / volume of water treated	Examines chemical resource use efficiency based on material per unit of output	Region of Peel
	Weight of chemicals used / volume of wastewater treated		
	Number of breaks or leaks in the water distribution system / length of distribution system		City of Calgary
	Number of collection system failures / length of collection system		Charleston Water
	Number of sewer system overflows / length of collection system		Charleston Water
	Planned maintenance / total maintenance	Measures the effort for planned maintenance rather than reactive maintenance in order to increase higher infrastructure reliability, rehabilitation and replacement	Toronto Water Charleston Water
	Water meter program implementation	Measure the program for replacing all existing water meters and flat-rate accounts with automatic meter reading (AMR) meters	Toronto Water
	# of backflow devices in compliance w/state regulations	Program established to encourage compliance with backflow requirements and provide inspection services to ensure compliance (program description attached)	Tualatin Valley
	Response time to water main break repair	Measures the field responsiveness to water main breaks in order to increase higher infrastructure reliability, rehabilitation and replacement	Toronto Water
	% requests resolved within 3 days	Levels show the percentage of Help Desk calls that are resolved within three days.	Charleston Water
	Use of IWA/AWWA Water Audit Method	Quantify the percentage of produced water that fails to reach customers and cannot otherwise be accounted for through authorized usage	ABCWUA
	Manage O&M at budget	Operations and Maintenance cost control, metered water ratio	Louisville
	Plant Health Index	Targets and ranges for plant processes have been developed and are tracked on a daily basis.	Union Sanitary District
	% lab parameters certified	Levels show the total percentage of CWS lab parameters that remain certified after regulatory agency biannual laboratory audits.	Charleston Water
	% protests upheld	Levels show the total number of protests received by CWS annually and the percent of these protests that were not substantiated or had no merit	
	GIS implementation		Tualatin Valley
	"Smart" SCADA implementation	Most utilities have SCADA, but the real value comes in a smart SCADA system that enables unattended operation, energy and water quality optimization, asset planning, asset management, etc.	

Appendix B-1
Community sustainability

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
Promote Customer Service Affordability	Water Service Affordability	Measure the affordability of water services to customers, as a percentage of household income	ABCWUA
	Wastewater Service Affordability	Measure the affordability of wastewater services to customers, as a percentage of household income	ABCWUA
Implement Environmental Management System (EMS)	EMS Improvement Programs Completed	Levels reflect the percent of environmentally-related improvement programs started as compared to those completed.	Charleston Water
	# Audit findings	Levels measure the total number of EMS audit findings discovered each year by the CWS EMS Internal Auditing Team and the third-party, external auditor.	Charleston Water
Support for Community Programs	Degree of support and participation in Habitat for Humanity	Levels reflect the participation of CWS associates in supporting and strengthening our key communities through the Habitat for Humanity event	Charleston Water
	Degree of support and participation in Day of Caring	Levels reflect the participation of CWS associates in supporting and strengthening our key communities through the United Way "Day of Caring" national event	Charleston Water
	United Way Funds Raised & Percent Participation	Levels reflect funds contributed and the percent of participation by CWS associates in supporting and strengthening key communities.	Charleston Water
	Degree of support and participation in Operation Round-up	This program assists those less fortunate with funds to pay their water/wastewater bill, and/or goes to Water Missions International—a worldwide relief effort organization serving the water and sanitation needs of people in developing countries and disaster areas.	Charleston Water
Implement Successful Recycling and Resource Conservation Programs to Support Sustainability	Tons recycled	Levels measure the volume in tons of products recycled by CWS associated within both operations and administration.	Charleston Water Tualatin Valley
	Water Consumption (by CWS Operations) in CCF	Levels measure the volume of water use that CWS has consumed in one hundred cubic feet (CCF) for all CWS operational facilities where water reduction measures are possible.	Charleston Water
Actively support employee and corporate participation in establishing and supporting community goals	Minority Spent as % of total	% of Certified Minority Spends as % of total >= 10%	Louisville
	Women Spent as % of total	% of Certified Women Spends as % of total >= 5%	Louisville
	Management participation	Community stewardship participation	Louisville
	Beach water quality - Environmental stewardship monitoring through measuring beach water quality for safe swimming and natural habitat	Ratio of adverse quality beach postings (Total number of beach postings/ Total number of days beach tested)	Toronto Water
Manage Greenhouse Gas Emissions to Support Environmental Goals	Net greenhouse gas emission	This measure helps drinking and wastewater utilities to understand and reduce their individual contributions to area greenhouse gas emissions.	Region of Peel
Promote Sustainability Through CIP Sustainability Review	Degree to which CIP program supports sustainability objectives		Tualatin Valley
Promote Energy Efficiency	Energy Usage (in kWh)	Levels reflect the volume of energy used in all operations and at all facilities.	Charleston Water Toronto Water Region of Durham
	National Water and Wastewater Benchmarking Initiative (NWWBI) - Water Distribution Protect the Environment	Peaking Factor (MDD/ADD)	Region of Durham
	NWWBI -Water Treatment - Energy Efficiency	Energy Consumed in kWh/ML Treated	Region of Durham
		Breakdown of Energy Consumed in kWh/ML Treated	Region of Durham

Appendix B-1
Community sustainability

Leading practice (edited to provide uniformity among different utilities)	Metrics		Participating utilities reporting use
	Metric (used to track effectiveness)	Comments	
	NWWBI-Wastewater Treatment -Energy Efficiency	Energy Consumed in kWh/ML Treated	Region of Durham
		Breakdown of Energy Consumed in kWh/ML Treated	Region of Durham
		Cost of Energy Purchased / ML Treated	Region of Durham
Support Overall Utility System Efficiency	Percentage of Total Households Serviced by Municipal Water	# of households with water connections	Region of Durham
	Average Occupancy Ratio = Serviced Population /Serviced Households		Region of Durham
	Non Revenue Water in Liters per Connection per Day		Region of Durham
	Average Utilization Rate of Water Treatment Plants	% Average Capacity Utilization = Average Day Flow ÷ Plant Rated Capacity`	Region of Durham
	Demand exceeds 90% of Water Supply	Peak Capacity Utilization = # Days Plant Operated at > 90% of Plant Rated Capacity	Region of Durham
Support Environmental Stewardship	# of days of water restrictions	Includes both mandatory and voluntary restrictions (collect separately the number of each).	Region of Durham
	Per capita Average Day Consumption for Residential Customers		Region of Durham
	Peaking Factor (Maximum Day Demand/Average Day Demand)		Region of Durham

Appendix B-2
Leading practice documentation

Attribute	Utility	Leading practice	Detailed description	Capability (How well developed and documented is the process at the Utility)										Execution (How well is the process done at the Utility)										Metrics				Supporting documentation (workflows, procedures etc. with hyperlink to actual document)	Comments
				Process development					Process documentation					Process coverage					Process frequency											
				Informal	Aware	Formalized	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A1. Product Quality	Green Bay MSD	Effluent Quality	Effluent meets all WPDES permit requirements					x					x				x						x	Days per year in full compliance	Water quality monitoring is conducted daily and logged to determine if effluent is in compliance with requirements	365	365	Monthly monitoring reports to state regulatory agency	
	Green Bay MSD	Air Quality	Air emissions meet all state and federal permit requirements				x					x					x						x	Days per year in full compliance	Air emissions parameters from sewage sludge incinerators are monitored for regulatory parameters. Some parameters are monitored daily, some are monitored with annual stack tests	365	330	Semi-annual monitoring reports to state regulatory agency	
	Toronto Water	Drinking Water Quality Compliance	Achieve full drinking water system compliance with all regulatory requirements for public health and safety protection					x					x				x						x	Percentage of compliance to drinking water standards	Number of drinking water microbiological test results within provincial standard/ Total number of drinking water microbiological tests on commissioned & operating systems	100%	99.84%	Data from drinking water systems annual reports	
	Toronto Water	Drinking Water Public Safety	Maintain continuous safe drinking water to public that is free of boil water advisories					x					x				x						x	Boil water advisories	Weighted number of days when a Boil Water Advisory issued by the Ministry of Health applicable to a Municipal Water Supply was in effect	0	0	Data from Toronto Public Health	
	Toronto Water	Wastewater Treatment Quality Compliance	Achieve full wastewater treatment compliance with all regulatory requirements for public health and safety protection					x					x				x						x	Percentage of compliance to provincial wastewater plants certificates of approval	Annual compliance for all wastewater plants to MOE C of As	100%	100%	Data from wastewater treatment plants annual reports	
	Region of Peel	Water Quality Compliance	Water product quality complies with Safe Drinking Water Act, etc.				x					x					x					x		NA	Critical water safety indicators are continuously monitored by SCADA analyzers equipped with alarm capabilities. Water quality monitoring is conducted daily and logged to determine if water quality complies with water quality requirements. Daily or 72 hour regulated reviews are conducted to ensure compliance with legislated requirements. Routine audits and annual inspections by the regulator confirm compliance. Score cards are issued by the MOE for grading of individual drinking water systems	N/A	N/A	Annual reports compiled by the system owner, annual inspection reports issued by the regulator, monthly reports documenting water safety indicators and operational parameters. Daily station logs, work orders, station reports, flushing records, SOPs and Performance Standards are in place. Operations and Maintenance Manuals, Operational Plans, Protocols are accessible to all relevant staff. (EIM or hard copy binders)	
	Charleston Water	Drinking Water Compliance	Levels quantify the percentage of time each year that a water utility meets all drinking water standards in the U.S. National Primary Drinking Water Regulations.					x					x					x					x	% time regulatory standards met	Percent of time each year that a water utility meets all drinking water standards in the U.S. National Primary Drinking Water Regulations.	100%	100%	Water quality reports submitted to regulating agency; Monthly Operating Reports; Performance Scorecard software	Key Performance Indicator (KPI)
	Charleston Water	Wastewater Treatment Effectiveness Rate	Levels quantify a utility's compliance with the effluent quality standards (expressed as the percent of time each year that an individual wastewater treatment facility is in full compliance with applicable effluent quality requirements).					x					x					x					x	% time regulatory standards met	Percent of time each year that an individual wastewater treatment facility is in full compliance with applicable effluent quality requirements).	100%	100%	Water quality reports submitted to regulating agency; Monthly Operating Reports; Performance Scorecard software	Key Performance Indicator (KPI)
	Charleston Water	Wastewater Treatment Toxicity Events	Levels reflect the number of wastewater toxicity violations experienced each year.					x					x					x					x	# Events		0	0	Water quality reports submitted to regulating agency; Monthly Operating Reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Systematic Process Compliance (Findings per Internal Audits)	Levels reflect the number of findings discovered by the CWS Internal Auditing Department each year as compared to the number of audits conducted.					x					x					x					x	% (Findings divided by Audits)		0.68	0.5	Audit reports; Performance Scorecard software	Performance Indicator (PI)
	ABCWUA	Drinking Water Compliance	Quantify the percentage of time each year that the ABCWUA meets all of the health related drinking water standards in the US National Primary Drinking Water Regulations				x					x					x						x	Number of days in full compliance	Provide safe and reliable drinking water to our customers 100% of the time	365	365	Weekly reports detailing monitoring and compliance submittals	
	ABCWUA	Wastewater Treatment Effectiveness Rate	Quantify the ABCWUA's compliance with the effluent quality standards in effect at each of its wastewater treatment facilities			x					x					x					x			Percent of time each year that an individual wastewater treatment facility is in full compliance with applicable effluent quality requirements	Minimize environmental impacts to the river by returning high quality water to the river	96.2%	95.1%	Information obtained from Laboratory Information System	
	ABCWUA	Water Service Interruptions (Planned <4 hours)	Quantify the numbers of water outages experienced by ABCWUA customers			x					x					x				x				Number of customers experiencing disruption of water service per 1,000 customer accounts per year	Reduce water supply interruptions and provide reliable water service to meet customer expectations of full water service all of the time	1.4	1.4	Information obtained from Maximo (CMMS)	This metric has actually decreased mostly because the ABCWUA acquired a private utility (17,000 accounts).
	ABCWUA	Water Service Interruptions (Unplanned <4 hours)	Quantify the numbers of water outages experienced by ABCWUA customers			x					x					x				x				Number of customers experiencing disruption of water service per 1,000 customer accounts per year	Reduce water supply interruptions and provide reliable water service to meet customer expectations of full water service all of the time	0.4	0.3	Information obtained from Maximo (CMMS)	This metric has remained steady over five year planning period.
	ABCWUA	Sewer Overflow Rate	Quantify the condition of the collection system and the effectiveness of routine maintenance				x					x					x					x		Number of sewer overflows per 100 miles of collection piping	Improve the condition and reliability of the collection system and reduce customer complaints	1.2	2.7	Information obtained from Maximo (CMMS)	
	ABCWUA	Biosolids Beneficial Use	Beneficially reuse biosolids by diverting 20% of the biosolids to compost					x					x				x						x	Biosolids diverted to compost		15%	27%	Laboratory Information System, spreadsheets, hardcopy reports	

Appendix B-2
Leading practice documentation

Attribute	Utility	Leading practice	Detailed description	Capability (How well developed and documented is the process at the Utility)										Execution (How well is the process done at the Utility)										Metrics				Supporting documentation (workflows, procedures etc. with hyperlink to actual document)	Comments
				Process development					Process documentation					Process coverage					Process frequency											
				Informal	Aware	Formalized	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A1. Product Quality	Region of Durham	NWWBI - Water Utility - Protect Public Health	Impacts of Water Quality on Customers					x					x					x					x	# of days when a boil water advisory was in effect - Actual Risk	# of days when a boil water advisory issued by the regulatory authorities was in effect because of detected contaminants in the water supply.				
	Region of Durham	NWWBI - Water Utility - Protect Public Health	Impacts of Water Quality on Customers					x					x					x					x	# of days when a water advisory was in effect	# of days when a water advisory issued by the regulatory authorities was in effect. Advisories issued due to high levels of chemicals, metals or other substances that are not affected by boiling the water. Examples include high levels of lead, potassium permanganate, or products such as soap which may be introduced into the system by a backflow event. Excludes boil water advisories.				
	Region of Durham	NWWBI - Water Distribution - Protect Public Health	Preventative Maintenance					x					x				x						x	Cumulative Length Cleaned as % of System Length	This is the length of main cleaned on at least one occasion during the year using flushing, swabbing and/or pigging methods to remove biofilms, sediment, and corrosion by-products from water main interiors. This generally improves water quality and hydraulic capacity. Do NOT double count mains that are cleaned on two or more occasions. Excludes service connections and mains cleaned before cement lining. Excludes lengths that are spot flushed for the purpose of retaining a chlorine residual.				
	Region of Durham	NWWBI - Water Distribution - Protect Public Health	Compliance and Health & Safety					x					x					x					x	Average Value of THMs (mg/L)	Enter values for the system target, the average value and the number of days with an occurrence over the group target (see definitions for these terms below). Trihalomethanes are a chlorination disinfection by-product produced when chlorine reacts with residual organic compounds.				
	Region of Durham	NWWBI - Water Distribution - Protect Public Health	Compliance and Health & Safety					x					x					x					x	# of days with total coliform Occurrences	Enter the number of days with positive occurrences of Total coliform in samples tested (if the sample has to retest positive before being considered as a positive sample then only include these). The concentration of coliform organisms, the total coliform group includes four genera in the Enterobacteriaceae family, including; Escherichia, Klevisella, Citrobactor and Enterobacter.				
	Region of Durham	NWWBI - Water Distribution - Protect Public Health	Compliance and Health & Safety					x					x					x					x	Average Value for Turbidity (NTU)	Enter values for the system target, the minimum value, the maximum value and the average value and the number of days with an occurrence over the group target (see definitions for these terms below). Turbidity is a measure of suspended material in the water.				
	Region of Durham	NWWBI - Water Treatment - Protect Public Health	Raw Water Quality					x					x					x					x	Raw Water Turbidity (% of days in Turbidity Range)	Enter both the annual maximum and average of raw water turbidity supplied to the treatment plant (measure in nephelometric turbidity units, NTU). Daily raw water averages. A measure of the presence of suspended matter or particles in the water.				
	Region of Durham	NWWBI - Water Treatment - Protect Public Health	Compliance and Health & Safety					x					x					x					x	Average Annual Treated Water Turbidity (NTU)	If the datasheets are being completed for a filtration plant (e.g. Direct filtration, membrane, or conventional filtration) then the values for the plant turbidity target, the average turbidity value and the number of days with an occurrence over the group target should be entered into this row of the datasheets (see definitions for these terms below).				

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Leading practice documentation

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				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A1. Product Quality	Region of Durham	NWWBI - Water Treatment - Protect Public Health	Compliance and Health & Safety					x					x					x					x	# of Total Coliform Occurrences in Treated Water	Enter the number of days with positive occurrences of Total coliform in samples tested (if the sample has to retest positive before being considered as a positive sample then only include these). The concentration of coliform organisms, the total coliform group includes four genera in the Enterobacteriaceae family, including; Escherichia, Klevisella, Citrobactor and Enterobacter.				
	Region of Durham	NWWBI - Water Treatment - Protect Public Health	Compliance and Health & Safety					x					x					x					x	Annual Average Treated Water Nitrates	Enter values for the plant target, the average value and the number of days with an occurrence over the group target (see definitions for these terms below). Nitrates (NO3) are inorganic ions found in surface water sources and groundwater. Any source of Nitrogen can be potentially converted to nitrate. Contamination commonly comes from septic system, agricultural fertilizers, erosion of natural deposits and feed lots.				
	Region of Durham	NWWBI - Wastewater - Protect the Environment	Environmental Compliance																					# of Non- Compliances	The number of times permit limits are exceeded. If the non-compliance contains more than one parameter (i.e. out of compliance on BOD and TSS) each parameter is recorded as one non-compliance. Only out of compliance if the Certificate of Approval STATES you are out of compliance. For example – if you have a monthly TP limit and you are over the limit 6 days of the month but the average for the month isn't over the limit, you are not out of compliance. Includes non-compliances for volume limits.				
	Region of Durham	NWWBI - Wastewater - Protect the Environment	Environmental Compliance																					# of reported surcharges or unregulated flows	The number of times a surcharge from the wastewater treatment plant has to be reported to the regulatory agency. Surcharges which do not have to be reported to the regulatory agency should not be included. (Excludes CSOs and SSOs, which are reported in the wastewater collection datasheets, and Plant Bypasses which should be recorded separately). An example of a surcharge is a high flow condition which results in a spill to the surrounding area. Distinction between a surcharge and bypass is a surcharge is an uncontrolled spill to the surrounding area and a bypass is a controlled release of untreated or partially treated wastewater to the receiving body.				
	Region of Durham	NWWBI - Wastewater - Protect the Environment	Environmental Compliance																					# of Raw Sewage Plant Bypasses	The number of occurrences that raw sewage bypasses the wastewater treatment plant even if it is not out of compliance with the plant's permit to operate (excludes secondary plant bypasses).				
	Region of Durham	NWWBI - Wastewater - Protect the Environment	BOD Discharged to the Environment																					kg of BOD Discharged to Environment per capita	The environmental discharge limits specified in the plant's permit to operate (Certificate of Approval) for Total BOD. Please provide both the limit value and the permit conditions, for example 25 mg/L and maximum monthly average.				
A1. Product Quality	Region of Durham	OMBI - Water	Compliance					x					x					x					x	Percentage of Compliance to Drinking Water Standards	# of drinking water microbiological test results within standard as set out in Ontario Regulation 169/03 under the Ontario Drinking Water Act. The Ontario Drinking Standards for Microbiological Tests are provided by Schedule 1 of Ontario Regulation 169/03	1	0.9989	Reports from Water Traxx System	
	Region of Durham	OMBI - Water	Community Impact					x					x					x					x	# of Household Days with Boil Water Advisories	# of days boil water advisory in effect multiplied by # of households affected	0	0	Reports from Water Traxx System	
	Region of Durham	OMBI -Wastewater	Compliance					x					x					x					x		Percentage of wastewater estimated to have by-passed treatment		0.0017	Compliance	

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Leading practice documentation

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				Process development					Process documentation					Process coverage					Process frequency											
				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A1. Product Quality	Region of Durham	MPMP - Water	Water Quality					x					x					x					x	Weighted number of days when a boil water advisory issued by the Medical Officer of Health, applicable to a municipal water supply, was in effect	Number of days when a boil water advisory issued by the Medical Officer	0	0	Reports from Water Traxx System	
	Region of Durham	MPMP -Wastewater	Compliance					x					x					x					x		Percentage of wastewater estimated to have by-passed treatment		0.0017	Compliance	
	City of Calgary	Water Quality Compliance	Percentage of time the treated drinking water quality meets provincial regulations					x				x			x								x	Days per year in full compliance/365 x 100	The City of Calgary is required to produce drinking water quality that meets or exceeds the requirements of Alberta Environment and Health Canada. Lab Services, Glenmore/Bearspaw Water Treatment laboratories monitor over 150 different parameters including inorganic, organic and microbiological to effectively monitor both Raw and Finished water quality for both water treatment plants. These analyses include due diligence monitoring that is not part of the regulatory requirements. This meets and/or exceeds the provincial regulations 100 percent of the time throughout the year.	1	1	Provincial Regulations as outlined in Approval No. 476-01-00 and established Health Canada limits.	
	City of Calgary	Wastewater Effluent Quality Compliance	Percentage of time the wastewater meets provincial regulations for effluent quality					x					x					x					x	Days per year in full compliance/365 x 100	The City of Calgary is required to meet the monthly effluent limits set by Alberta Environment	1	1		
	City of Calgary	Deliver Quality Products and Services	Water Availability (Outages)			x						x		x									x	Reported as a total for the quarter or as a quarterly average for the previous quarters and years. The numerator is the number of services without unplanned water interruption caused by a water main break.		TBD	1190		The numerator is the approximate annual number of services that encountered water outage. This is calculated by multiplying the annual number of main break by 20. 20 are the approximate number of services attached to a main, and are affected by a break. The denominator 4 is used to calculate the quarter average for the year.
	City of Calgary	Deliver Quality Products and Services	Wastewater Availability (Blockages)				x				x						x						x	Reported as a total for the quarter or as a quarterly average for the previous quarters and years. The numerator is the number of services (commercial and residential) that experienced blockages caused by the city's assets.		TBD	1029		
	City of Calgary	Enhance and protect the environment by complying with regulatory requirements	Number of reported environmental and regulatory contraventions					x					x					x					x	Total sum of reported incidences on actual environmental and regulatory incidences as defined in the description above. The data is reported as a quarterly total or the average for the reporting period.	This sums all reported incidences on possible and actual environmental and regulatory incidences. This measure includes all incidences on 1) environmental reportable incidences, 2) drinking water withdrawal incidences, 3) approval to operate water treatment plant – regulatory incidences, 4) Approval to operate wastewater treatment plants – regulatory incidences. These are incidences that are reported by HAZMAT to Alberta Environment and are caused by Water Resources or Water Services and not by an external third party	TBD	16		The City of Calgary has well defined processes in place for dealing with contraventions. Challenges can occur due to provincial regulations and Operating Approval requirements that can be vague or have 'grey' areas, which can lead to individual interpretations varying across business units as to what reportable contraventions entail. Regardless of this, communication across divisions has led to a successful process implementation amongst appropriate parties.
	Louisville	Provide Safe High Quality Water	Assure safe water supply, meet water quality regulations and customer expectations for distribution water quality.					x					x					x					x	Turbidity >0.5 NTU samples	99% of all samples ,0.5 ntu	99%	99.90%		
	Louisville	Provide Safe High Quality Water	Assure safe water supply, meet water quality regulations and customer expectations for distribution water quality.					x					x					x					x	Chlorine<0.5 ppm samples	99% samples have levels <0.5 ppm	99%	100%		
	Louisville	Provide Safe High Quality Water	Assure safe water supply, meet water quality regulations and customer expectations for distribution water quality.					x					x					x					x	Positive total coliform samples	% of total samples negative	99%	99.30%		
	Louisville	Provide Safe High Quality Water	Assure safe water supply, meet water quality regulations and customer expectations for distribution water quality.					x					x					x					x	Violation reported?	Violation Reports	NO	NO		
	Louisville	Provide Safe High Quality Water	Assure safe water supply, meet water quality regulations and customer expectations for distribution water quality.					x					x					x					x	Water Quality CSI <=890	Index of customer surveyed for water quality	890	874		

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Leading practice documentation

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				Process development					Process documentation					Process coverage					Process frequency											
				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A1. Product Quality	Louisville	Provide Safe High Quality Water	Assure safe water supply, meet water quality regulations and customer expectations for distribution water quality.					x					x					x					x	Number of discolored water complaints <=450	Reduce to <= 450	450	262		
	Union Sanitary District	NPDES compliance	Plant process monitoring and control is managed to ensure 100 % compliance					x					x					x					x	# incidents of Plant NPDES violations, pass-through, interference		0	0	NACWA Gold Awards for perfect NPDES Permit Compliance for 17 of the last 18 years (and a silver award for the year we missed gold)	
	Union Sanitary District	Preventing Sanitary Sewer overflows	Collection System maintenance process is designed and managed to minimize SSOs					x					x				x					x		# SSOs, could be converted to SSOs/mile sewer	# category 1 and 2 SSOs, as defined by the CA RWQCB: Category 1 SSO: Any discharge ≥ 1,000 gallons	C1: 0 C2: ≤ 10	FY 1 to date: 0/5 FY10: 2/8 FY09: 2/7	CS SOP's, scorecard CA SSO Incident Map	The Collection System Services Workgroup has a detailed strategy to prevent SSOs and a scorecard to track effectiveness.
	Gwinnett County DWR	Water quality compliance	Water product quality complies with National Primary Drinking Water Regulations and National Pollutant Discharge Elimination System permit requirements.					x					x					x					x	Days per year in full compliance.	Water quality monitoring is conducted daily (and instantaneous as needed) and logged to determine if water quality complies with water quality requirements.	100%	100%	Monthly compliance reports documenting compliance submitted to state regulating agency. See also attached balanced scorecard and monthly operations report.	100% of our in-house compliance lab, as well as many of the plants' process control lab procedures, are certified by the American Association for Laboratory Accreditation for ISO/IEC 17025, and have been for many years.
	Gwinnett County DWR	SDWA compliance rate	Gwinnett balanced scorecard metric					x					x					x					x	Days per year in full compliance.	Water quality monitoring is conducted daily (and instantaneous as needed) and logged to determine if water quality complies with water quality requirements.	100%	100%	Monthly compliance reports documenting compliance submitted to state regulating agency. See also attached balanced scorecard and monthly operations report.	100% of our in-house compliance lab, as well as many of the plants' process control lab procedures, are certified by the American Association for Laboratory Accreditation for ISO/IEC 17025, and have been for many years.
	Gwinnett County DWR	Wastewater treatment compliance rate	Gwinnett balanced scorecard metric					x					x					x					x	Days per year in full compliance.	Water quality monitoring is conducted daily (and instantaneous as needed) and logged to determine if water quality complies with water quality requirements.	100%	100%	Monthly compliance reports documenting compliance submitted to state regulating agency. See also attached balanced scorecard and monthly operations report.	100% of our in-house compliance lab, as well as many of the plants' process control lab procedures, are certified by the American Association for Laboratory Accreditation for ISO/IEC 17025, and have been for many years.
	MSDGC	Industrial Discharger Enforcement	MSD takes Enforcement in accordance with Enforcement Response Plan					x			x						x					x		# flagged uncited violations	Database flags violations and enforcement action is tracked	<10	8	Reports from iPacs database	
	MSDGC	Industrial Permits	All Significant Industrial Users have accurate and active permits					x			x							x					x	Permits issued on time	Database creates permit tasks that must be completed prior to permit finalized and approved.	100%		Reports from iPacs database	
	MSDGC	Inspection of industrial users	All permitted industrial users are inspected annually					x				x						x					x	Required count vs. completed	Database creates inspection tasks that must be scheduled and completed within the calendar year.	100%	100%	Reports from iPacs database	
	MSDGC	Industrial discharge sampling	All Significant Industrial Users are sampled at least annually for all required pollutants and surcharge sampling.					x		x								x					x	# sample events complete vs required	Each industry has sample requirements per their permit that must be scheduled and sampled within the required timeframe (annually, semi-annually etc)	100%	98%	Reports from iPacs database	
	South East Water	Drinking Water Quality Compliance	The purpose is to monitor that drinking water is being provided within SE Water's area that meets the requirements of the Drinking Water regulations. A significant parameter in the regulations is the yearly E. coli target of 98%.					x					x					x					x	Compliance with drinking water regulations		100%	100%	Drinking Water HACCP Plan Certified Quality Management System Drinking Water Quality Database NATA Lab Audits - HACCP, DoH Monthly Reporting Annual Report	
	South East Water	Treatment Plant Compliance	Effluent Standards specified by the EPA in each of the Sewage Treatment Plant licences if met should not exert any detrimental effect on the environment.					x					x					x					x	Treatment Plant Compliance		100%	100%	STP HACCP Plan Certified Quality Management System STP Database NATA Lab Audits - HACCP, EPA Monthly Reporting STP Annual Assurance Document	Compliant for 13 consecutive years
	South East Water	EPA Licence						x					x					x					x	Compliance with licence		100%	100%	Annual Assurance Report	
	South East Water	Biosolids - Reuse	Dry Mass			x					x					x						x		% of Biosolids reused		105.00%	111.00%		
	South East Water	Trade Waste	No of issuing Trade Waste Consents within ten days				x					x						x					x	% of Trade Waste Consents issued within ten days		95%	98%		
	South East Water	WQ Complaints (Potable)	This indicator provides information on the degree of satisfaction customers have in the quality of potable water they are receiving.					x				x					x						x	Complaints received per 1,000 Customers		2.2	2.0	ESC Auditing Quality Management System Procedural Guidelines / Flow Charts	
	South East Water	WQ Complaints (Recycled Class A)	This indicator provides information on the degree of satisfaction customers have in the quality of Recycled water they are receiving.				x					x					x					x		Complaints received per 1,000 Customer		6.0	2.3	ESC Auditing Quality Management System Procedural Guidelines Customer Satisfaction Survey	

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Leading practice documentation

Attribute	Utility	Leading practice	Detailed description	Capability (How well developed and documented is the process at the Utility) – Process development					Capability – Process documentation					Execution (How well is the process done at the Utility) – Process coverage					Execution – Process frequency					Metrics				Supporting documentation (workflows, procedures etc. with hyperlink to actual document)	Comments
				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A1. Product Quality	South East Water	Potable water substitution	To track achievement of recycling and potable substitution targets set by Government in the Central Regional Sustainable Water Strategy up to 2030, which then filters down to 4-year Water Plan targets (2008-09 & 2009-13), and rolling 3-year Corporate Plans (2008-11). The Water Plans are approved by the ESC, and a selection of KPIs is routinely reported to the ESC (Note that the Strategy Group has the role of coordinating the KPI collation and reporting for all Company servicing KPIs).				x					x						x					x	10 GL / year potable		20% (by 2010)	21%		
A2. Customer Satisfaction	Green Bay MSD	High Customer Satisfaction	Addresses customer perceptions of utility. This is measured through surveys sent to customers.		x					x				x					x					Satisfaction with specific issues	Percentage of stakeholders who annually rate specific activities of the utility as positive	80	Unknown	Periodic stakeholder survey results summary reports	
	Toronto Water	Customer service request types	Measures the enquiries/complaints from the public of specific water issues for continuous service delivery improvement				x					x										x		Customer water enquiries/complaints requests by type	Number of enquiries/complaints on water outage, low pressure, odour, colour/turbidity per 1000 households	TBD	5.49	Data from internal work management system records and lab records	
	Toronto Water	Customer service delivery and response	Measures the internal responsiveness to escalated customer complaints for continuous service delivery improvement			x				x						x				x				Escalated complaints tracking	Registry of customer complaints that have not been completed by internal processes and customer has submitted formal complaint doc	TBD	2	Data from customer complaints tracking logs	
	Region of Peel	Low Complaint Rates	This measure assesses the complaint rates experienced by the utility with individual quantification of customer service and utility service complaints.				x					x					x					x		Number of complaints per reporting period (annually). Peel Population serviced is over 1.3 M.	Number of complaints are logged daily by customer service representatives. Annually (or as required) the total number of complaints is calculated. Complaints submitted directly to Water Quality Staff or other sections of PW or within Peel are also logged in a database.	NA - this number is not static and subject to change (e.g.. unexpected circumstances, projects, program implementation)	799 (0.061%)	Report Hansen Database - Work Orders/Service Requests/ Water Quality Complaint Resolution Protocol	Complaints are categorized by type. Water Quality related complaints are further categorized based on type of concern. Reporting system has been created to capture all types of problem codes. IMS reports are created and made available.
	Charleston Water	Overall Customer Satisfaction Rating (Rating Scale of 1-10)	Levels show the average satisfaction rating on a scale of 1–10 (1=not at all satisfied; 10=very satisfied) retail and wholesale customer groups, as determined in a biannual telephone survey.					x					x					x					x	Scale of 1–10 (1=not at all satisfied; 10=very satisfied)		8.5	Retail: 9; Wholesale: 8.6	Biannual Customer Survey Report; Performance Scorecard Software	Key Performance Indicator (KPI)
	Charleston Water	Provide Reliable Service	Levels show survey opinions of CWS providing reliable service.					x					x			x							x	Percent		100%	Retail: 99%; Wholesale: 100%	Biannual Customer Survey Report; Performance Scorecard Software	Performance Indicator (PI)
	Charleston Water	Providing Quality Water	Levels show retail customers and wholesale customers surveyed believe CWS does a "good job" or "very good job" of providing quality drinking water.					x					x			x							x	Percent		98%	Retail: 95%; Wholesale: 100%	Biannual Customer Survey Report; Performance Scorecard Software	Performance Indicator (PI)
	Charleston Water	Billing - Customer Survey Feedback, % of customers reporting correct billing	Levels quantify billing problems as reported by customers in the biannual customer survey. Retail customers are asked if they had a problem with their water/sewer bill in the last year. Wholesale customer were asked to rate CWS on billing accuracy.					x					x			x							x	Percent		95%	Retail: 92%; Wholesale: 100%	Biannual Customer Survey Report; Performance Scorecard Software	Performance Indicator (PI)
	Charleston Water	Billing Adjustments per 10,000 Accounts - Annual Average	Levels quantify the number of billing adjustments per 10,000 accounts, regardless of the reason (CWS meter reading error, customer leak, etc.).				x						x					x					x	# Adjustments per 10,000 customer accounts		65.00	Not reported for 2010	Performance Scorecard Software	Performance Indicator (PI)
	Charleston Water	Billing Accuracy	This indicator replaces Billing Adjustments. This new measure better represents billing accuracy for CWS by showing the percentage of bills that are accurate rather than the number of adjustments per 10,000 bills.				x						x					x					x	% Bills accurate		99.50%	99.27%	Performance Scorecard Software	Performance Indicator (PI)
	Charleston Water	Customer Service Satisfaction	Levels reflect service received for the primary modes of contact: phone, office visit, field visit, and website (includes e-mail).				x						x			x							x	Percent		None	Retail: Phone: 88%, Office Visit: 96%; Field Visit: 84%; Web Site: 94%; Wholesale: 100%	Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Customer Service Quality Complaint Rate	Levels quantify customer service-related complaints, including helpfulness of staff, responsiveness, bill problems, etc. (expressed as a rate—the number of complaints per 1,000 accounts).					x					x			x							x	Monthly ave. of complaints per 1,000 accounts		2.8	2.16	CMMS; Monthly Operating Reports; Performance Scorecard Software	Key Performance Indicator (KPI)

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A2 Customer Satisfaction	Charleston Water	Technical Quality Complaint Rate	Levels quantify technical complaints as a rate—complaints per 1,000accounts. Technical complaints are defined as those related to water or sewer service and field activities, and include water quality complaints, complaints about construction, etc.					x					x			x							x	Monthly ave. of complaints per 1,000 accounts		3.4	3.66	CMMS; Monthly Operating Reports; Performance Scorecard Software	Key Performance Indicator (KPI)
	Charleston Water	Number of Community Outreach Activities	Levels track the number of events such as community festivals, career fairs, talks to civic and business groups, and other events in which CWS Speakers Bureau members engage with stakeholders and customers to educate them about CWS services.					x			x						x						x	Number		48	48	Database; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Web Site Visits	Levels track the number (average monthly) of visits to CWS's website, charlestonwater.com, since2007.					x					x					x					x	Average Monthly		30,000	32,900	Google Analytics; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Reads Customer Newsletter	Levels show how frequently retail customers read CWS's quarterly customer newsletter, which is mailed with water bills.					x				x				x							x	Percent read		60%	Yes: 34%; Sometimes: 25%	General report; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Twitter Followers per 1,000 Customer Accounts	Levels quantify the number of people following CWS on Twitter, a popular social media site used to engage customers.					x					x					x					x	Followers per 1,000 Customer Accounts		10	6	General report; Performance Scorecard software	Performance Indicator (PI)
	ABCWUA	Customer service complaint rate	Measure the complaint rates experienced by the ABCWUA, with individual quantification of those related to customer service and those related to core utility services				x					x					x				x			Number of customer service complaints per 1,000 customer accounts	Improve customer satisfaction with service and product	16	14	Information obtained Customer Service Billing System (Oracle CC&B)	Meter reading complaints most common
	ABCWUA	Technical quality complaint rate	Measure the complaint rates experienced by the ABCWUA, with individual quantification of those related to technical quality of service					x					x					x					x	Number of technical quality complaints per 1,000 customer accounts	Improve customer satisfaction with service and product	11.2	10.7	Information obtained from Maximo (CMMS) and Laboratory Information System	
	ABCWUA	Call Wait Time	Maintain call wait time for all call centers to less than 1 minute, 90 percent of the time					x					x				x					x		Maintain call wait time for all call centers to less than 1 minute, 90 percent of the time		90%	87%	Siemens, HiPath 4000 Procenter	
	ABCWUA	First Call Resolution	Number of calls handled divided by total number of calls offered		x						x					x						x		Number of calls handled divided by total number of calls offered		90%	85%	Siemens, HiPath 4000 Procenter	This metric is still be developed. ABCWUA recently participated in a First Call Resolution benchmarking study. From the study results, ABCWUA will develop a metric and target. Offered calls does not included abandoned or call back inquiries.
	ABCWUA	Meter Reading Accuracy					x					x					x					x		Number of meters accurately read divided by total active meters		100%	99.90%	Meter reading system uploaded to billing system	
	ABCWUA	Billing Accuracy	Measure the effectiveness of the ABCWUA's billing practices				x					x					x					x		Number of error-driven billing adjustments per 10,000 bills generated during the year	Improve billing accuracy to minimize customer complaints	15	21	Information obtained Customer Service Billing System (Oracle CC&B)	
	Region of Durham	NWWBI - Water Utility -	Provide Good Customer Service					x					x				x					x		Total # of water quality complaints	Total # of customer complaints received at the customer service centre/plant/public works yard. Include all complaints related to water quality, i.e. taste and odour, colour and temperature and other or unknown quality related issues. If the breakdown			Reports from Customer Inquiry Database	
	Region of Durham	NWWBI - Water Utility -	Provide Good Customer Service					x					x				x					x		Total # of water quality complaints by reason	as above by individual reasons				
	Region of Durham	NWWBI - Water Distribution	Have satisfied and informed customers and improve level of trust					x					x				x					x		# of water pressure complaints	# of customer complaints received at the customer service centre that were related to water pressure in the distribution system. Should be a sum of complaints regarding high and low water pressure. Note: A complaint will typically require follow-up action			Reports from Customer Inquiry Database	
	Region of Durham	NWWBI - Water Distribution	Have satisfied and informed customers and improve level of trust					x					x				x					x		# of High Water Pressure Complaints	# of customer complaints received at the customer service centre that were related to high water pressure in the distribution system.			Reports from Customer Inquiry Database	
	Region of Durham	NWWBI - Water Distribution	Have satisfied and informed customers and improve level of trust					x					x				x					x		# of Low Water Pressure Complaints	# of customer complaints received at the customer service centre that were related to low water pressure in the distribution system.			Reports from Customer Inquiry Database	

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A2. Customer Satisfaction	Region of Durham	NWWBI - Water Distribution	Have satisfied and informed customers and improve level of trust					x					x					x					x	# of customer days without service	Sum of (# of service connections affected by any service interruption X # of hours affected / 24 hours) for each service interruption occurrence. Distribution systems only.			Reports from Customer Inquiry Database	
	Region of Durham	NWWBI- Wastewater Collection	Provide Good Customer Service					x					x					x					x	# of wastewater related customer complaints	# of customer complaints received at the customer service center that were related to sanitary and combined wastewater collection systems. Include blockages (in sewers or service connections), overflows, odours etc. A complaint requires a follow-up action			Reports from Customer Inquiry Database	
	Region of Durham	NWWBI- Wastewater Collection	Provide Good Customer Service					x					x					x					x	% of Calls for service resolved within defined levels of service	When a site visit is made in response to a call that is received during working hours for an emergency, what is the target maximum amount of time between receiving the call and the O&M crew being on-site to undertake the preliminary assessment (not necessary)			Response time from Depots	
	Region of Durham	NWWBI- Wastewater Treatment	Provide Good Customer Service					x					x				x					x		# of odour complaints	Number of odour complaints by the public relating to the WWTP.			Reports from Customer Inquiry Database	
	Region of Durham	OMBI - Water	Customer Service					x					x				x					x		Number of Enquiries/Complaints on Water Outage, Low Pressure, Taste, Odour, Colour/Turbidity per 1,000 Households	# of enquiries/complaints received. Only the enquiries/ complaints that result in a site visit from Technical staff or by Depot Staff are to be included in the total.			Reports from Customer Inquiry Database	
	City of Calgary	Continually improve customer service to maintain a high level of customer satisfaction	Number of service requests from 311 (City managed customer contact centre)					x					x				x						x	Number of all service requests from 311 going to Water Resources and Water Services	This measures the monthly average volume of service requests that Water receives over the reporting period. It is a measure of the number of complaints that Water Resources and Water Services receive as well as provides us some leading indicator of future performance on customer responsiveness.	TBD	11972		
	City of Calgary	To deliver timely response to customers	Percentage overdue 311 service requests					x					x				x						x	This metric is the consolidation of the percentage overdue rates of all service requests that Water Resources and Water Services receive from 311. Each 311 service requests has a target date by which a service request has been dealt with and closed in 311. Any service request that has not been closed by this target date, is recorded as overdue.		0.12	0.12		
	City of Calgary	To deliver timely response to customers	Percent of time response to an emergency in the water distribution system is within 1 hour				x					x						x					x	Number of trouble calls responded to within one hour / total number of trouble calls. The response time is measured from the time the call is activated to the time the crew arrives on site.	This measure tracks Water's performance on responding to an emergency in the distribution system like a Water Main break. The one hour response time target is the service level for emergencies in the water distribution system.	0.8	0.88		
	City of Calgary	To deliver timely response to customers	Percent of time response to an emergency in the wastewater collection system is within 2 hours				x				x						x					x		Number of trouble calls under 2 hours / total number of trouble calls. Data entry errors and calls during non-service hours between 1:30 am and 6:30 am are excluded from calculations. The response time is measured from the time the call is activated to the time the crew arrives on site.	This measure tracks Water's performance on responding to an emergency in the wastewater collection distribution system (e.g., choked main or sewer back-up) The two hour response time target is the service level for emergencies in the wastewater collection system.	0.8	0.8		
	City of Calgary	To provide safe, adequate supply of quality drinking water	Drinking Water Quality complaints					x					x					x					x	The data is presented as a quarterly total or average for the reporting period. The complaints are the number of 311 water quality service requests on drinking water odor, taste, color and appearance.	This measures the number of customer complaints on water quality related to odor, taste, color and appearance. This is a leading indicator of the level of customer satisfaction with the quality of drinking water.	TBD	171		

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A2. Customer Satisfaction	Louisville	Enhance Customer Service, Satisfaction, and Value	Meet and exceed customer needs and expectations, including providing appropriate information on product quality and services					x					x					x					x	Quarterly Customer Survey measuring information, reliability, and price value	Average information factor >=830 Average reliability factor >= 900 Average Price/Value factor >=785	830 900 785	823 887 740		
	Louisville	Enhance Customer Service, Satisfaction, and Value	Invest in new technologies and programs to enhance customer satisfaction and achieve best in in class customer service				x					x					x						x	Total % abandonment rate	% of abandoned calls				
	Louisville	Enhance Customer Service, Satisfaction, and Value						x					x					x					x	Water Rate Changes	Water rate changes at or below CPI +1	2.60%	4.50%		
	Union Sanitary District	Fast response to customer calls	Fast response to calls for service result in satisfied customers and fewer claims against the District. It also minimizes negative impacts on the environment.					x					x				x					x		Response time to calls	From time initial call is received until crew is on-site	Within 1 hour 95% of the time	96%	Call logs, Work order system records	
	Union Sanitary District	Collecting customer feedback	We distribute customer feedback surveys to permit customers, regulated industrial users and the general public.				x				x					x					x			Positive responses on surveys (varies depending on the type of survey)		Varies	Varies		
	Gwinnett County DWR	Main breaks per 100 miles	Gwinnett balanced scorecard metric					x					x					x					x	main breaks/ 100 miles per year	This metric divides the total number of distribution main breaks in the county distribution system by 100 miles of water mains. The denominator does not include the length of service lines between the mains and the meter. Twelve-month rolling average data.	10.5	5.9	Monthly operations report.	
	Gwinnett County DWR	Unplanned outages per 1000 accounts	Gwinnett balanced scorecard metric					x					x					x				x		Unplanned outages per 1000 accounts	This indicator will give the number of unplanned water outages experienced by water customers. The KPI is expressed as the number of customers experiencing unplanned service disruptions per 1000 customer accounts on a month-by-month basis. Customer outages of any duration are counted as one each.	5.5	6.9	Monthly operations report.	This indicator will provide information on the effectiveness of distribution maintenance, rehabilitation, and repair activities vis-a-vis unplanned water service outages. This KPI will also provide input on future valve spacing and installation, and whether valves are properly positioned
	Gwinnett County DWR	Average speed to answer	Gwinnett balanced scorecard metric				x				x				x					x				avg speed to answer (R12MA)	Average speed to answer is the monthly average number of minutes customers calling Customer Service and Billing must wait before they get a service representative on the line. Units are expressed as minutes and decimal fractions of minutes, not as minutes and seconds.	3	6.39	Hi-Path call management systems	Intention to Increase our responsiveness to customers
	Gwinnett County DWR	% distribution response time < 2 hours	Gwinnett balanced scorecard metric					x					x					x				x		% distribution response time < 2 hours	This KPI represents the percentage of calls during the given month to which Distribution crews respond within two hours if repairs are to occur immediately; otherwise, this KPI measures the duration between notification and the time that an inspector/investigator arrives on scene.	75	74	SAP work orders & monthly reports	The KPI will assist in implementation of policies and procedures to meet customers' level of service reliability expectations. DWR made a conscious business decision to set lower targets and limits for this particular KPI and to not fix leaks if the overtime repair cost exceeds the lost revenue. Distribution crews will nonetheless continue to repair leaks after hours that threaten property damage, health, or traffic problems
	Gwinnett County DWR	% collection response time < 2 hours	Gwinnett balanced scorecard metric					x					x					x				x		% collection response time < 2 hours	This metric calculates the percentage of calls responded by the Collections crew within two hours if repairs are to occur immediately; otherwise, it measures the time for an investigator or inspector to arrive on scene. Examples of reasons for the call include sewer line repair and contractor damages to sewer lines	85	87	SAP, Lucity work order and monthly report	Track and improve repair crew response time to reduce SSO volume
	Gwinnett County DWR	e-transactions	Gwinnett balanced scorecard metric					x					x					x			x			no. of e-transactions	This KPI measures the monthly number of water and sewer customers who conduct transactions through any of several e:business modules	45000	62424	web portal information; SAP/ISU invoicing & billing reports	Reduce customer service and billing unit costs, making more personnel resources available to assist customers with issues. Customers have the option of eliminating their paper bill, which reduced meter reading contracts and postage
Satisfaction	Tualatin Valley	Rewards for Cust Svc Excellence	Pat on the Back program - public recognition for excellent customer service. When customer or coworker finds employee going above and beyond, their name is submitted for a 'Pat on the Back'					x					x				x						x		Count of number of submissions rec'd	100	120	Spreadsheet kept by HR staff	Easy to get these for 'front line' employees - harder for admin or support functions

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A2. Customer	South East Water	Customer Complaints KPI	To monitor the number of complaints made. Can be used to measure improvements in the service Company is providing to customers.					x					x					x				x		Complaints received per 1,000 Customers		3.0	3.4	Montage HiAffinity	
	South East Water	Complaints to EWOV	To monitor the number of complaints made to the Energy & Water Ombudsman in relation to Company business. This provides information as to how well Company handles customer complaints.					x					x					x					x	Complaints received per 1,000 Customers		0.164	0.220	Benchmarked as a metro water supplier Benchmarked Victoria wide	
	South East Water	Unmet Customer Demand for Recycled Water	The volume of lost Class A water delivery due to a treatment plant shutdown that was/is prompted by out-of-specification recycled water as specified in the ‘Product Specifications and Standards Plan.					x					x				x					x		Volume of water not able to meet demand (ML)		63 ML	2.7 ML	KPI Reports	
	South East Water	Customer minutes off supply (planned & unplanned)	To report the Customer minutes off water supply for the reporting period. It is a partial indicator of customer service and the condition of the water network, and how effectively the operation of the network is being managed.					x					x					x					x	å (Interruption time x Customers Affected) ¾¾¾¾¾¾¾¾¾¾¾¾¾ Total No of Company Customers		25.3 min	21.0 min	ESC Audits - A1	
	South East Water	Spills within buildings from sewerage system	To monitor sewage system performance and its impact on private buildings from spills.				x						x					x					x	Total number of spills		20	24		
	South East Water	Account Call Centres - Calls answered within 30 seconds (%)	To maintain customer service standards in respect to answering of account and customer enquiry phone calls by the business.					x					x					x					x	% of calls answered within 30 seconds		93.00%	94.10%	ESC Audits - A1	
	South East Water	Account Call Centre Quality	To monitor and assess the nature of responses provided by the call centre staff to its customers for contiguous training and improvement.				x				x						x						x	Each individual member is assessed based upon pre-set criteria and a team score is derived from these figures		N/A	N/A	Procedure	This is a new measure which only commenced at the start of the current 2001/12 financial year. Target is set at 90%
	South East Water	Fault calls answered within 30 seconds (%)	To maintain customer service standards in respect to answering of fault calls by the business					x					x					x					x	% of calls answered within 30 seconds		96.00%	96.90%	ESC Audits - B1	
	South East Water	Unplanned water supply interruptions restored within 3 hours (%)	This indicator determines the quality of the water supply service response to unplanned interruptions. The amount of time customers are without service is to be managed within tolerable guidelines and the Customer Charter					x					x					x					x	% of unplanned interruptions restored within 3 hrs		90.00%	89.60%		
A2. Customer Satisfaction	South East Water	Unplanned water supply interruptions restored within 5 hours (%)	This indicator determines the quality of the water supply service response to unplanned interruptions. The amount of time customers are without service is to be managed within tolerable guidelines and the Customer Charter					x					x					x					x	% of unplanned interruptions restored within 5 hrs		99.70%	99.40%		
	South East Water	Unplanned customer minutes off water supply (minutes)	To report the unplanned Customer minutes off supply for the reporting period. It is a partial indicator of customer service and the condition of the water network, and how effectively the operation of the network is being managed.					x					x					x					x	å (Interruption time x Customers Affected) ¾¾¾¾¾¾¾¾¾¾¾¾¾ Total No of Company Customers		17.1 min	15.3 min		
	South East Water	Average duration of planned water supply interruptions (minutes)	This is when the customer has received at least 2 days notification of the interruption. All notified interruptions caused by third parties should be included. This differs from the Asset Performance definition, was it involved periodic maintenance of our infrastructure.					x					x					x					x	Total time of all water supply interruptions divided by total number of interruptions	Average amount of time (mins) customers are without water supply due to planned works	205.6 min	184.7 min	Prometheus Montage Dashboard Communications Centre Script IMS	
	South East Water	Planned water supply interruptions restored within five hours (%)	This indicator determines the quality of the water supply service response to planned interruptions. The amount of time customers are without service is to be managed within tolerable guidelines and the Customer Charter					x					x					x					x	Percentage of planned water supply interruptions that are restored within five hours		74.20%	74.90%		
	South East Water	Average planned customer minutes off water supply (minutes)	To report the planned Customer minutes off supply for the reporting period. It is a partial indicator of customer service and the condition of the water network, and how effectively the operation of the network is being managed.					x					x					x					x	å (Interruption time x Customers Affected) ¾¾¾¾¾¾¾¾¾¾¾¾¾ Total No of Company Customers		7.1 mins	5.7 mins		
	South East Water	Time taken to rectify sewer blockage (minutes)	The responsiveness of the business to sewer blockages is a measure of its quality of service and resourcefulness					x					x					x					x	Total time taken (mins) to rectify all blockages divided by total number of blockages		147 min	128 min		
	South East Water	Customer Satisfaction KPI	Customer satisfaction with Company on a scale of 0 to 10, where 6 and above is deemed to be satisfied.					x					x					x					x	% of customers rating Company at 6 and above		80%	84%	Surveyed every 12 months	

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		Customer Satisfaction (for new product or service)	Average percentage of the customer satisfaction survey result from customers who have purchased goods or services from Company.			x					x							x				x		Average % of survey result for new products/services		87%	90%		
	South East Water	Willingness to pay	Survey/Study Undertaken to ascertain customers willingness to pay for variety of initiatives				x					x				x						x		No Metric		N/A	N/A	Survey/Study Results	
A3. Employee Leadership & Development	Green Bay MSD	Succession Planning	Ensuring internal staff interested in positions are prepared to compete with external candidates			x				x						x					x			Competitiveness of interested internal candidates	Positions that require external competition			Report from HR manager	
	Green Bay MSD	Leadership Development	Number of candidates successfully completing GBMSD leadership development program				x					x					x					x		Number of candidates that successfully complete the program		90%	90%	Report from HR manager	
	Toronto Water	High performing workforce	Enhance management and staff accountability			x					x						x					x		Management supervisor training	Number of training hours completed/ Number of Managers and Supervisors	TBD	9.7	Data from Skills and Development and Human Resources records	
	Toronto Water	Employer of choice	Measures high performing workforce retention			x					x					x				x				Voluntary exits	Number of voluntary exits/ Total number of Budgeted Positions	TBD	0.40%	Data from HR records & budget documents	
	Region of Peel	Succession Planning	Identifying successors for positions within the organization and ensuring staff identified have adequate training			x				x					x						x			Positions that have a successor	Number of positions that have an identified internal successor versus total number of positions	N/A	N/A	Training program in place that captures licensing information and courses attended for unionized staff only. The training program is well developed but staff movement into senior positions is not documented.	Supervisors and managers have observed staff moving up into senior positions but not formally documented. Succession planning is a new initiative that is in development.
A3. Employee Leadership & Development	Charleston Water	Associate Satisfaction	Levels measure associate satisfaction with their employment derived from the bi-annual CWS Associate Survey. The associate survey is a critical component in measuring associate satisfaction, and all CWS employees are encouraged to participate.					x					x					x					x	Percent satisfied overall		80%	85%	Third-party report; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Associate Survey Participation	Levels measure the percentage of CWS associates who participated in the bi-annual CWS associate survey					x					x					x					x	Percent participation		85%	83%	Third-party report; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Performance Plans Aligned with Strategic Plan	Levels measure integration of the Strategic Plan into individual performance goals and associate development plans.					x					x					x					x	Percent associates		99.50%	84.92%	HR reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Sick Days per Associate	Levels measure the number of sick days used annually per full time employee (FTE).					x					x					x					x	# sick days used annually per full time employee (FTE)		5	6.13	HR reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Formal Grievances Filed	Levels reflect the number of formal grievances filed by associates each year. Coupled with the associate survey, this is another measure of associate satisfaction.					x					x					x					x	# grievances filed by associates per year		2	2	HR & Human Affairs Program reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Team Incentive Completion	Levels measure the percentage of team incentives completed on an annual basis. Team Incentives involve large groups of individuals within a department working together to accomplish a series of action items (action plan) with a major end-goal established.					x					x					x					x	% team incentives completed per year		98%	100%	Performance Scorecard software	Performance Indicator (PI); Accomplishing Team Incentives is a major factor in fostering teamwork, customer focus, and performance excellence.
	Charleston Water	Exit Interview Completion	Levels measure the percentage of exit interviews completed on associates leaving the organization.					x					x					x					x	% associates exit interviews completed on		75%	45%	HR reports; Performance Scorecard software	Performance Indicator (PI); Exit interviews are considered a good source for collecting information vital to continuous improvement.
	Charleston Water	Total Leadership Training Hours Delivered	Levels reflect the stratification of total CWS training by hours devoted solely to developing leaders in the organization.				x					x					x						x	Hours	Total all leadership training	6000	6729	HR reports; Performance Scorecard software	Key Performance Indicator (KPI)
	Charleston Water	Training Hours Per Associate	Levels measure the number of training hours accomplished per full time employee (FTE) on an annual basis.				x					x					x						x	Hours per associate		50	53.4	HR reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Skills Training Hours Delivered	Levels measure the amount of training devoted to skilled workers in CWS.				x					x					x						x	Hours	Total all training	7000	9162	HR reports; Performance Scorecard software	Key Performance Indicator (KPI)
	Charleston Water	Environmental Certifications	Levels show the total number of certifications held versus the total number required to meet environmental operating permit requirements.					x					x					x					x	Number associates with certification	Includes water treatment, water distribution, wastewater collection, & wastewater treatment	Required: 7	Actual: 84	S.C. State database; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Safety Training Hours per Associate	Levels measure the total amount of safety training delivered per FTE.					x					x					x					x	Hours per associate		12	12.16	Training Management System (TMS) database; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Training Evaluations	Levels measure CWS training ranking scores on an annual basis.				x					x					x					x		1 to 5 Scale (5 best)		4.85	4.91	HR reports; Performance Scorecard software	Performance Indicator (PI)

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				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
	Charleston Water	Percent Associates with Career Development Plans	CWS develops its associates toward meaningful initiatives for professional and career growth. Levels measure the number of associates who have career development plans in place in support of the CWS Succession Plan.					x					x					x					x	% Associates with plans		99%	89%	Performance Appraisals; HR reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Promotions within Career Paths	Levels measure the number of promotions within associates' career path.					x					x					x					x	Number of promotions		75%	92%	HR reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Voluntary Turnover	Levels measure the annual rate for associates who have resigned voluntarily.					x					x					x					x	% associates resigned voluntarily		1.29%	4.60%	HR reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	First Year Turnover	First-Year Turnover stratifies annual turnover, measuring the percent of new employees who leave the company during their first year of employment regardless of reason.					x					x					x					x	% First-year turnover		5.50%	18.75%	HR reports; Performance Scorecard software	Performance Indicator (PI)
A3. Employee Leadership & Development	Charleston Water	CWS Performance Appraisal Trends	CWS use associate performance analyses to continuously improve our work environment toward high associate engagement, motivation and satisfaction, along with a focus on high continually improving performance.					x					x					x					x	% Associates meeting "Fully Meets High Expectations" or better		None	98.40%	Performance Appraisals; HR reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Associate Recognition	Levels measure the amount of positive associate responses to the statement "I am Recognized for my work." in recent associate surveys.					x					x					x					x	% Associates	Answered survey question with "I am recognized for my work"	60%	68%	Survey instrument; HR reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Expenditures Devoted to the Human Resources Dept.	Expenditures devoted to HR infer direct support of associate programs toward associate satisfaction and well-being. Measures the percent of total annual CWS budget applied toward the HR budget.					x					x					x					x	% Total budget devoted to HR		1.55%	1.57%	Financial Management System software; budget reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Ethical Practices Results-Associate Surveys	Levels reflect the percentage of CWS associates who agree or strongly agree that management and the company establishes and maintains high ethical standards.					x					x					x					x	% Associates	These levels additionally demonstrate the overall ethical atmosphere at CWS.	85.00%	80.00%	Survey instruments; Performance Scorecard software	Performance Indicator (PI)
	ABCWUA	Employee Turnover Rate	Rate of employee departures (voluntary, involuntary, retirement) per year as a percentage			x					x					x					x			Number of regular employee departures divided by average number of regular employees			12%	Combination of Peoplesoft ERP and Lotus databases	No target has been established for this metric as it was obtained for the 2009 QualServe Survey
	ABCWUA	Retirement Eligibility	Rate of employees eligible for retirement within the next five years, as a percentage			x					x				x					x				Number of regular employees eligible for retirement within the next five years, divided by the average number of regular employees			19%	Combination of Peoplesoft ERP and Lotus databases	No target has been established for this metric as it was obtained for the 2009 QualServe Survey
	ABCWUA	Internal Promotions	Rate of internal employee promotions per year as a percentage			x					x					x					x			Number of internal promotions divided by total number of positions filled			33%	Combination of Peoplesoft ERP and Lotus databases	No target has been established for this metric as it was obtained for the 2009 QualServe Survey
	ABCWUA	Vacant Positions	Maintain a utility-wide vacancy rate					x					x				x					x		Percent of vacant positions divided by total budgeted positions		9%	7%	Combination of Peoplesoft ERP and Lotus databases	
	ABCWUA	Training Hours per Employee	Measure the quantity of formal training ABCWUA employees actually completing				x					x				x					x			Number of formal training hours per employee per year	Improve employee knowledge and skills to maintain a motivated and effective works force	24	22	Spreadsheet maintained by Training Manager	
	Region of Durham	NWWBI - Water Utility	Certification of Field Staff					x					x					x					x	Certified Distribution System and Treatment Plant Field Staff	Enter the number of certified field staff employed at each certification level for the distribution system and the treatment plant (where certification is based on experience and the successful completion of training and examinations to the requirements of the Provincial Regulator). Record only the highest certification gained by any one staff member, unless that staff member is cross trained between treatment and collection, whereupon a second certification may be added.			Recorded for MOE - helps to know who is certified to move into vacancies	
	Region of Durham	NWWBI - Water Utility	Labour Rates					x					x					x					x	Distribution System and Treatment Plant Field Staff	Add the hourly wages paid to field staff according to the different classes defined by your certifying provincial authority. Rates should exclude all benefits paid by the employer on the employees behalf.			Union Agreement - compares pay scale to other municipalities	

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	Region of Durham	NWWBI - Wastewater Utility	Certification of Field Staff					x					x					x					x	Certified Collection System and Treatment Plant Field Staff	Enter the number of certified field staff employed at each certification level for the collection system and the treatment plant (where certification is based on experience and the successful completion of training and examinations to the requirements of				
	Region of Durham	NWWBI - Wastewater Utility	Labour Rates					x					x					x					x	Collection System and Treatment Plant Field Staff	Add the hourly wages paid to field staff according to the different classes defined by your certifying provincial authority. Rates should exclude all benefits paid by the employer on the employees behalf.				
A3. Employee Leadership & Development	Region of Durham	NWWBI - Water Distribution	Labour Issues indication of Staff Morale and Absenteeism					x					x					x					x	# of sick days taken per field employee	Average number of sick days taken per field employee, including days taken because of sick kids or sick spouses. Excludes long term disability and any time paid by WCB. Also record total # of sick hours taken for field employees for use in the availability calculations.				
	Region of Durham	NWWBI - Water Distribution	Labour Issues					x					x					x					x	# of safety training hours per employee	Average number of safety training hours per field employee.				
	Region of Durham	NWWBI - Water Distribution	Training					x					x					x					x	Total # of safety training hours for actual employees	The total number of safety training hours taken for all field staff employees that includes confined space entry, safety meetings, hazardous chemical training, WHMIS etc. Actual employees refers to the number of field FTEs as entered in the section previous.				
	Region of Durham	NWWBI - Water Distribution	Training					x					x					x					x	Total # of other training hours per employee	The total number of other training hours taken for all field staff employees that excludes safety training hours but includes conferences, seminars etc. Actual employees refers to the number of field FTEs as entered in the section previous.				
	Region of Durham	NWWBI - Water Distribution	Retirement Issues - Succession Planning					x					x					x					x	# of field employees in age bracket ##-##	Number of field staff employees that are within the given age bracket in the current year when the data sheets are being completed.				
	Region of Durham	NWWBI - Water Distribution	Retirement Issues - Succession Planning					x					x					x					x	# of field staff eligible to retire in X to X years	The calculations for these measures are based on assuming that staff are eligible to retire after either Y years of service or Z years old, whichever condition comes first. To report the number of staff that are eligible to retire in X years, you need to calculate for each field staff their age (z), years of service (y) and number of years until eligible for retirement (x).				
	Region of Durham	NWWBI -Water Treatment	Labour Issues indication of Staff Morale and Absenteeism					x					x					x					x	# of sick days taken per field employee	Average number of sick days taken per field employee, including days taken because of sick kids or sick spouses. Excludes long term disability and any time paid by WCB. Also record total # of sick hours taken for field employees for use in the availability calculations.				
	Region of Durham	NWWBI -Water Treatment	Labour Issues					x					x					x					x	# of safety training hours per employee	Average number of safety training hours per field employee.				
	Region of Durham	NWWBI -Water Treatment	Training					x					x					x					x	Total # of safety training hours for actual employees	The total number of safety training hours taken for all field staff employees that includes confined space entry, safety meetings, hazardous chemical training, WHMIS etc. Actual employees refers to the number of field FTEs as entered in the section previous.				
	Region of Durham	NWWBI -Water Treatment	Training					x					x					x					x	Total # of other training hours per employee	The total number of other training hours taken for all field staff employees that excludes safety training hours but includes conferences, seminars etc. Actual employees refers to the number of field FTEs as entered in the section previous.				

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	Region of Durham	NWWBI -Water Treatment	Retirement Issues - Succession Planning					x					x					x					x	# of field employees in age bracket ##-##	Number of field staff employees that are within the given age bracket in the current year when the data sheets are being completed.				
A3 Employee Leadership & Development	Region of Durham	NWWBI -Water Treatment	Retirement Issues - Succession Planning					x					x					x					x	# of field staff eligible to retire in X to X years	The calculations for these measures are based on assuming that staff are eligible to retire after either Y years of service or Z years old, whichever condition comes first. To report the number of staff that are eligible to retire in X years, you need to calculate for each field staff their age (z), years of service (y) and number of years until eligible for retirement (x).				
	Region of Durham	NWWBI - Wastewater Collection	Labour Issues indication of Staff Morale and Absenteeism					x					x					x					x	# of sick days taken per field employee	Average number of sick days taken per field employee, including days taken because of sick kids or sick spouses. Excludes long term disability and any time paid by WCB. Also record total # of sick hours taken for field employees for use in the availability calculations.				
	Region of Durham	NWWBI - Wastewater Collection	Labour Issues					x					x					x					x	# of safety training hours per employee	Average number of safety training hours per field employee.				
	Region of Durham	NWWBI - Wastewater Collection	Training					x					x					x					x	Total # of safety training hours for actual employees	The total number of safety training hours taken for all field staff employees that includes confined space entry, safety meetings, hazardous chemical training, WHMIS etc. Actual employees refers to the number of field FTEs as entered in the section previous.				
	Region of Durham	NWWBI - Wastewater Collection	Training					x					x					x					x	Total # of other training hours per employee	The total number of other training hours taken for all field staff employees that excludes safety training hours but includes conferences, seminars etc. Actual employees refers to the number of field FTEs as entered in the section previous.				
	Region of Durham	NWWBI - Wastewater Collection	Retirement Issues - Succession Planning					x					x					x					x	# of field employees in age bracket ##-##	Number of field staff employees that are within the given age bracket in the current year when the data sheets are being completed.				
	Region of Durham	NWWBI - Wastewater Collection	Retirement Issues - Succession Planning					x					x					x					x	# of field staff eligible to retire in X to X years	The calculations for these measures are based on assuming that staff are eligible to retire after either Y years of service or Z years old, whichever condition comes first. To report the number of staff that are eligible to retire in X years, you need to calculate for each field staff their age (z), years of service (y) and number of years until eligible for retirement (x).				
	Region of Durham	NWWBI - Wastewater Treatment	Labour Issues indication of Staff Morale and Absenteeism					x					x					x					x	# of sick days taken per field employee	Average number of sick days taken per field employee (days taken because of sick kids or sick spouses not included). Excludes long term disability and any time paid by WCB. Also record total # of sick hours taken for field employees for use in the availability calculations.				
	Region of Durham	NWWBI - Wastewater Treatment	Labour Issues					x					x					x					x	# of safety training hours per employee	Average number of safety training hours per field employee.				
	Region of Durham	NWWBI - Wastewater Treatment	Training					x					x					x					x	Total # of safety training hours for actual employees	The total number of safety training hours taken for all field staff employees that includes confined space entry, safety meetings, hazardous chemical training, WHMIS etc. Actual employees refers to the number of field FTEs as entered in the section previous.				
	Region of Durham	NWWBI - Wastewater Treatment	Training					x					x					x					x	Total # of other training hours per employee	The total number of other training hours taken for all field staff employees that excludes safety training hours but includes conferences, seminars etc. Actual employees refers to the number of field FTEs as entered in the section previous.				

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A3 Employee Leadership & Development	Region of Durham	NWWBI - Wastewater Treatment	Retirement Issues - Succession Planning					x					x					x					x	# of field employees in age bracket ##-##	Number of field staff employees that are within the given age bracket in the current year when the data sheets are being completed.				
	Region of Durham	NWWBI - Wastewater Treatment	Retirement Issues - Succession Planning					x					x					x					x	# of field staff eligible to retire in X to X years	The calculations for these measures are based on assuming that staff are eligible to retire after either Y years of service or Z years old, whichever condition comes first. To report the number of staff that are eligible to retire in X years, you need to calculate for each field staff their age (z), years of service (y) and number of years until eligible for retirement (x).				
	City of Calgary	To strengthen the workplace	Number of Resignations					x					x					x					x	Data is presented as quarterly total for the reporting period. The data only includes core workforce (defined by HR as permanent, probationary or permanent/trial employees) who resigned and have permanently departed The City as of the reporting period. For this definition, retirements are NOT included. Also, movements between Water Resources and Water Services are NOT included.	Resignations of employees could be an indicator of the level of employee satisfaction. Likewise, resignations carry some cost implication to the business, thus monitoring it would provide valuable information to decision-makers.	TBD	20		
	City of Calgary	To strengthen the workplace	Number of retirements					x					x					x					x	Data is presented as quarterly total and quarterly average. The data only includes core workforce (defined by HR as permanent, probationary or permanent/trial employees) who have permanently departed The City with the coding of "Retirement" as of the reporting period. Also, movements between Water Resources and Water Services are NOT included.	To track the actual number of retirements, given the demographic trend of an aging workforce.	TBD	7.5		
	City of Calgary	To strengthen the workplace	Number of new hires					x					x					x					x	data is presented as quarterly total or quarterly average for the reporting period. The data only includes core workforce hired (defined by HR as permanent, probationary or permanent/trial employees) hired from outside the City. Transfers from other business units are not included in the count. Contingent employees (Temporary, Seasonal, etc.) transitioning to Core employees are not included in the count.	To track the actual number of new hires and ascertain the effectiveness of recruitment efforts and the existing and emerging challenges of recruitments.	23	23		
	Louisville	Dedicated workforce committed to innovation and continuous improvement	Provide an environment which values quality of work life, continuous learning, employee contribution, and well being.				x				x						x			x				Talent Resource Planning	All manager positions have documented Talent Resource Planning	All	All		
	Louisville	Dedicated workforce committed to innovation and continuous improvement	Maintain a high level of organizational effectiveness				x				x						x			x				Individual Development Plans	All employees have documented individual development plans	All	All		
	Union Sanitary District	Competency-based training and assessment system	A system of job competency requirements, training and assessments has been developed for the operators, mechanics and collection system workers					x					x			x							x	# Job competency modules developed; # of employees successfully passing assessments	Each module consists of a description of competency requirements, standard answers, SOPs, training materials and a tested assessment process.	Developed annually		JCRs, Training courses, assessment documentation, SOPs	Our system is the only true competency-based training program that we know about in the w/ww profession. Eventually, we will use it to develop staffing plans, and expand into admin areas.
	Union Sanitary District	Leadership School	Combination of community college courses and internal training designed to prepare employees for promotion to mgmt and develop leaders within the organization.			x					x					x					x			No metrics				Participant satisfaction surveys	Currently 4 months into the first 18 month session

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				Process development					Process documentation					Process coverage					Process frequency											
				Informal	Aware	Formalized	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A3. Employee Leadership & Development	Gwinnett County DWR	Succession planning	Identifying successors for critical management positions within DWR.			x			x						x					x				% key management positions with candidates	Number of key management positions that have an identified internal successor (3) versus total number of positions (13).	100%	23%	Report from managers and HR system.	Tracked via balanced scorecard.
	Gwinnett County DWR	Training hours per employee	Gwinnett balanced scorecard metric			x						x					x					x		avg training hours / water employee	This KPI measures the average hours spent in training per employee in DWR-Water necessary to successfully discharge their responsibilities. This will be a cumulative ytd measure of average hours in training by the employees in the water divisions. All of these certification, general training and safety training hours, as well as conference hours, professional development classes, and professional organization meetings are to be recorded.	14	22-43	Training class attendance rosters, conference attendance, CEU classes, safety class rosters, timesheets.	Water divisions will maintain an accredited, well-educated staff that remain current on the state of the practice for the industry. Ensure that staff are adequately trained on safety issues relevant to their position and job function. A better informed staff should translate into less accidents, less lost time and a better work environment.
	Tualatin Valley	District-wide initiatives	Cross-functional teams formed to tackle District-wide issues build leadership skills			x					x						x				x			None					
	Tualatin Valley	Strategic Planning																											
	MSDGC	Core Competencies	The core competency model has been integrated into the Administration interviewing process. A diverse team is selected for the interview panel. This panel is responsible for identifying the essential compentencies for selecting a candidate to succeed in this position, developing questions based on the identified competencies which are approved by the HR section, and rating candidate for selection purposes.				x					x					x					x		% of key positions that have Core Competencies developed for them.	Number of key positions that have core competencies assigned to them.	100%	100%	HR tracking forms	
	MSDGC	Onboarding Process	Onboarding program includes: onboarding home page, onboarding checklist, new employee e-book, new employee orientation, welcome email and new employee survey.				x					x				x						x		Number of Engineering employees who go through the process.	Onboarding program includes: onboarding home page, onboarding checklist, new employee e-book, new employee orientation, welcome email and new employee survey.	100%	100%	Standard Onboarding Form	
	South East Water	Culture survey	The Human Synergistics OCI & OEI tool is used to measure culture at Company. The full survey is conducted every 12 - 18 months with pulse surveys being conducted periodically. Company also measure culture through an internally					x					x				x						x	Year to Year comparison across business groups. Also used to assess performance key of commercial partners.		N/A	N/A	Detailed Results and Circumplex Analysis	
	South East Water	Leadership Program	Company has developed and implemented a People Manager leadership program that aligns to the organisation's vision and values. The curriculum is underpinned by action learning and includes modules on managing strategic change and Leader as Coach. Company also identify specific leadership development requirements for individuals and apply the Human Synergistic LSI tool to enhance individual leadership capability which is also supported by an assigned Coach.					x					x				x						x	Leadership development is linked to individual PMPs and opportunities for development and training disccussed during formal PMP meetings.		N/A	N/A		Staff deliver their leadership initiative as part of the program delivery requirements
A3. Employee Leadership & Development	South East Water	Reward & Recognition Program	Company has a diverse scheme that recognises both corporate and business unit initiatives. Company incorporates Length of Service Awards into its Reward and Recognition Program, and celebrates a Chairman's Award based on Customer Service.				x					x						x				x		Reward and recognition is delivered through structured and unstructure formats. Staff and managers are encourage to participates in a manner which best suits individual and team/business needs.	Program initiatives are documented in corporate management systems	N/A	N/A	Aquanet HR Assist	"Bruce Naisbitt Award" is nominated and judged by peers
	South East Water	Performance Management Plan	Individual performance and development plans are aligned with business goals and corporate KPI's. The goals are articulated with an action and measure and align to the development plans and organisational values.				x					x					x						x	Performance Management Plans are prepared and assessed annually. Mid year reviews are conducted.		N/A	N/A		
	South East Water	Position Descriptions	Detailed description of each position within the company and their role and skill requirements			x						x				x						x				N/A	N/A		
	South East Water	Training Skills Matrix	A document used for identification of training and skill/s requirements for positions across all areas of the business				x					x				x				x				No Metric		N/A	N/A		
	South East Water	Learning Needs Analysis	Company collate data extracted from Performance and Development Plans and conduct learning needs analysis which informs the Organisation's Professional Development Curriculum.			x				x						x				x				No Metric		N/A	N/A		

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				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
	South East Water	Succession Planning	Workforce Plans are linked to Talent and Succession Management processes. The Workforce Planning process is reviewed each 12 months and linked to employee and position profiling. Peer Reviews are conducted at the Senior Level using McKinsey's 9 Box Grid.				x					x					x				x			% of Positions within the company that have a successor	Number of positions that have an identified internal successor versus total number of positions	50%	30%	Report from managers/HR system	Tracked via spreadsheet by management team
A4. Operational Optimization	Green Bay MSD	Electrical Usage per volume treated	Examines electrical use efficiency based on volume of wastewater treated				x					x					x				x			Electrical use in kWh per million gallons of wastewater treated	Compare to NACWA benchmark	1800	2150	Spreadsheet built on data from operations, accounting, and HR	
	Green Bay MSD	Total Cost per volume treated	Examines total expenses of the utility based on volume of wastewater treated				x					x					x				x			Total annual expenses of the utility per million gallons of wastewater treated	Compare to NACWA benchmark	3000	2310	Spreadsheet built on data from operations, accounting, and HR	
	Green Bay MSD	O&M Cost per volume treated	Examines total O&M expenses of the utility based on volume of wastewater treated				x					x					x				x			Annual O&M expenses of the utility per million gallons of wastewater treated	Compare to NACWA benchmark	1600	1,570	Spreadsheet built on data from operations, accounting, and HR	
	Green Bay MSD	Operations staff per volume per day treated)	Examines number of operations staff (Treatment, maintenance, conveyance) based on volume of wastewater treated				x					x					x				x			Number of operations staff per million gallons per day of wastewater treated	Compare to NACWA benchmark	1.6	1	Spreadsheet built on data from operations, accounting, and HR	
	Green Bay MSD	Total Staff per 10,000 population served	Examines total utility staff based on population served				x					x					x				x			Number of total utility staff divided by population served	Compare to NACWA benchmark	4.8	4.2	Spreadsheet built on data from operations, accounting, and HR	
	Toronto Water	Reliability centered maintenance (RCM) program	Measures the effort for planned maintenance rather than reactive maintenance in order to increase higher infrastructure reliability, rehabilitation and replacement				x					x					x					x		Preventative maintenance ratio	Total number of preventative maintenance activities/ Total number of maintenance activities	TBD	56%	Data from internal work management system records	
	Toronto Water	Meter reliability with optimal technology for accurate water billing and maintenance	Measure the program for replacing all existing water meters and flat-rate accounts with automatic meter reading (AMR) meters				x					x					x					x		Water meter program implementation	Total number of AMR meters installed/ Total number of AMR installations planned	TBD	48%	Data from water meter program management records	
	Toronto Water	Responsiveness to water main breaks	Measures the field responsiveness to water main breaks in order to increase higher infrastructure reliability, rehabilitation and replacement				x					x					x					x		Response time water main break	Total responses to a water main break within 2 hrs of notification/ Total number of responses to water breaks within the reporting period	100%	76%	Data from internal work management system records	
	Toronto Water	Water treatment capacity	Measures the average capacity utilization of the water treatment plants				x					x					x					x		Avg Water Capacity Utilization	Avg day flow/ Plants rated capacity	TBD	52.5%		
	Toronto Water	Wastewater treatment capacity	Measures the average capacity utilization of the wastewater treatment plants				x					x					x					x		Avg Wastewater Capacity Utilization	Avg day flow/ Plants rated capacity	TBD	78.9%		
	Region of Peel	Customer accounts per employee	Examines resource use efficiency				x					x					x					x		Number of accounts per number of full time employees (FTEs)	FTE = 2,080 hour per year of employee time equivalent. This assumes a normal 40 hour work week.	N/A	N/A	National Water and Wastewater Benchmarking Initiative Report	Peel reviews the number of FTEs per 1000 water meters for meter reading only. Peel also considers the number of FTE/ML of water treated and for transmission and distribution the number of FTE per 100 kms of pipe. Peel takes into consideration its service levels to its customers and various maintenance targets which is a more thorough and detailed approach.
	Region of Peel	Chemical use per volume delivered/processed	Examines chemical resource use efficiency based on material per unit of output				x					x					x					x		Amount of chemicals used/MG delivered processed during reporting period				Report from operators	
	Region of Peel	Chemical use per volume delivered/processed	Examines chemical resource use efficiency based on material per unit of output																					kg/ML (kilograms per million litres)	Chlorine - 2.6 kg/ML	N/A		Report from operators	Tracked via spreadsheet by Operations
A4. Operational Optimization	Region of Peel	Chemical use per volume delivered/processed	Examines chemical resource use efficiency based on material per unit of output																						Coagulant (Alum)- 8.9 kg/ML	N/A			Chemical use depends on raw water quality; chemical doses can be optimized but not predicted or targeted. Cannot be compared to other utilities.
	Charleston Water	Planned Maintenance Ratio - Key Processes	Levels measure the effectiveness of the maintenance program. Planned maintenance extends equipment life, reduces downtime, and equipment lifecycle costs.					x					x					x					x	% Planned Maintenance	Planned maintenance ratios above 85% are generally indicative of overstaffed maintenance functions and are less desirable.	80%	Water Treatment: 71%; Water Distribution: 77%; Wastewater Collection: 87%; Wastewater Treatment: 87%	Computerized Maintenance Management (CMMS) reports; Monthly Operating Reports (MORs); Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Planned Maintenance Ratio - Fleet Maintenance	Levels measure the effectiveness of the maintenance program.					x					x				x						x	% Planned Maintenance		60%	56%	Computerized Maintenance Management (CMMS) reports; Monthly Operating Reports (MORs); Performance Scorecard software	Performance Indicator (PI)

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	Charleston Water	Inflow / Infiltration Reduction	Levels measure average daily wastewater flow rates as measured at the Wastewater Treatment Plant and the number of customer accounts.					x					x					x					x	Million Gallons (MG) treated per year	Comparisons are made to the increase in customer accounts	20	21.56	SCADA reports; Monthly Operating Reports (MORs); Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Retention of Lab Certification	Levels show the total percentage of CWS lab parameters that remain certified after regulatory agency biannual laboratory audits.					x					x					x					x	% certified	(i.e., CWS was found to have followed all proper procedures as specified in the CWS Purchasing Guide and prescribed under State requirements)	100%	100%	Lab reports; Monthly Operating Reports (MORs); Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	CWS Procurement - # of Protest / CWS Actions Upheld (%)	Levels show the total number of protests received by CWS annually and the percent of these protests that were not substantiated or had no merit					x					x					x					x	% protests upheld		100%	100%	Purchasing Dept. reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Information Technology - Technical Help Desk - % Turnaround within 3 Days	Levels show the percentage of Help Desk calls that are resolved within three days.					x					x					x					x	% requests resolved within 3 days		80%	84%	IT software; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Wastewater Collection System Integrity	Levels quantify the total number of collection system leaks, breaks, failures, etc., requiring correction and/or repair per 100 miles of piping.					x					x					x					x	# Failures per 100 miles of pipe		7.08	2.93	Computerized Maintenance Management (CMMS) reports; Monthly Operating Reports (MORs); Performance Scorecard software	Key Performance Indicator (KPI)
	Charleston Water	Water Distribution System Integrity	Levels quantify the total number of distribution system leaks, breaks, failures, etc., requiring correction and/or repair per 100 miles of piping.					x					x					x					x	# Overflows per 100 miles of pipe		24.00	17.00	Computerized Maintenance Management (CMMS) reports; Monthly Operating Reports (MORs); Performance Scorecard software	Key Performance Indicator (KPI)
A4. Operational Optimization	Charleston Water	Sanitary Sewer Overflow Rate	Levels provide a measure of wastewater collection system piping condition and the effectiveness of routine maintenance by quantifying the number of sewer overflows per 100 miles of collection piping.					x					x					x					x	# Failures per 100 miles of pipe		2.00	1.46	Computerized Maintenance Management (CMMS) reports; Monthly Operating Reports (MORs); Performance Scorecard software	Performance Indicator (PI)
	ABCWUA	Customer Service Cost Per Account	Measure the amount of resources the ABCWUA applies to its customer service program				x					x					x					x		Total customer service cost and the number of active accounts	Improve efficiency by reducing customer service cost per account while meeting customer expectations	$19.58	$18.98	ERP (Peoplesoft)	
	ABCWUA	Customer Accounts per Employee (Water)	Measure employee efficiency				x					x					x					x		Number of active accounts per employee and average million gallons of water delivered and processed per day per employee	Provide efficient service to our customers to meet their expectations	957	1,023	ERP (Peoplesoft) and Billing System (Oracle CC&B)	
	ABCWUA	Customer Accounts per Employee (Wastewater)	Measure employee efficiency				x					x					x					x		Number of active accounts per employee and average million gallons of wastewater collected and treated per day per employee	Provide efficient service to our customers to meet their expectations	1,114	1,138	ERP (Peoplesoft) and Billing System (Oracle CC&B)	
	ABCWUA	MGD Water Delivered per Employee	Measure employee efficiency				x					x					x					x		Number of active accounts per employee and average million gallons of water delivered and processed per day per employee	Provide efficient service to our customers to meet their expectations	0.45	0.44	ERP (Peoplesoft), Billing System (Oracle CC&B), and SCADA	
	ABCWUA	MGD Wastewater Processed per Employee	Measure employee efficiency				x					x					x					x		Number of active accounts per employee and average million gallons of wastewater collected and treated per day per employee	Provide efficient service to our customers to meet their expectations	0.32	0.33	ERP (Peoplesoft), Billing System (Oracle CC&B), and SCADA	
	ABCWUA	Water O&M Cost Ratios: O&M Cost per account	Quantify all utility costs related to operations and maintenance (O&M), with breakouts of those costs related to water treatment and delivery, as related to volumes processed and the number of active customers				x					x					x					x		Total O&M costs and total number of active customer accounts	Maintain lower O&M costs without reducing customer level of service	$213	$202	ERP (Peoplesoft) and Billing System (Oracle CC&B)	
	ABCWUA	Water O&M Cost Ratios: O&M Cost per MG processed	Quantify all utility costs related to operations and maintenance (O&M), with breakouts of those costs related to water treatment and delivery, as related to volumes processed and the number of active customers				x					x					x					x		Total O&M costs and total volume of water distributed	Maintain lower O&M costs without reducing customer level of service	$1,297	$1,206	ERP (Peoplesoft) and Billing System (Oracle CC&B)	
	ABCWUA	Water O&M Cost Ratios: Direct cost of treatment per MG	Quantify all utility costs related to operations and maintenance (O&M), with breakouts of those costs related to water treatment and delivery, as related to volumes processed and the number of active customers				x					x					x					x		Total Direct O&M costs and total volume of water treated	Maintain lower O&M costs without reducing customer level of service	$48	$55	ERP (Peoplesoft) and Billing System (Oracle CC&B)	
	ABCWUA	Wastewater O&M Cost Ratios: O&M Cost per account	Quantify all utility costs related to operations and maintenance (O&M), with breakouts of those costs related to wastewater collection and treatment, as related to volumes processed and the number of active customers				x					x					x					x		Total O&M costs and total number of active customer accounts	Maintain lower O&M costs without reducing customer level of service	$144	$140	ERP (Peoplesoft) and Billing System (Oracle CC&B)	

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	ABCWUA	Wastewater O&M Cost Ratios: O&M Cost per MG processed	Quantify all utility costs related to operations and maintenance (O&M), with breakouts of those costs related to wastewater collection and treatment, as related to volumes processed and the number of active customers				x					x					x					x		Total O&M costs and total wastewater collected	Maintain lower O&M costs without reducing customer level of service	$813	$713	ERP (Peoplesoft) and Billing System (Oracle CC&B)	
	ABCWUA	Wastewater O&M Cost Ratios: Direct cost of treatment per MG	Quantify all utility costs related to operations and maintenance (O&M), with breakouts of those costs related to wastewater collection and treatment, as related to volumes processed and the number of active customers				x					x					x					x		Total Direct O&M costs and total wastewater treated	Maintain lower O&M costs without reducing customer level of service	$358	$349	ERP (Peoplesoft) and Billing System (Oracle CC&B)	
A4. Operational Optimization	ABCWUA	Distribution System Water Loss (Apparent Loss)	Quantify the percentage of produced water that fails to reach customers and cannot otherwise be accounted for through authorized usage			x					x				x					x				IWA/AWWA Water Audit Method using sound, consistent definitions for the major forms of water consumption and water loss encountered in drinking water utilities	Improve water use efficiency and recover lost revenue		4%	AWWA Water Audit Software	No target has been established for this metric as it was obtained for the 2009 QualServe Survey
	ABCWUA	Distribution System Water Loss (Real Loss)	Quantify the percentage of produced water that fails to reach customers and cannot otherwise be accounted for through authorized usage			x					x				x					x				IWA/AWWA Water Audit Method using sound, consistent definitions for the major forms of water consumption and water loss encountered in drinking water utilities	Improve water use efficiency and recover lost revenue		9%	AWWA Water Audit Software	No target has been established for this metric as it was obtained for the 2009 QualServe Survey
	ABCWUA	Water Energy Consumption Efficiency	Measure the direct energy consumed to supply treated water expressed as kWh/MG			x				x						x					x			Direct energy consumed to supply treated water divided by the volume supplied and treated on an annual basis			44,309	SCADA & Electric Utility Billing	No target has been established for this metric as it was obtained for the 2009 QualServe Survey
	ABCWUA	Wastewater Energy Consumption Efficiency	Measure the direct energy consumed to collect and treat wastewater expressed as kWh/MG			x				x						x					x			Direct energy consumed to collect and treat wastewater divided by the volume collected and treated on an annual basis			25,797	SCADA & Electric Utility Billing	No target has been established for this metric as it was obtained for the 2009 QualServe Survey
	Region of Durham	NWWBI - Water Utility - Meets service requirements with Economic Efficiency	- Operating Cost Effectiveness - Cost of water Quality Monitoring/population served					x					x					x					x	Cost of all water quality monitoring	Annual costs of all water quality monitoring for the water utility, i.e. includes monitoring for the distribution/transmission system and all water treatment plants (including sources). Includes laboratory wages, supplies, contracted work etc. Includes costs for all plants and systems in the water utility whether benchmarked individually or not. Excludes costs of replacing equipment such as analysers and includes costs of process tests e.g. from filters				Lab Costs for all the testing
	Region of Durham	NWWBI - Water Utility - Meets service requirements with Economic Efficiency	Cost of Customer Billing/ Service Connection																					Cost of water customer billing	The water utility cost to bill customers. That is the cost of producing bills and sending bills, but it also includes the cost of bill adjustments and re-bills and any extraordinary costs such as special needs and ad hoc requests. The cost to operate and maintain the billing system (operating system lease, back office) and collection agency costs must be included here as well. If there is shared customer billing, for example water and wastewater, then allocate the cost specifically for the water utility (if unknown then allocate by # of customers). This cost excludes the cost of metering O&M and meter reading.			Total amount from budget numbers - no breakdown available	*no actual cost of customer billing broken down for water and sewer - prorated out by number of accounts
	Region of Durham	NWWBI - Water Utility - Meets service requirements with Economic Efficiency	Total Operating cost/population served					x					x					x					x	Total water operating cost	The sum of all annual operating costs (O&M and indirect charge-backs) for water treatment and distribution/transmission systems. Include costs for all plants and systems in the water utility whether benchmarked individually or not. Includes all costs related to infrastructure that the utility owns and operates. Includes O&M revenues for treated water supplied to neighbouring regions/municipalities. Excludes capital costs and costs. Excludes Bulk water purchase (considered separately).			Budgets/ Planning Populations	

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A4. Operational Optimization	Region of Durham	NWWBI - Water Utility - Meets service requirements with Economic Efficiency	Total Operating Cost/ ML Treated					x					x					x					x	Total ML Treated	The total volume of treated water received from the treatment plants to the distribution/transmission system. Equals the total treated water if there is only one treatment plant delivering water to the transmission/distribution system. (Include treated water volume supplied to neighbouring regions/municipalities)				
	Region of Durham	NWWBI - Water Utility - Protect the Environment	Cost of Water Conservation Program/Population Served				x					x					x					x		Cost of water conservation program	Includes all costs incurred by the utility during that year for the program promoting conservation of potable water.				
	Region of Durham	NWWBI - Water Utility - Provide Good Customer Communication	Cost of Customer Communication/Population Served		x					x														Cost of Customer Care	Includes all costs incurred by the utility to communicate with customers. This includes customer service centre or call centre operator wages, equipment and supplies, and customer follow up. It includes the costs to produce brochures, the costs to publish water quality reports, the cost of maintaining a utility website, etc.				
	Region of Durham	NWWBI- Water Distribution - Meets service Requirements with Economic Efficiency	O& M Cost/km length - cost effectiveness					x					x					x					x	Total Cost O & M/ total pipe length	Operation & Maintenance cost allocations for the entire distribution system minus those relating specifically to pump stations and customer metering. Exclude capital costs. Capital replacements should be recorded under "Capital Investments", and new capital under "New Capital Investment" (note that if minor capital costs cannot be separated out, indicate the $ limit for minor capital in the Notes field). See also definitions for Wages, Equipment and Materials, Contracted Services (Internal), Contracted Services (External), Energy, Staff Training & Other.				
	Region of Durham	NWWBI- Water Distribution - Meets service Requirements with Economic Efficiency	O & M Cost / km length - Cost Effectiveness					x					x					x					x	Total Length	Total length of main in the distribution/transmission/integrated system (i.e. excluding length of service connections, hydrant leads and standpipe leads). For the distribution system length include all connecting pipes between pump stations, rechlorination facilities and storage facilities if these are located within the distribution system. For the transmission system length include all connecting pipes between pump stations, rechlorination facilities and storage facilities when located between the source and the treatment plant or between the treatment plant and the distribution system.				
	Region of Durham	NWWBI- Water Distribution - Meets service Requirements with Economic Efficiency	O&M Cost +Actual Indirect Chargeback/km length					x					x					x					x	Indirect Chargebacks	The total cost of all indirect services that the utility paid under the water utility distribution system's budget. Indirect services include Admin, Human Resources, Finance, Customer billing, Insurance, IT (including GIS and other information management systems except for Maintenance Management Systems as these are considered O&M) and any other similar costs that support the utility.				
	Region of Durham	NWWBI- Water Distribution - Meets service Requirements with Economic Efficiency	O & M Cost as % of replacement value - cost effectiveness																					Total Replacement Value	The amount of money needed to replace all of the existing infrastructure. The replacement value shall include all engineering costs, construction, supervision, taxes, etc (excluding land purchasing). If this value is developed by a calculations based on unit values times the number of units, unit replacement values shall be estimated based on average construction costs over the last 5 years. For example, if 20 main replacements have been constructed over the last five years, the average unit cost per km of main can be estimated from all 20 construction projects (excluding inflation).				

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A4. Operational Optimization	Region of Durham	NWWBI- Water Distribution - Meets service Requirements with Economic Efficiency	Pump Station O&M Cost/ pump station Horsepower																					Total Hp for all pump stations	Sum of the pump station horsepower for all pumps (including standby) in all pump stations in the distribution system. Exclude any pumps that are required to pump from the water treatment plant to the distribution system (treated water pumps within the treatment plant).				
	Region of Durham	NWWBI- Water Distribution - Meets service Requirements with Economic Efficiency	Metering O&M Costs /# of Meters																					Metering O&M Costs /# of Meters	All Operations & Maintenance cost allocations for customer meter reading, billing and maintenance. If metering costs cannot be identified, a percent of total system O & M costs can be estimated. Total System O&M cost = Pipes O&M cost + Pump Station O&M cost + Metering O&M cost. Capital replacements should be recorded under "Capital Investments", and new capital under "New Capital Investment" (note that if minor capital costs cannot be separated out, indicate the $ limit for minor capital in the Notes field). See also definitions for Wages, Equipment and Materials, Contracted Services (Internal), Contracted Services (External), Energy, Staff Training & Other. Note, the cost of meter reading should additionally be recorded as a separate item under the category and heading "Distribution-Goal 3-Other Costs". Customer billing should also be recorded in this way under the category and heading "Utility-Rates & Financing-Goal 3". The sum of all meters within the distribution/transmission system. In some cases this will be greater than the number of metered service connections due to some properties having many meters (e.g. if a strata has a meter at the property line plus meters at each unit).			The sum of all meters within the distribution/transmission system. In some cases this will be greater than the number of metered service connections due to some properties having many meters (e.g. if a strata has a meter at the property line plus meters at each unit).	
	Region of Durham	NWWBI- Water Treatment Meets service Requirements with Economic Efficiency	O & M Cost / ML Treated - Cost Effectiveness																					Total O& M Cost/ ML Treated	Sum of the actual O&M costs incurred in the operation of the water treatment plant (excludes capital costs, indirect costs, transfers to reserves and debt/interest charges). Revenues are only included where there are recoveries for work done by Water Utility staff that is extraneous to the utility (for example, for lab tests for other utilities). Total O&M should exclude O&M revenues received for treated water supplied to neighbouring regions/municipalities.				
	Region of Durham	NWWBI- Water Treatment Meets service Requirements with Economic Efficiency	O & M Cost / Groundwater Well - Cost Effectiveness																					Groundwater Well System Replacement Cost	The amount of money needed to replace all existing infrastructure used for raw water treatment; include costs relating to surface water abstraction, surface water storage reservoirs, pumping facilities and related infrastructure - do not include costs for groundwater infrastructure (see below). The replacement value shall include all engineering costs, construction, supervision, taxes, etc (excluding land purchasing). Total value for each type of infrastructure is calculated by multiplying the unit value by the number of units (where appropriate). Unit replacement values shall be estimated based on average construction costs over the last 5 years. For example, if 20 main replacements have been constructed over the last five years, the average unit cost per km of main can be estimated from all 20 construction projects (excluding inflation).				

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A4. Operational Optimization	Region of Durham	NWWBI- Water Treatment Meets service Requirements with Economic Efficiency	O&M Cost + Capital Reinvestment Cost/ML Treated					x					x					x					x	Capital Reinvestment	A project which substantially maintains the life of the treatment system. This is intended to be a measure of reinvestment to maintain current facilities and excludes expansion of system to handle growth and upgrading to a higher level of service. Projects which serve one or more purpose (maintenance and expansion) should be prorated in order to also capture the capital applied for investment activities. Include both contracted capital work and internal costs associated with capital such as wages for capital engineering staff i.e. design, tendering, etc. Includes capital reinvestment (i.e. replacement) costs for utility systems components (for example: pipes (including valves, hydrants, reservoirs etc), pump stations and meters).				
	Region of Durham	NWWBI- Water Treatment Meets service Requirements with Economic Efficiency	O&M Cost +Actual Indirect Chargeback/ML Treated			x				x							x						x	Indirect Chargeback	The total cost of all indirect services that the utility paid under the water treatment plant's budget. Indirect services include Admin, Human Resources, Finance, Customer billing, Insurance, IT (including GIS and other information management systems except for Maintenance Management Systems as these are considered O&M) and any other similar supporting costs.				This amount is not specific - we are given a total for the whole water utility and break it down between linear and vertical by operation expenses and then the vertical portion throughout the plant system by ML Treated
	Region of Durham	NWWBI- Water Treatment Meets service Requirements with Economic Efficiency	Indirect Costs as a % of Total Operating Costs			x				x							x						x	Indirect Chargeback	see above				see above
	Region of Durham	NWWBI- Water Treatment Meets service Requirements with Economic Efficiency	Chemical Cost/ML Treated					x					x					x					x	Chemical Cost	Annual cost for each chemical listed in the table. The value reported should only include the cost for the chemicals consumed this year and not the total cost of chemicals purchased.			Actual receipts of chemicals purchased	
	Region of Durham	NWWBI - Wastewater Utility - Meets service requirements with Economic Efficiency	Total Operating cost/population served					x					x					x					x	Total Operating Costs	The sum of all annual operating costs (O&M and indirect charge-backs) for wastewater treatment and collection/trunk systems. Include costs for all plants and systems in the wastewater utility whether benchmarked individually or not. Includes all costs related to infrastructure that the utility owns and operates Excludes capital costs and costs paid for regional wastewater treatment.				
	Region of Durham	NWWBI - Wastewater Utility - Meets service requirements with Economic Efficiency	Total Operating Cost/ ML Treated					x					x					x					x	Total ML Treated	Total annual volume of all daily flows that enter the treatment plants in ML. For collection only systems, this should be the total annual volume that the municipality contributes to the regional wastewater trunk system.				
	Region of Durham	NWWBI- Wastewater Collection - Meets service Requirements with Economic Efficiency	O& M Cost/km length - cost effectiveness					x					x					x					x	Total Collection System O&M Cost	Sum of the actual O&M costs incurred in the operation of the collection/trunk system (excludes capital costs, indirect costs, transfers to reserves and debt/interest charges). Total System O&M cost = Pipes O&M cost + Pump Station O&M cost. Revenues are only included where they are recoveries for work done by wastewater utility staff that is extraneous to the utility (for example, for lab tests for other utilities).				

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				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A4. Operational Optimization	Region of Durham	NWWBI- Wastewater Collection - Meets service Requirements with Economic Efficiency	O & M Cost as % of replacement value - cost effectiveness					x					x					x					x	Replacement Value Total System	A project which substantially maintains the life of the utility systems. This is intended to be a measure of reinvestment to maintain current facilities and excludes expansion of system to handle growth and upgrading to a higher level of service. Projects which serve one or more purpose (maintenance and expansion) should be prorated in order to also capture the capital applied for investment activities. Include both contracted capital work and internal costs associated with capital such as wages for capital engineering staff i.e. design, tendering, etc. Includes capital reinvestment (i.e. replacement and relining) costs for utility systems components (for example: pipes - including valves, hydrants, reservoirs etc - pump stations and meters).				
	Region of Durham	NWWBI- Wastewater Collection - Meets service Requirements with Economic Efficiency	O&M Cost + Capital Reinvestment Cost/ML Treated					x					x					x					x	Capital Reinvestment	A project which substantially maintains the life of the utility systems. This is intended to be a measure of reinvestment to maintain current facilities and excludes expansion of system to handle growth and upgrading to a higher level of service. Projects				
	Region of Durham	NWWBI- Wastewater Collection - Meets service Requirements with Economic Efficiency	O&M Cost +Actual Indirect Chargeback/km length					x					x					x					x	Indirect Chargebacks	The total cost of all indirect services that the utility paid under the collection system budget. Indirect services include Admin, Human Resources, Finance, Customer billing, Insurance, IT (including GIS and other information management systems except for Maintenance Management Systems as these are considered O&M) and any other similar costs.				
rational Optimization	Region of Durham	NWWBI- Wastewater Collection - Meets service Requirements with Economic Efficiency	Indirect Costs as a % of Total Operating Costs					x					x					x					x	Indirect Chargebacks	see above				
	Region of Durham	NWWBI- Wastewater Collection - Meets service Requirements with Economic Efficiency	Pump Station O&M Cost/Pump Station Horsepower					x					x					x					x	Pump Station O&M Costs and Total PS Hp	All Operations & Maintenance cost allocations for pump station inventory. If pump station costs cannot be identified, a percent of collection system O & M costs will be estimated. Total System O&M cost = Pipes O&M cost + Pump Station O&M cost. Exclude capital costs (if minor capital cannot be separated out, indicate the $ limit for minor capital in the Notes field). Capital costs of pump replacements etc should be recorded under the Capital Reinvestment cost. Capital costs of new pumps etc should be recorded under the New Capital Investment cost. See also definitions for Wages, Equipment and Materials, Contracted Services (Internal), Contracted Services (External), Energy and Staff Training - only apply to pump stations. Sum of the pump station horsepower for all pumps (including standby) in all pump stations in the collection/trunk system. Exclude pump stations servicing only stormwater sewers or influent pump stations located within wastewater treatment plants.				

Appendix B-2
Leading practice documentation

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				Process development					Process documentation					Process coverage					Process frequency											
				Informal	Aware	Formalized	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A4. Operationa	Region of Durham	NWWBI- Wastewater Treatment - Meets service Requirements with Economic Efficiency	Pipes O&M Costs/ km Length																					Pipes O&M Costs	All Operations & Maintenance cost allocations for pipe inventory (including sewer, service connections, manholes, etc.). Total System O&M cost = Pipes O&M cost + Pump Station O&M cost. Exclude capital costs (if minor capital cannot be separated out, indicate the $ limit for minor capital in the Notes field). Capital costs of replacements of pipe etc should be recorded under the Capital Reinvestment cost. Capital costs of new pipes etc should be recorded under the New Capital Investment cost. See also definitions for Wages, Equipment and Materials, Contracted Services (Internal), Contracted Services (External), Energy and Staff Training - only apply to pipe system inventory excluding pump stations.				
	Region of Durham	NWWBI- Wastewater Treatment - Meets service Requirements with Economic Efficiency	O&M Costs per ML Treated																					Treatment Plant O&M Costs (Including Biosolids)	Sum of the actual O&M costs incurred in the operation of the wastewater treatment plant (excludes capital costs, indirect costs, transfers to reserves and debt/interest charges). Revenues are only included where there are recoveries for work done by wastewater treatment staff that is extraneous to the plant (for example, for lab tests for other utilities).				
perational Optimization	Region of Durham	NWWBI- Wastewater Treatment - Meets service Requirements with Economic Efficiency	O&M costs as a % of WWTP Replacement Value					x					x					x					x	Plant Replacement Value	The amount of money needed to replace all of the existing infrastructure. The replacement value shall include all engineering costs, construction, supervision, taxes, etc (excluding land purchasing). Total value for each type of infrastructure is calculated by multiplying the unit value by the number of units (where appropriate). Unit replacement values shall be estimated based on average construction costs over the last 5 years. For example, if 20 main replacements have been constructed over the last five years, the average unit cost per km of main can be estimated from all 20 construction projects (excluding inflation).				
	Region of Durham	NWWBI- Wastewater Treatment - Meets service Requirements with Economic Efficiency	Total Operating Cost with Actual Indirect Chargeback																					Indirect Chargeback	The total cost of all indirect services that the utility paid under the water treatment plant's budget. Indirect services include Admin, Human Resources, Finance, Customer billing, Insurance, IT (including GIS and other information management systems except for Maintenance Management Systems as these are considered O&M) and any other similar supporting costs.				This amount is not specific - we are given a total for the whole water utility and break it down between linear and vertical by operation expenses and then the vertical portion throughout the plant system by ML Treated
	Region of Durham	NWWBI- Wastewater Treatment - Meets service Requirements with Economic Efficiency	Indirect Costs as a % of Total Operating Costs																					see above	see above				

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A4 Ope	Region of Durham	NWWBI- Wastewater Treatment - Meets service Requirements with Economic Efficiency	Biosolids Thickening and Dewatering Costs / Dry Tonnes Dewatered																					Biosolids Dewatering Costs/ Dry Tonnes Dewatered	These include all costs for the Biosolids Dewatering activities; i.e. labour, equipment, materials energy and contracted costs associated with mechanical dewatering. List the processes for which costs have been included in the Notes field on the datasheets. Odour control O&M costs should be included in the biosolids dewatering costs where the odour control processes are directly related to biosolids dewatering operations. See also Wages, Equipment and Materials, Contracted Services (Internal), Contracted Services (External), Energy and Other definitions. Annual volume of sludge / biosolids delivered for dewatering (please convert flow rate based on hours the dewatering equipment is in operation - for example if your centrifuge feed rate is 1 m^3/hr only operating 8 hours a day = 8 m^3. Includes any sludge received from other plants.				
A4 Operational Optimization	Region of Durham	NWWBI- Wastewater Treatment - Meets service Requirements with Economic Efficiency	Biosolids Storage & Disposal Costs / Dry tonnes Remaining after Processing																					Biosolids Storage and Disposal Cost	These include all costs for the Biosolids Storage and Disposal activities; i.e. labour, equipment, materials energy, contracted and other costs associated with: storage lagoons, landfill tipping, land disposal, pumping off-site, trucking off-site, composting completed by an external company, incineration and pelletization. If the costs of trucking off-site or tipping fees are known, record them in the separate data fields. List the storage and disposal activities for which costs have been included in the Notes field on the datasheets. Odour control O&M costs should be included in the biosolids storage and disposal costs where the odour control processes are directly related to biosolids storage and disposal operations. See also Wages, Equipment and Materials, Contracted Services (Internal), Contracted Services (External), Energy and Other definitions.				
	Region of Durham	NWWBI- Wastewater Treatment - Meets service Requirements with Economic Efficiency	Bisolids Management Cost/ Mass Delivered for Processing					x					x					x					x	Bisolids Management Cost/ Mass Delivered for Processing	Sum of the "Biosolids Stabilization Cost", "Biosolids Dewatering Cost" and the "Biosolids Storage and Disposal Cost" plus any additional miscellaneous costs non-specific to either processing or storage and disposal such as public relations costs. If the Biosolids Processing Cost is unknown or incomplete, no data should be entered into this field. The mass of the biosolids/sludge trucked or pumped to another internal wwtp or treatment facility. Note, additional processing at off-site locations completed by an external company are considered as final disposal and are not included in this data. Mass of biosolids removed in dry tonnes = % dry solids x mass (tonnes) or volume (m^3) of wet solids. Assume wet solids have similar density to water, i.e. 1 tonne = 1 m^3.				
	Region of Durham	OMBI - Water	OMBI Total Operating Cost for the Distribution / Transmission of drinking Water per KM of Water Distribution Pipe																					OMBI Total Operating Cost for the Distribution / Transmission of drinking Water per KM of Water Distribution Pipe					

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	Region of Durham	OMBI - Water	OMBI Total Operating Cost for the Treatment and Distribution / Transmission of Drinking Water per Megalitre of Drinking Water Treated					x					x					x					x	OMBI Total Operating Cost for the Treatment and Distribution / Transmission of Drinking Water per Megalitre of Drinking Water Treated					
	Region of Durham	MPMP- Water	Operating Cost for the Distribution / Transmission of drinking Water per KM of Water Distribution Pipe (MPMP)					x					x					x					x	Operating Cost for the Distribution / Transmission of drinking Water per KM of Water Distribution Pipe (MPMP)	In those municipalities were the activity of " water meter reading and billing" results in the issuance of a bill for both water & wastewater services, then the costs of the water meter reading and billing activity should be allocated between water and wastewater programs. Costs could be distributed based on the number of sewer or wastewater accounts relative to the total number of accounts, the number of billing transactions or other cost allocation methodologies which would fairly distribute the cost of the activity between the two service areas.				
A4. Operational Optimization	Region of Durham	MPMP- Water	Operating Cost for the Treatment of Drinking Water per Megalitre of Drinking Water Treated (MPMP)					x					x					x					x	Operating Cost for the Treatment of Drinking Water per Megalitre of Drinking Water Treated (MPMP)	All reporting for both water Supply and Water and Wastewater Measures under the MPMP and OMBI must clearly identify if the Municipality reporting has total jurisdiction over the system (i.e. (Treatment & Distribution/ Transmission) or only has partial jurisdiction over the system such as Treatment only, Treatment & Transmission or Distribution Only Operation & Maintenance Costs for Water Supply Plants include the following: Surface Water Treatment Plants Intake Pipe(s) and Crib(s). All building and structural works. All treatment works, processes and pumping equipment. All mechanical, electrical, and chemical systems Plant Operations control systems and monitoring equipment On site treated water storage reservoirs. High lift pumping equipment to service pressure District 1. All sampling and laboratory tests related to daily operations and testing required to meet compliance reporting in accordance with MOE Certificate of Approval.				
	Region of Durham	OMBI-Wastewater	OMBI Total Operating Cost of Wastewater Collection / Conveyance per KM of Pipe					x					x					x					x						
	Region of Durham	OMBI-Wastewater	OMBI Total Operating Cost of Wastewater Treatment/Disposal per Megalitre Treated					x					x					x					x						
	Region of Durham	OMBI-Wastewater	OMBI Total Operating Cost of Wastewater Treatment/Disposal and Collection / Conveyance per Megalitre Treated					x					x					x					x						
	Region of Durham	MPMP - Wastewater	Operating Cost of Wastewater Collection/Conveyance per KM of Pipe (MPMP)					x					x					x					x						
	Region of Durham	MPMP - Wastewater	Operating Cost of Wastewater Treatment/Disposal and Collection/Conveyance per Megalitre Treated (MPMP)					x					x					x					x						
	Region of Durham	MPMP - Wastewater	MPMP Total Cost of Wastewater Collection/Conveyance per KM of Pipe					x					x					x					x						
	Region of Durham	MPMP - Wastewater	MPMP Total Cost of Wastewater Treatment/Disposal per Megalitre Treated					x					x					x					x						
	Region of Durham	MPMP - Wastewater	MPMP Total Cost of Wastewater Treatment/Disposal and Collection/Conveyance per Megalitre Treated					x					x					x					x						
	City of Calgary	Provide a cost-effective and sustainable water supply system	Average cost of treating a megaliter of water			x							x		x								x	Water Treatment O&M costs ($)/ Total water treated (ML)	This measures the cost of operating and maintaining the water treatment plants per ML unit of water produced	$ 175	$ 140		

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Leading practice documentation

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				Process development					Process documentation					Process coverage					Process frequency											
				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
	City of Calgary	Provide a cost-effective and sustainable wastewater system	Average cost of treating a megaliter of wastewater			x							x		x								x	Wastewater Treatment O&M costs ($)/ Total wastewater treated (ML)	This measures the cost of operating and maintaining the wastewater treatment plants per ML unit of wastewater treated	$ 186	$ 207		
A4. Operational Optimization	City of Calgary	Provide a cost-effective and sustainable distribution system	O&M cost per km – Distribution System			x							x		x								x	The data is reported as quarterly average for the reporting period. Numerator: Distribution cost includes cost incurred by Meters, DC and Construction services, excludes pump maintenance costs. O&M costs include: Salary and Wages; Contract & General Services; Materials, Equipment & Supplies; excludes: Debt Charges. Denominator: Distribution system length (km) includes transmission and distribution mains and excludes service pipes.	Total actual O&M costs incurred in the maintenance and operations of the distribution system (excludes capital costs, indirect costs, debt/interest charges). Includes Pipe O&M cost and Metering O&M cost. Distribution system length includes transmission and distribution mains and excludes service pipes. (Note: NWWBI Benchmarking definition included sampling cost as part of the Pipe O&M cost)	$ 1,575	$ 1,582		
	City of Calgary	Provide a cost-effective and sustainable wastewater collection system	O&M cost per km – Collection System (Wastewater)			x							x		x								x	Data is reported as quarterly average for the reporting period. Numerator: Collection O&M costs include costs incurred by System Maintenance, Public Response and Construction Services. O&M costs include: Salary and Wages; Contract & General Services; Materials, Equipment & Supplies; excludes: Debt Charges. Denominator: System length only includes mains (trunks and force mains owned by the city, including commercial and multi-family services; excludes residential services).	Total actual O&M costs incurred in the maintenance and operations of the collection system (excludes capital costs, indirect costs, debt/interest charges).	$ 1,200	$ 863		
	City of Calgary	Provide a cost-effective and sustainable stormwater system	O&M cost (000s) per km – Stormwater System			x							x		x								x	Data Reported as quarterly average. Numerator: Stormwater O&M costs include costs incurred by System Maintenance, Public Response and Construction Services. O&M costs include: Salary and Wages; Contract & General Services; Materials, Equipment & Supplies; excludes: Debt Charges. Denominator: The stormwater system length includes main and catch basin leads and C/MF services.	Total actual O&M costs incurred in the maintenance and operations of the stormwater system (excludes capital costs, indirect costs, debt/interest charges).	$ 425	$ 359		
	City of Calgary	Provide a cost-effective and sustainable distribution system	Number of breaks or leaks in the water distribution system/100km of water distribution pipe																					Number of breaks or leaks in the water distribution system divided by the distribution system length in kilometers		8	5		
	City of Calgary	Provide a cost-effective and sustainable wastewater collection system	Number of blocked Sewers/100km of sewer pipe				x				x						x					x		Number of blocked Sewers divided by the average collection system length in kilometers		6	6.2		

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				Process development					Process documentation					Process coverage					Process frequency											
				Informal	Aware	Formalized	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
	Louisville	Achieve synergies that reduce cost, improve service or increase efficiency	Operations and Maintenance cost control, metered water ratio					x					x					x					x	O&M Cost per Customer	Total Operations and Maintenance Cost per Customer	219.54	212.15		
	Louisville	Achieve synergies that reduce cost, improve service or increase efficiency	Operations and Maintenance cost control, metered water ratio					x					x					x					x	O&M Cost per million gallons sold	Total Operations and Maintenance cost per million gallons sold	1570.31	1558.59		
A4 Operational Optimization	Louisville	Achieve synergies that reduce cost, improve service or increase efficiency	Operations and Maintenance cost control, metered water ratio				x				x					x					x			# of process improvements	Total number of documented improvements	100	185		
	Louisville	Achieve synergies that reduce cost, improve service or increase efficiency	Operations and Maintenance cost control, metered water ratio				x				x					x					x								
	Louisville	Achieve synergies that reduce cost, improve service or increase efficiency	Operations and Maintenance cost control, metered water ratio																					# of operational improvements	Total number of documented improvements	14	20		
	Louisville	Achieve synergies that reduce cost, improve service or increase efficiency	Operations and Maintenance cost control, metered water ratio					x					x					x					x	Metered water Ratio	% of pumped water that is metered	85%	83.20%		
	Louisville	Achieve synergies that reduce cost, improve service or increase efficiency	Operations and Maintenance cost control, metered water ratio					x					x					x					x	Manage O&M at budget	Operations and Maintenance at budget (100% of budget)	100%	97.30%		
	Union Sanitary District	Treatment Plant Operation	Targets and ranges for plant processes have been developed and are tracked on a daily basis.					x					x					x					x	Plant Health Index	Measure aggregates 36 individual process metrics into one index.	≥85	90	Plant records (SCADA, lab reports)	
	Union Sanitary District	Energy use reduction	Energy conservation (LED lighting pilot), co-gen, solar				x					x					x					x		Energy use, total and amount generated on-site				See Plant scorecard	Also see Operational Resiliency
	Union Sanitary District	Collection System Maintenance	Effective maintenance of the CS as evidenced by cost of cleaning and TVing, balanced by # of SSOs and other problems					x					x					x					x	Ave cost of cleaning per mile		$0.33 to $0.53	FY 10: $0.38	Work order system records. See CS scorecard	
	Union Sanitary District	Collection System Maintenance	Effective maintenance of the CS as evidenced by cost of cleaning and TVing, balanced by # of SSOs and other problems																					Ave cost of televising per mile		$0.38 to $0.67	FY 10: $0.63		
	Gwinnett County DWR	Average customer service cost per account	Gwinnett balanced scorecard metric				x			x								x					x	Average customer service cost per account	Total customer service and billing cost / water accounts, as a twelve-month rolling average. Cost data includes all direct and indirect costs attributable to salary and benefits of all customer service and billing personnel (full time and temporary), contracts, a proportional share of total utility indirect costs, meter installation costs, meter reading, meter maintenance, meter repair and replacement, preparation and delivery of bills, receipt and processing of payments, collection on delinquent accounts, dunning, turn on and turn off service, ISU programming and upgrades, web payment program, and investigation and resolution of complaints. Specifically, the number of accounts shall be the end-of-month number of water accounts, using the same account metric as is used to calculate gpmd and in the fiscal proforma.	4	3.39	2011 SAP reports of actual expeditures; master consumption / billing reports for account data	To effectively manage customer service activities to decrease the cost of operations while increasing customer service satisfaction
	Gwinnett County DWR	Production O&M cost per mgal	Gwinnett balanced scorecard metric				x			x								x					x	Production O&M cost per mgal	The O&M costs in the numerator of this ratio will be the rolling twelve-month cumulative total amount of operating costs incurred by the Water Production Division. The denominator is the cumulative million gallons of finished water produced over the same twelve-month period.	525	521	Power bills, SAP, MOR, water production finished water monthly reports	Intent is to improve operation and maintenance cost and efficiency, by determining actual current costs, benchmarking trends, making operational adjustments, and refining future targets.
	Gwinnett County DWR	Distribution O&M cost per 100 miles	Gwinnett balanced scorecard metric					x					x					x					x	Distribution O&M cost per 100 miles	This KPI measures the twelve-month rolling average distribution system operations and maintenance costs per 100 miles of distribution and transmission mains. DWR management and staff costs not included	250,000	240,078	Monthly operations report	This indicator will provide O&M cost as an internal trend indicator in order to demonstrate gains in efficiency.

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A4. Operational Optimization	Gwinnett County DWR	kWh per mgal finished water	Gwinnett balanced scorecard metric			x				x							x					x		kWh per mgal finished water	Energy efficiency expressed as KWH / MG of finished water pumped from both facilities. The numerator is the cumulative total of KWH usage over the prior 12 months. The denominator is the cumulative total of finished water produced over the same period.	2100		Power Bills (SAP), SCADA (Monthly Reports	
	Gwinnett County DWR	Craft utilization	Gwinnett balanced scorecard metric					x					x		x					x				Craft utilization	Measure utilization of maintenance resources in Water Production Division. The numerator sums up technicians' work hour reported in CMMS work orders. The denominator is total technicians' time worked. Six-month rolling average	75	74.5	MAXIMO and SAP	Improve maintenance effectiveness through efficient utilization of craft time.
	Gwinnett County DWR	Collection O&M cost per 100 miles	Gwinnett balanced scorecard metric					x					x					x					x	Collection O&M cost per 100 miles	This KPI measures the twelve-month rolling average gravity sewer system operations and maintenance cost per 100 miles of gravity sewer mains. DWR management and staff overhead and indirect costs not included.	150000	148489	GIS, SAP Analyzer, Lucity	This indicator will provide the unit O&M cost as an internal trend indicator in order to demonstrate gains in efficiency
	Gwinnett County DWR	Reclamation O&M cost per mgal	Gwinnett balanced scorecard metric			x				x					x					x				Reclamation O&M cost per mgal	The O&M cost in the numerator of this ratio is the rolling 12-month cumulative amount of operating costs for the County's operating water reclamation facilities. The denominator is the cumulative million gallons of wastewater treated and discharged as reclamation facility effluent over the same 12-month period. This will be the rolling 12-month average daily flow (mgd) for the County's operating water reclamation facilities to be taken from the Monthly Flow Report (which is based on the Discharge Monitoring Reports), times 365 days/year	1,250	1,141	SAP, Monthly Business Services reports, Discharge Monitoring Reports. Note: Discharge Monitoring Reports and the Monthly Business Services Report are not available until approximately the 15th of the following month, therefore, this will be a lagging indicator	This type of cost monitoring will help us improve operation and maintenance cost efficiency by bringing a focus to actual current costs, benchmarking trends, and providing us the opportunity to make operational adjustments, monitor the O&M cost impacts and refine future targets
	Gwinnett County DWR	kWh per mgal reclaimed water	Gwinnett balanced scorecard metric			x			x						x					x				kWh per mgal reclaimed water	Energy efficiency expressed as KWH / MG of water reclaimed at Gwinnett facilities. The numerator is the cumulative total of KWH usage over the prior 12 months. The denominator is the cumulative total of reclaimed water produced over the same period.	4,800	4,396	Power Bills (SAP), Monthly DMRs	
	Tualatin Valley	Backflow Compliance Program	Program established to encourage compliance with backflow requirements and provide inspection services to ensure compliance (program description attached)				x					x						x					x	# of backflow devices in compliance w/state regulations		0.95	0.97	Backflow software report	http://www.tvwd.org/your-water/backflow-prevention.aspx
	Tualatin Valley	Sustainability Program																											
	Tualatin Valley	GIS	Having a complete and accurate GIS record of the system is a fundamental "best practice" since it enables so many other "best practices" such as CMMS, asset management, emergency incident response, enhanced customer outreach, response to customer complaints, etc.				x					x					x					x		None					
	Tualatin Valley	SCADA	Most utilities have SCADA, but the real value comes in a smart SCADA system that enables unattended operation, energy and water quality optimization, asset planning, asset management, etc. The key – as we're now finding thanks to recently completed upgrades – is the ability to retrieve and analyze the operational data. It's not just a control system, it's a gold mine of data just waiting to be tapped to achieve these higher level objectives.					x				x					x					x							
		Average time taken to rectify bursts and leaks (priority 1) (minutes)						X					X				X					X		Average time taken to rectify (mins)		290	262	Prometheus Montage Dashboard Communications Centre Script IMS	
	South East Water	Average time taken to rectify bursts and leaks (priority 2) (minutes)	To report for how long, on average, a customer is without water services for the reporting period. It is a partial indicator of customer service and the condition of the water network					X					X				X					X		Average time taken to rectify (mins)		380	279	Prometheus Montage Dashboard Communications Centre Script IMS	

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A4. Operational Optimization		Average time taken to rectify bursts and leaks (priority 3) (minutes)						X					X				X					X		Average time taken to rectify (mins)		1,810	1,735	Prometheus Montage Dashboard Communications Centre Script IMS	
	South East Water	Average time taken to rectify bursts and leaks (priority 1) (minutes)	To report for how long, on average, a customer is without water services for the reporting period. It is a partial indicator of customer service and the condition of the water network					X					X				X					X		Average time taken to rectify (mins)		290	262	Prometheus Montage Dashboard Communications Centre Script IMS	
		Average time taken to rectify bursts and leaks (priority 2) (minutes)						X					X				X					X		Average time taken to rectify (mins)		380	279	Prometheus Montage Dashboard Communications Centre Script IMS	
		Average time taken to rectify bursts and leaks (priority 3) (minutes)						X					X				X					X		Average time taken to rectify (mins)		1,810	1,735	Prometheus Montage Dashboard Communications Centre Script IMS	
	South East Water	Average time to attend sewer spills and blockages (minutes)	The responsiveness of the business to sewer spills and blockages is a measure of its quality of service and resourcefulness					X					X			X						X		Average time taken to attend (mins)		48	48	Prometheus Montage Dashboard Communications Centre Script IMS	
	South East Water	Time to rectify sewer spills and blockages						X				X					X					X		Average time taken to rectify (mins)		147	127.7	Prometheus Montage Dashboard Communications Centre Script IMS	
	South East Water	Reputation survey (Government, Government Agencies and Water Industry)	Using the Strategic Intelligence method; the Average reputation scores of the 'Government Stakeholder' and 'Government Agency' stakeholder groups.			X					X						X				X			% of customers who have rated us at 6 and above	Survey is performed every 18 months	78%	74%		

Appendix B-2
Leading practice documentation

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				Process development					Process documentation					Process coverage					Process frequency											
				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A5. Financial Viability	Green Bay MSD	Annual debt service as a percent of total expense	Examines amount of annual long term debt as a percentage of total utility expenses			x						x					x				x			Debt service as a percent of annual total expense	Compare to NACWA benchmark	28	24.1		
	Green Bay MSD	Average residential service charge per year	Examines typical annual residential user charge for largest community served				x					x					x				x			Rate for sewer service for typical municipal residential customer	Compare to NACWA benchmark	330	265		
	Toronto Water	Water cost Effectiveness	Measure the operational cost effectiveness of water treatment and distribution				x					x					x					x		Water operating cost to water volume demand ratio	Operating cost of water treated, supplied, and distributed/ ML of water delivered	TBD	$548.18	Data from OMBI database & dictionary	
	Toronto Water	Wastewater cost Effectiveness	Measure the operational cost effectiveness of wastewater collection and treatment				x					x					x					x		Wastewater operating cost to wastewater treated volumes	Operating cost of wastewater treated, disposed and collected/ ML of wastewater treated	TBD	$618.61	Data from OMBI database & dictionary	
	Toronto Water	Reserve level maintenance	Maintain target reserves				x					x					x					x		Reserve level ratio actual to plan	Total amount of actual reserves/ total planned reserve levels	TBD	87%	Data from Finance records	
	Toronto Water	Overtime hours	Measure overtime hours for implementing viable service delivery			x					x					x						x		Overtime hours ratio	Total overtime hours/ Total number of normal hours	TBD	17%	Data from Finance records	
	Region of Peel	Annual budget and financial process	Balance operating expenditure and revenue and determine the contribution level for capital spending				x					x						x					x					http://www.peelregion.ca/finance/2011-budget/pdfs/07-2011-Water-Budget-Document.pdf	
	Region of Peel	Master plan update	identify projected growth and subsequent infrastructure requirement				x					x						x					x						The plan is updated every 5 years and currently being reviewed
	Charleston Water	Water Operations & Maintenance (O&M) Cost per Account	Levels quantify all utility costs related to operations and maintenance per active customer account.					x					x					x					x	$ per customer account		$307	$293	Financial Management System software; Budget reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Wastewater Operations & Maintenance (O&M) Cost per Account	Levels quantify all utility costs related to operations and maintenance per active customer account.					x					x					x					x	$ per customer account		$462	$455	Financial Management System software; Budget reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Water Operations & Maintenance (O&M) Cost per Million Gallon (MG) Produced	Levels quantify all costs related to operations and maintenance per volume processed (in million gallons).					x					x					x					x	$ per MG produced		$1,362	$1,562	Financial Management System software; Budget reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Wastewater Operations & Maintenance (O&M) Cost per Million Gallon (MG) Produced	Levels quantify all costs related to operations and maintenance per volume processed (in million gallons).					x					x					x					x	$ per MG produced		$2,800	$2,883	Financial Management System software; Budget reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Water Direct Cost per Million Gallon (MG) Produced	Levels quantify total costs for salaries, direct benefits, and direct operational and maintenance costs associated with treatment.					x					x					x					x	$ per MG produced (direct)		$383	$458	Financial Management System software; Budget reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Wastewater Direct Cost per Million Gallon (MG) Produced	Levels quantify total costs for salaries, direct benefits, and direct operational and maintenance costs associated with treatment.					x					x					x					x	$ per MG produced (direct)		$670	$723	Financial Management System software; Budget reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Bond Rating	Levels demonstrate CWS's bond ratings by three major rating agencies over a six year period.					x					x					x					x	Standard bond rating scales		AAA	AAA	Bond Ratings from Bond Rating Agencies	Key Performance Indicator (KPI) - Bond rating agencies periodically review the organizations audited financial statements and CAFR and this has resulted in numerous upgrades in CWS's bond ratings since 2005 due to the excellent results of these measures.
	Charleston Water	Debt Service Ratio	Levels define the amount of cash flow available to meet annual interest and principal payments on debt. Bond ordinances require that CWS maintain a coverage ratio of 1.2. Internal CWS policy sets higher target levels for this measure (a minimum of 1.4) than required by bond ordinance which assures bond holders and customers of CWS's excellent financial situation and long term sustainability.					x					x					x					x	Ratio	This measure is a key indicator of financial status throughout the year, as it combines elements of revenue, expense, and debt figures into one measure and is reviewed closely by rating agencies in establishing bond ratings.	1.49	1.72	Budget reports; Performance Scorecard software	Key Performance Indicator (KPI)
	Charleston Water	Customer Accounts - Growth	Levels indicate the number of customer accounts CWS serves on an annual basis					x					x					x					x	# Accounts	This measure is a key element of the earnings test as it effects multiple components: revenue, expense, and contribution figures.	Water: 107,000; Wastewater: 49,000	Water: 107,000; Wastewater: 48,000	Customer Service System software; Finance reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Days Cash on Hand	This measure reflects the number of days of cash CWS has on hand to meet financial obligations.					x					x					x					x	Days $ on Hand	This measure is looked at by rating agencies as an indication of an organization's financial sustainability and flexibility.	544.00	1148.00	Finance reports; Performance Scorecard software	Performance Indicator (PI) - The higher the number of days of cash on hand to meet financial obligations provides increased flexibility as there is more money available for unforeseen conditions.
	Charleston Water	Days Working Capital	Similar to Days Cash on Hand, this measure is used as an indication of an organization's financial sustainability and depicts the number of days of operating expenses which could be covered by the current balance of cash and investments after the current liabilities are paid (working capital).					x					x					x					x	Days $ on Hand		495.00	1179.00	Finance reports; Performance Scorecard software	Performance Indicator (PI)

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				Informal	Aware	Formalized	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A5. Financial Viability	Charleston Water	Current Ratio	Levels measure the ability to pay current obligations and signify the level of liquidity available.					x					x					x					x	Ratio current assets to current liabilities		5.50	10.08	Finance reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Quick Ratio	Levels measure the ability of an entity to pay current obligations with the most liquid of assets only–cash and receivables. The Quick Ratio is more stringent than the Current Ratio					x					x					x					x	Ratio current receivables to current liabilities		5.20	5.44	Finance reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Profit on Sales	This measure looks at how much of every dollar of revenue a company actually keeps in earnings.					x					x					x					x	% Profit on sales	A higher profit margin indicates a more profitable company that has better control over its costs compared to its competitors.	31.00%	18.47%	Finance reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Rate Comparison	Levels compare the combined bill for customers using 8Ccf or 5,984 gallons.					x					x					x					x	Rate in Dollars		$70.33	$70.33	Finance reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Cumulative Rate Comparison	Levels reflect rate increases per year in percent.					x					x					x					x	% Rate increase per year		0.59%	0.59%	Finance reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Opportunities for Improvement (OFIs) from GFOA on Annual CAFR	Levels show the number of OFIs from GFOA on the annual CAFR over a five year period.					x					x					x					x	Findings per audit		6.00	6.00	Comprehensive Annual Financial Report (CAFR); Finance reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Operating Margin	The Operating Margin indicates the financial margin available to pay operating expenses and is a measure of financial performance considered by ratings agencies.					x					x					x					x	% Margin (net income + interest divided by sales)	The larger the percentage the better. This measure does not include any influence from depreciation or contributions and simply measures the amount of operating revenues remaining after paying operating expenses.	31.00%	49.23%	Finance reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Free Cash as a Percent of Depreciation	This ratio looks at how the cash created in the current year from operations meets the needs of maintaining the system.					x					x					x					x	%	Current surplus revenues after payment of operating expenses, debt service, and operating transfers out divided by current year depreciation.	95.00%	95.00%	Finance reports; Performance Scorecard software	Performance Indicator (PI)
	ABCWUA	Debt Ratio	Effective balance between long-term debt, asset value, and O&M expenditures			x				x						x					x			Total liabilities and total assets	Maintain low debt burden and communicate fiscally responsible to our customers	51%	51%	ERP (Peoplesoft)	ERP is very limited; difficult to maintain accurate data
	ABCWUA	Return on Assets	Quantify the ABCWUA's level of indebtedness			x				x						x					x			Net income and total assets	Improve ABCWUA's financial health	1%	-1%	ERP (Peoplesoft)	ERP is very limited; difficult to maintain accurate data
	ABCWUA	Cash Reserves	Quantify number of days of available cash reserve as an indicator of financial liquidity			x				x						x					x			Days of reserve available is based on undesignated cash reserves and continued cost of ongoing operations			33	ERP (Peoplesoft)	No target has been established for this metric as it was obtained for the 2009 QualServe Survey
	Region of Durham	NWWBI- Water Utility	Water rate for a typical size SF residential connection (consuming 250 m^3/year)					x					x					x					x	Water rate for a typical size SF residential connection (consuming 250 m^3/year)	For municipalities with metered SF residential connections, the annual cost of water should include the (base fee for the typical meter size + other water fees) X the frequency of base fee charge + the annual price per cubic meter X 250m^3. The current year (i.e. the year of data collection, not the historic year) annual water rate for a house with a typical size single family residential connection and water meter (i.e. for a detached house) consuming 250 m^3/year (equivalent to 3 people at 300L/person/day). The typical size should be the most common (i.e. in most cases at least 50% of the single family connections or meters).				
ability	Region of Durham	NWWBI- Water Distribution - Performance Measures	5 year Running Average Capital Reinvestment/ Replacement Value																					5 year Running Average Capital Reinvestment/ Replacement Value					
	Region of Durham	NWWBI- Water Distribution - Performance Measures	% of main length replaced					x					x					x					x		Total length of water mains that are replaced in a planned situation (non-emergency). See also "Planned Maintenance."				
	Region of Durham	NWWBI- Water Distribution - Performance Measures	Cost of Fire Hydrant O&M/ # of fire Hydrants				x					x					x					x		Cost of Fire Hydrant O&M	Annual operations and maintenance costs allocated to fire hydrants (entire hydrant assemblies including hydrant valves). Includes the costs of regular inspections, testing and repairs.				
	Region of Durham	NWWBI- Water Distribution - Performance Measures	Cost of Meter Reading O&M /#of meters																					Cost of Meter Reading O&M	Total cost of reading customer meters. Includes both internal and/or external sub-contractor costs. This value should only include costs directly associated with reading meters. It should not include other maintenance costs, which are recorded in "D-Costs: metering O&M costs". Note that this value must be incorporated into "D-Costs: metering O&M costs".				

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				Informal	Aware	Formalized	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A5. Financial Viabi	Region of Durham	NWWBI- Water Distribution - Performance Measures	Unit Cost of Flushing ($/km)					x					x					x					x	Unit Cost of Flushing ($/km)	Unit cost for flushing water mains in $/km all inclusive of labour, equipment, vehicles, contract costs etc.				
	Region of Durham	NWWBI- Water Distribution - Performance Measures	Cost of main break repairs as a % of Total O&M Costs																					Cost of main break repairs	Cost of main break repairs all inclusive of labour, equipment, overhead and contract costs. Restoration costs such as utility cuts, and paving are also to be included. See also "Unplanned Maintenance" & "# of main breaks".				
	Region of Durham	NWWBI- Water Distribution - Performance Measures	Replacement Value					x					x					x					x	Replacement Value	The amount of money needed to replace all of the existing infrastructure. The replacement value shall include all engineering costs, construction, supervision, taxes, etc (excluding land purchasing). If this value is developed by a calculations based on unit values times the number of units, unit replacement values shall be estimated based on average construction costs over the last 5 years. For example, if 20 main replacements have been constructed over the last five years, the average unit cost per km of main can be estimated from all 20 construction projects (excluding inflation).				
	Region of Durham	NWWBI- Water Treatment Performance Measures	5 year running average Capital Reinvestment/ Replacement Value					x					x					x					x						
A5. Financial Viability	Region of Durham	NWWBI - Wastewater Utility - Performance Measures	Sewer rate for a typical residential connection/meter (based on consumption of 250 m^3/year of water)					x					x					x					x		The current year's (i.e. the year of data collection, not the historic year) annual sewer user rate for a typical size single family residential service connection (i.e. for a detached house) consuming 250 m^3/year of water. Historically we have collected data based on a 4" service connection, however for some municipalities this is not the typical size. The typical size should be the most common (i.e. in most cases at least 50% of the single family connections). For municipalities with metered SF residential water connections, the annual sewer rate charged to the customer will usually include the base fee (may be based on the water meter size) X the frequency of base fee charge + a consumption fee based on the annual price per cubic meter X 250m^3. For municipalities without metered SF residential water connections, the annual sewer user rate charged to the customer will include the flat fee X the frequency of flat fee charge.				
	Region of Durham	NWWBI - Wastewater Collection - Performance Measures	5 year Running Average Capital Reinvestment/ Replacement Value					x					x					x					x						
	Region of Durham	NWWBI - Wastewater Collection - Performance Measures	% of sewer length replaced					x					x					x					x	Length replaced	Total length of sewer main replaced in a planned situation (non-emergency).				
	Region of Durham	NWWBI - Wastewater Treatment - Performance Measures	% of sewer length replaced and relined					x					x					x					x	length relined	Total length of sewer mains that are relined including all cement lining of cast iron mains.				
	Region of Durham	NWWBI - Wastewater Collection - Performance Measures	5 year Running Average Capital Reinvestment/ Replacement Value					x					x					x					x						
	Region of Durham	OMBI - Water	Average Age of Water Pipe (years)				x					x						x					x	Average Age of Water Pipe	The average age of all water pipes (excluding connections) for Distribution and Transmission weighted by length. Length Weighted Average Age = ((length of pipe at age x) (age x) + (length of pipe at age y) (age y) +.....) / total length of pipe Where age x = average age of age range x, for example for range 0 - 24 years, the average age is 12, therefore x = 12				

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	Region of Durham	OMBI - Wastewater	Average Age of Wastewater Pipe (years				x					x						x					x	Average Age of Wastewater Pipe	The average age of all wastewater sewage pipes (excluding connections) within the collection system weighted by length. Length Weighted Average Age = ((length of pipe at age x) (age x) + (length of pipe at age y) (age y) +.....) / total length of pipe Where age x = average age of age range x, for example for range 0 - 24 years, the average age is 12, therefore x = 12.				
	Region of Durham	OMBI - Wastewater Treatment	Number of Days Demand exceeds 90% of Plant Capacity					x					x					x					x	Number of Days Demand exceeds 90% of Plant Capacity	Peak Capacity Utilization = # Days Plant Operated at > 90% of Plant Rated Capacity.				
A5. Financial Viability	City of Calgary	To ensure good spending of capital budget	Capital Spending (%)			x							x		x								x	Data presented as a cumulative % spending year-to-date. Numerator: Value of actual capital spent YTD. Denominator: Total capital budget for the year	Annually there is an approved budget for capital projects. This performance measure will allow the WMT to track the YTD spending of this capital budget to ensure we are not overspending or even significantly under spending the capital budget allocated for the year.	TBD	43%		
	City of Calgary	To ensure good attainment of operating budget objectives	Operating Budget Variance (%)			x							x		x								x	The data is presented as cumulative percent variance year-to-date. Numerator: Variance = Budgeted Net Expenditure/revenue – Actual Net. Denominator: Budgeted Net Expenditure/revenue Expenditure/revenue	There is an approved operating budget each year. This includes revenue and expenditure targets for the year. Reporting on the operating budget variance will provide information on how the two business units are doing vis-à-vis their operating budget forecast.	TBD	17%		
	Louisville	Recognize and support the stockholders interest	Provide a return on equity for our owner while maintaining reasonable rates for our customers					x					x					x					x	Basket of financial ratios and 10 year proforma	Financial ratios measuring profitability, dividend, liquidity, capitalization and coverage				
	Louisville	Recognize and support the stockholders interest	Cost of service rate study					x					x					x					x	Cost of service rate analysis	% rates recover cost of service	100%	100%		
	Louisville	Assure steady top-line revenue growth and profitability	Top-line growth				x					x				x					x			Total Revenue from new business net operating income	Create new business strategies to ensure revenue an profitability	750K	581K		
	Union Sanitary District	Balanced, competitive rates	Sewer Service rates are kept low compared to other rates in surrounding service areas					x					x					x					x	Annual residential sere rate compared to agencies in surrounding communities	A survey of rates is done each spring	Lower 33rd percentile	15th percentile	Survey results	
	Gwinnett County DWR	Balance between debt, revenue, assets and expenditures.	Effective balance between long-term debt, asset value, revenues and O&M expenditures. Rates are set several years in advance, and more distant years added periodically - in advance of rate-resolution expiration. In other words, we rarely set rates for the next 2 to 3 years, because those rates were set several years ago; our practice has generally been to amend the resolution to add the fourth and fifth year out.				**x**					**x**				x			x					Minimum debt service coverage ratio of 1.50.	Target a certain percentage of equity funding to balance cash flow	1.50	1.80	See attached 2009 rate resolution.	We maintain a long-range fiscal proforma whereby rates are set. Outstanding principal currently approximately $1,100,000,000. Our revenue bonds have been rated AAA by three rating agencies for many years.
	Gwinnett County DWR	Meters meeting AWWA accuracy standards	Gwinnett balanced scorecard metric					x			x							x					x						
	Gwinnett County DWR	% Total uncollected receivables	Gwinnett balanced scorecard metric - see supporting documentation					x					x					x					x	% Total uncollected receivables	The KPI is a percentage of uncollected receivables to total YTD revenue receivable in the water and sewer enterprise.	1	0.67		
	Gwinnett County DWR	Business case evaluations	Significant capital, operating, and strategic decisions are vetted through a rigorous multi-disciplinary evaluation.				**x**						**x**				x					x						See attached BCEs for Mulberry/Alcovy, Jackson, Old Norcross, Rosemoore, and South Gwinnett, as a few examples.	
	Tualatin Valley	Long Term projections	Cash flow projections simple enough to do scenario planning and sensitivity analysis																										
	MSDGC	Increasing reliance on cash financing	Increasing amount of capital expenditures that are cash financed each year			x					x					x					x			Cash Finaning / Year	Increasing annual cash financed expenditures each year for next 5 years	5%	5%	Annual Finance Plan	
	MSDGC	Cash flow forecast evolves against baseline	Cash flow forecast is based on project schedule by activity				x					x					x					x		Cash flow reported monthly	Cash flow updated monthly with updated budgets and schedules	100%	100%	Monthly Cash Flow Forecast Report	
	MSDGC	Conservative revenue estimates and revenue requirements	Conservative estimates - including reduction in customers/usage over time - keeps rates high enough to meet revenue requirements					x					x					x					x	Annual revenue requirment analysis	Fund balances do not reflect rate is too low (or too high)	100%	100%	Annual Rate Report, Annual Official Statement	
	South East Water	Monthly Business Performance Report	Analysis of actual results against budget on a monthly, YTD and Annual basis					x				x					x					x		No Metric		N/A	N/A	Monthly Business Report	
	South East Water	Long Term Water Plan and Financial Plan	High level financial projections for profit/loss, balance sheet and cash flow.					x				x					x						x	Approval by Board. DTF and ESC	Approved at April Board Meeting of each year.	N/A	N/A		
iability	South East Water	Operating profit before tax						x					x					x					x	Reported to Board monthly	To measure the accounting profit of the business excluding tax.	$116.7M	$95.4M		

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A5. Financial Viabi	South East Water	Gearing						x					x					x					x	Reported to Board monthly	To measure the extent to which the business is financed by debt.	37.70%	33.60%		
	South East Water	FFO Net interest cover						x					x					x					x	Reported to Board monthly	To measure the ability of the business to cover its annual cash interest obligations.	3.5 times	3.3 times		
	South East Water	Return on Invested Capital						x					x					x					x	Reported to Board monthly	Measures the returns generated by the business relative to its cost of capital.	5.7%	<5.7%		
A6. Infrastructure Stability	Toronto Water	Infrastructure reliability, rehabilitation, and replacement	Execute planned capital improvement projects (CIP) to address renewal need of aging infrastructure				x					x					x					x		Backlog of renewal	Total present worth of renewal and replacement needs	0	$1,724	Data (millions) from Water Infrastructure Management . Target year 2020.	
	Toronto Water	Capital program delivery	Meet capital delivery targets				x					x					x					x		Capital delivery effectiveness	Total CIP actual expenditures/ CIP budgeted expenditures	80%	88%	Data from Water Infrastructure Management	
	Toronto Water	Infrastructure leakage	Measures how well the infrastructure is being managed for control of real water losses			x					x					x				x				Infrastructure Leakage Index (ILI)	Current annual real losses/ Unavoidable annual real losses	2.50	5.23	Data from Water Infrastructure Management	
	Toronto Water	Stormwater and basement flooding management	Measure total number of basement floodings				x					x					x					x		Basement floodings	Total number of incidents of water in the basement in the reporting period	0	375	Data from internal work management system records	
	Toronto Water	Age of water pipe	Measure age of linear water infrastructure				x					x				x				x				Avg age of water pipe	The average age of all water pipes (excluding connections) for Distribution and Transmission weighted by length. Length Weighted Average Age = ((length of pipe at age x) (age x) + (length of pipe at age y) (age y) +.....) / total length of pipe	TBD	57.0	Data from OMBI database & dictionary	
	Toronto Water	Age of wastewater pipe	Measure age of linear wastewater infrastructure				x					x				x				x				Avg age of wastewater pipe	The average age of all wastewater sewage pipes (excluding connections) within the collection system weighted by length. Length Weighted Average Age = ((length of pipe at age x) (age x) + (length of pipe at age y) (age y) +.....) / total length of pipe	TBD	59.1	Data from OMBI database & dictionary	
	Region of Peel	Sufficient Asset (System) Renewal/Replacement	Measures the asset renewal/replacement rates over time. Targets will vary by utility and asset depending on each utility's determinations of acceptable risks for different asset classes.																					Asset/renewal/replacement rate (percent)	Total number of assets replaced per year for each asset class divided by total number of assets in each asset class	N/A	N/A	Asset renewal/replacement log	Tracked via spreadsheet by management team
	Region of Peel	Corporate Asset Management Strategy (non-growth infrastructure)	A framework that outlines how an organization will manage its assets to meet strategic objectives. The strategy includes sub-strategies related to risk management, lifecycle costs, asset levels of service to meet asset functional requirements, and identifies the resources and organizational staff requirements to support the strategy.			x					x					x					X			Supportable infrastructure needs, priorities and asset management plans	The framework will constantly monitored and amended to reflect Peel's changing infrastructure and service environment	N/A	N/A	Documentation under development. Metrics not formalized.	Documentation to be completed and the strategy reported to council.
	Region of Peel	Life-cycle Strategies	Methodologies by which to predict and optimize the asset life-cycle including points of rehabilitation and replacement and the associated costs.				x				x					x					x			% Asset funding matches asset needs. % assets meeting expected performance and condition requirements over the lifespan.		N/A	N/A	Technical Documentation for Optimized Decision Model	Internal use only until optimized decision modeling is tested. Precise metrics to be determined later when testing is complete and processes are in place.
	Region of Peel	Asset Risk Management Strategy	Consistent methodologies which establish risk tolerances and assess inherent, residual and current risk of assets and to prioritize infrastructure needs.				x					x				x					x			Assets are accurately prioritized	Funds are properly directed to Council priorities.	N/A	N/A	Draft Risk Management Strategy	Internal use only until draft is finalized. Precise metrics to be determined later when testing is complete and processes are in place.
	Region of Peel	Asset Levels of Service	Defined parameters which assets are required to meet in order to perform the necessary functions to support municipal services to the customers.				x					x				x					x			Customer satisfaction with services		N/A	N/A	Service to Asset (S2A) Diagrams	Internal use only. Levels of Service to be approved by Council. Precise metrics to be determined later when testing is complete and processes are in place.
	Region of Peel	Development Charge Background Study and By-law (growth-related asset management plan)	Outlines the infrastructure needs and costs to meet the levels of service and growth forecasts and calculates a charge paid by developers to subsidize the infrastructure costs. The framework and document is structured to meet the requirements of the Provincial Development Charges Act.					x					x				x					x		Growth portion of the infrastructure costs are fully recovered through the DC charge.		N/A	N/A	DC Background Study Report	
	Region of Peel	Asset Management Plans (non-growth infrastructure)	Long term capital plans identifying asset needs and costs to maintain sustainability of the organization's finances and services.			x				x					x						x			Number/percent of asset classes achieving risk and levels of service targets	Risk targets set by senior management & Council according to organizational risk tolerances	N/A	N/A	Approved Capital Budget & Forecast Long Term Infrastructure Investment Plan & reserve analysis	Being piloted for 2012 Capital Budget & Forecast

Appendix B-2
Leading practice documentation

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				Process development					Process documentation					Process coverage					Process frequency											
				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sporse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A6. Infrastructure Stability	Region of Peel	Detailed Asset Planning Tools (Peel's tools - Linear Asset Priority System, Pavement and Bridge Management System, Megamations, hydraulic models, traffic & transportation modeling, GIS)	Tools used to assess and prioritize infrastructure needs according asset levels of service and achieving risk targets.					x					x			x					x			Number of asset achieving or closing in on risk and levels of service targets.		N/A	N/A		
	Region of Peel	Strategic Asset Planning Tools (Peel CAM's Optimised Decision Model)	Tools used to assess and prioritize infrastructure needs according asset levels of service and achieving risk targets.				x				x					x					x			A balanced asset management plan which is affordable and meeting/approaching risk and levels of service targets.		N/A	N/A		Currently being tested. Precise metrics to be determined later when testing is complete and processes are in place.
	Charleston Water	Wastewater Collection System Rehabilitation & Replacement (R&R) Rate	Levels measure the degree to which a wastewater utility is replacing its infrastructure based on target lives for asset groups.					x					x					x					x	Rate of replacement based on need		22	50	Budget Reports; Spreadsheets; Performance Scorecard	Performance Indicator (PI)
	Charleston Water	Water Distribution System Rehabilitation & Replacement (R&R) Rate	Levels measure the degree to which a water utility is replacing its infrastructure based on target lives for asset groups.					x					x					x					x	Rate of replacement based on need		22	27	Budget Reports; Spreadsheets; Performance Scorecard	Performance Indicator (PI)
	ABCWUA	R/R Rate Water Pipeline/Distribution	Quantify the rate at which the ABCWUA is meeting its individual need for infrastructure renewal or replacement				x				x					x					x			Total actual expenditures reserved for renewal and replacement and total present worth for renewal and replacement needs	Reduce corrective maintenance by investing in infrastructure improvements to the system	0.5%	0.5%	Asset Management Plan	69% confidence level rating
	ABCWUA	R/R Rate Water Treatment Facility	Quantify the rate at which the ABCWUA is meeting its individual need for infrastructure renewal or replacement				x				x					x					x			Total actual expenditures reserved for renewal and replacement and total present worth for renewal and replacement needs	Reduce corrective maintenance by investing in infrastructure improvements to the system	1.2%	0.8%	Asset Management Plan	69% confidence level rating
	ABCWUA	R/R Rate Wastewater Pipeline/Collection	Quantify the rate at which the ABCWUA is meeting its individual need for infrastructure renewal or replacement				x				x					x					x			Total actual expenditures reserved for renewal and replacement and total present worth for renewal and replacement needs	Reduce corrective maintenance by investing in infrastructure improvements to the system	0.7%	0.6%	Asset Management Plan	69% confidence level rating
	ABCWUA	R/R Rate Wastewater Treatment Facility	Quantify the rate at which the ABCWUA is meeting its individual need for infrastructure renewal or replacement				x				x					x					x			Total actual expenditures reserved for renewal and replacement and total present worth for renewal and replacement needs	Reduce corrective maintenance by investing in infrastructure improvements to the system	1.1%	1.4%	Asset Management Plan	69% confidence level rating
	ABCWUA	Water Distribution System Integrity	Quantify the condition of the water distribution system			x					x					x					x			Number of leaks per 100 miles of distribution piping	Improve the condition and reliability of the water distribution system and reduce emergency repairs and water supply interruptions	41	35	Maximo (CMMS)	
	ABCWUA	Collection System Integrity	Measure of the condition of a sewage collection system			x					x					x					x			Number of collection system failures each year per 100 miles of collection system piping	Improve the condition and capacity of the collection system and minimize catastrophic failures	9	11	Maximo (CMMS) & collection system antiquated database	
	ABCWUA	Water Planned Maintenance Ratio: hours	Comparison of how effectively the ABCWUA is in investing in planned maintenance			x					x				x					x				Hours of planned maintenance compared to hours of corrective maintenance	Reduce emergency maintenance from system malfunctions	5%	8%	Maximo (CMMS)	
	ABCWUA	Water Planned Maintenance Ratio: cost	Comparison of how effectively the ABCWUA is in investing in planned maintenance			x					x				x					x				Cost of planned maintenance compared to cost of corrective maintenance	Reduce emergency maintenance from system malfunctions	17%	17%	Maximo (CMMS)	
	ABCWUA	Wastewater Planned Maintenance Ratio: hours	Comparison of how effectively the ABCWUA is in investing in planned maintenance			x					x				x					x				Hours of planned maintenance compared to hours of corrective maintenance	Reduce emergency maintenance from system malfunctions	50%	45%	Maximo (CMMS) & collection system antiquated database	
	ABCWUA	Wastewater Planned Maintenance Ratio: cost	Comparison of how effectively the ABCWUA is in investing in planned maintenance			x					x				x					x				Cost of planned maintenance compared to cost of corrective maintenance	Reduce emergency maintenance from system malfunctions	36%	37%	Maximo (CMMS) & collection system antiquated database	
	Region of Durham	NWWBI-Water Distribution - Provide Reliable service and Infrastructure	# of main breaks / per 100km length - System Reliability					x					x					x					x	Total # of Main Breaks	# of occurrences of distribution or transmission main breaks (include all breaks whether in the pipe or joints), includes pinholes and major breaks.				
	Region of Durham	NWWBI-Water Distribution - Provide Reliable service and Infrastructure	Major & Minor Main Breaks/ 100 km length					x					x					x					x	see above	see above				
	Region of Durham	NWWBI-Water Distribution - Provide Reliable service and Infrastructure	Main breaks by material type / 100 km length					x					x					x					x	see above	see above				

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A6. Infrastructure Stability	Region of Durham	NWWBI-Water Distribution - Provide Reliable service and Infrastructure	% of valves cycled					x					x					x					x	# of Valves Cycled - Total	Total number of valve cycling occurrences, which includes valves cycled more than once per year.				
	Region of Durham	NWWBI-Water Distribution - Provide Reliable service and Infrastructure	% of inoperable or leaking valves					x					x					x					x	# of inoperable or leaking valves	# of occurrences that mainline valves are known to be inoperable or leaking.				
	Region of Durham	NWWBI-Water Distribution - Provide Reliable service and Infrastructure	Non-Revenue Water in m3/km/day																					Total non-revenue water volume	Quantity of water that does not provide any revenue to the utility. NRW= Total volume delivered from the treatment plants – Billed authorized consumption. The data for this field is sourced directly from D-Description so please complete that section first				
	Region of Durham	NWWBI-Water Distribution - Provide Reliable service and Infrastructure	Infrastructure Leakage Index (ILI)																					Infrastructure Leakage Index (ILI)	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing the performance of utilities in operational management of real losses.				
	Region of Durham	NWWBI-Water Distribution - Provide Reliable service and Infrastructure	% of Hydrants Inspected (Level B) and (Level A)				x					x					x					x		Hydrant Checks	Hydrant checks can include checking operation, caps, oil, pressure, sounding access, winter leakage, freezing, and string test. If flow is checked, this is limited to ensuring that the hydrant flows on opening, and includes a performance check on flow rate. Hydrant checks are required by the Fire Code (frequency is dependant on local factors). Winter checks can be limited to checking access, evidence of leakage and using a string test to determine if there is water leakage. (Previously called a "Level A Check").				
	Region of Durham	NWWBI-Water Distribution - Provide Reliable service and Infrastructure	Breakdown of Hydrants Checked Level A				x					x					x					x		# Of Winter Hydrant Checks	Number of hydrants checked in the winter from October to April. See also "# of hydrants checked". The sum of summer hydrant checks and winter hydrant checks should equal the # of Hydrants Checked.				
Stability	Region of Durham	NWWBI-Water Distribution - Provide Reliable service and Infrastructure	# of emergency Service Connection Repairs or Replacements/# of Service Connections				x					x					x					x		# of Emergency Service Connection Repairs/ Replacements	Repairs to service connections due to breakdowns (either high or low emergency). High emergency breakdowns may result in loss of service or other severe detriment to the utility (e.g.; spill, etc.), maintenance must be deployed as soon as possible. Low emergency breakdowns may not result in loss of service or are protected by equipment redundancy, maintenance shall be deployed as the earliest convenience. Only includes repairs to the service connections for which the municipality is responsible. Service connections are defined as the pipe between the main and the property line.				
	Region of Durham	NWWBI-Water Distribution - Provide Reliable service and Infrastructure	# of Unplanned System Interruptions/ 100 km length																					# of unplanned system interruptions	Includes any water stoppage to customers due to failure in the publicly managed water transmission and/or distribution system for which the utility is responsible. This excludes planned interruptions. See also "Emergency Maintenance." This number may equate to the number of occurrences of main breaks, emergency service connection repairs and pump station failures				

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A6. Infrastructure Sta	Region of Durham	NWWBI_ Water Distribution - Maintenance Planning	Unplanned Maintenance Hours/ Total Maintenance Hours				x					x					x					x		Unplanned Maintenance Hours	Unplanned (breakdown) hours = # of hours spent by maintenance staff on high and low emergency work (time spent repairing equipment after it has broken down). High emergency work covers breakdowns that may result in loss of service or other severe detriment to the utility (e.g.; spill, etc.), maintenance must be deployed as soon as possible. Low emergency work covers breakdowns which may not result in loss of service or are protected by equipment redundancy, maintenance shall be deployed as the earliest convenience. Include both internal and external maintenance hours (e.g. some systems outsource all breakdown work therefore they should estimate all maintenance hours, both internal and external). These hours should include the entire time spent completing work orders. Administration such as ordering parts, recording work order information and updating the maintenance management system should therefore be included as well.				*= Preventative maintenance hours + Planned (scheduled) hours + Unplanned (breakdown) hours + Other hours. Include both internal and external maintenance hours (eg some systems outsource all breakdown work therefore they should estimate all maintenance hours, both internal and external). These hours should include the entire time spent completing work orders. Administration such as ordering parts, recording work order information and updating the maintenance management system should therefore be included as well.
	Region of Durham	NWWBI_ Water Treatment - Provide Reliable service and Infrastructure	# of Unplanned hours that Plant could not operate at Rated Capacity					x					x					x					x	# of Unplanned hours that Plant could not operate at Rated Capacity	# of hours that the plant cannot operate at its rated capacity (maximum day demand) that were not planned for.				
	Region of Durham	NWWBI_ Water Treatment - Provide Reliable service and Infrastructure	Unit Filter Run Volume (m3/m2)					x					x					x					x	Unit Filter Run Volume	This is an indicator of filter performance. If the value is > 200 m^3/m^2, then the filters are typically performing well. An average Unit Filter Run Volume can be calculated by dividing the Average Day Demand in m^3/day by the average number of filter washes per day (also called filter backwash frequency) and dividing that result by the average filter surface area in m^2 of one filter. It can also be calculated for individual filters by dividing the volume of water in m^3 produced by an individual filter, between backwashes, by the unit filter surface area in m^2 (if calculated for individual filters, the average should be entered into this field).				

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A6. Infrastructure Stability	Region of Durham	NWWBI_ Water Treatment - Maintenance Planning	Unplanned Maintenance Hours/ Total Maintenance Hours																						Sum of all maintenance hours below. = Emergency Maintenance + Urgent Maintenance + Corrective Maintenance + Preventative Maintenance + Inspections + Capital + Other hours Urgent maintenance hours = # of hours spent by maintenance staff on maintenance work that causes you to interrupt your daily schedule but is not captured under emergency work (above). Urgent work may not result in loss of service as the system is protected by equipment redundancy, and maintenance is deployed at the earliest practical convenience. As a guide include work that would cause you to interrupt your daily maintenance plan. Include both internal and external maintenance hours (e.g. some systems outsource all breakdown work therefore they should estimate all maintenance hours, both internal and external). Urgent maintenance hours completed by operations staff should also be included in this section. These hours should include the entire time spent completing work orders. Administration such as ordering parts, recording work order information and updating the maintenance management system should therefore be included as well.				
	Region of Durham	NWWBI_ Water Treatment - Protect the Environment	% residuals																						Total volume of all liquid wastes disposed of annually in ML, this number should include all individual and combined waste streams, take care not to double count wastes.				
	Region of Durham	NWWBI_ Water Treatment - Protect the Environment	% of Backwash Waste Treated																					Volume of BWW treated	Volume of Filter Backwash Waste that goes for further treatment prior to disposal. Annual figure in ML				
	Region of Durham	NWWBI_ Water Treatment - Protect the Environment	% of Filter-to-waste Treated																					Volume of FTW treated	Volume of Filter to Waste that goes for further treatment prior to disposal. Annual figure in ML				
	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	# of Blocked Sewers/ 100km length																					# of Blocked Sewers	# of blocked sewers = total number of blocked sewers that caused sanitary and combined sewer systems to back up, which required the deployment of equipment and labour to clear, regardless of reason (e.g., roots, greases, debris, poor hydraulics or structure). Exclude service connection blockages.				
	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	# of Blocked Sewers/ 100km length due to different causes																					# of Blocked Sewers	see above				
	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	% of Blocked sewers that were repeat occurrences																					# of blocked sewers that were repeat occurrences	Includes all blocked sewer main locations where more than one blockage occurred during the year (count each location).				

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				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A6 Infrastructure Stability	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	% of length cleaned/ Length that can be cleaned																					Length of system cleaned (single pass)	Report the length of main cleaned that used hydraulic or mechanical methods to remove grease, sediment, roots and debris etc. from sewer main interiors, for maintenance purposes. Do NOT double count sewers that are cleaned on two or more occasions. This metric is used to see how much of your system received cleaning, not the total amount of cleaning completed. Include the length of main cleaned prior to a CCTV inspection add this length to your total. If a main was cleaned more than once do not add these cleanings to your total. Exclude lengths cleaned immediately prior to slip-lining or any other pipe rehabilitation work, as such cleaning relates to capital reinvestment not general maintenance. The length of the system that can be cleaned. Can be calculated by taking the total sewer length, and subtracting the length of pipe where it is impossible to clean, if any.				
	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	% of length cleaned Hydraulically and/or Mechanically																					Length cleaned Hydraulically and/or Mechanically	Total length cleaned using high pressure flushing when root cutting was required. Do NOT double count sewers that are cleaned on two or more occasions. If a main was cleaned prior to a CCTV inspection add this length to your total. Exclude lengths cleaned immediately prior to slip-lining, or any other pipe rehabilitation work, as such activity relates to capital reinvestment not general maintenance.				
	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	% of manholes visually inspected																						Report the total number of manholes where zoom camera technologies have been used to survey either the manhole or sewer pipes associated with it. Include inspections on both new and existing systems. Report the total number of manholes that were inspected manually without the use of sophisticated technologies. Include inspections on both new and existing systems.				
	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	# of pump station failures/ # of pump stations																					Total # of reported pump station failures	# of pump station failures reported to a regulatory body due to mechanical faults rather than capacity or design issues (the metric is used to measure the mechanical reliability of stations).				
	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	5 year average # of sewer Repairs (planned & Emergency)/ 100 km length					x					x					x					x	# of planned sewer repairs	Repairs to mainline sewers that do not disrupt a crews regular working schedule (i.e. can be incorporated into working schedules over time) that if not made are unlikely to imminently compromise life, property and the environment. These are spot repairs not sewer replacements (e.g. less than 10m of pipe replaced) performed by either dig-down or trenchless methods, but includes sewer relining from one manhole to another. Only includes repairs for which the municipality is responsible.				
	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	% of Length CCTV Inspected					x					x					x					x	Length inspected by CCTV - Total	Total length inspected by CCTV, which does not include length inspected by zoom camera. This includes the sum of both CCTV inspection of new installations and existing sewer pipes.				

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A6. Infrastructure Stability	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	Breakdown of Length CCTV Inspected/ Length that can be inspected					x					x					x					x	Length of system that can be inspected by CCTV	The length of the system that can be inspected by CCTV. Can be calculated by taking the system's total sewer length, and subtracting the length of pipe where it is impossible to inspect by CCTV inspection, if any.				
	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	# of planned and emergency service Connection repairs/ 1000 service connections																					Planned & Emergency Service Connection Repairs	Repairs/replacements to service connections that can be added into a crews regular working schedule, which are unlikely to imminently compromise life, property and the environment. Only includes repairs/replacements for which the municipality is responsible. Service connections are defined as the sewer pipe between the sewer main and the property line. Repairs/replacements to service connections causing interruption to your crews daily work schedule - drop everything and go! - that if not made may imminently compromise life, property or the environment. Only includes repairs/replacements for which the municipality is responsible. Service connections are defined as the sewer pipe between the sewer main and the property line.				
	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	# of Blocked Service Connections/ 1000 Service Connections																					# blocked service connections	Number of blockages within the service connections for which the municipality is responsible. Only includes blockages that substantially restricts the flow in the service connection and have a commitment of equipment and labour deployed to service.				
	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	Unscheduled Maintenance Hours/Total Maintenance Hours																					Total Maintenance Hours	Total Maintenance hours = Preventative maintenance hours + Planned (scheduled) hours + Unplanned (breakdown) hours + Other hours. Include both internal and external maintenance hours (e.g. some systems outsource all breakdown work therefore they should estimate all maintenance hours, both internal and external). Maintenance hours completed by operations staff should also be included in this section. These hours should include the entire time spent completing work orders. Administration such as ordering parts, recording work order information and updating the maintenance management system should therefore be included as well.				
	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	Cost of CCTV/ Length of CCTV Inspected																					CCTV Unit Cost	Unit cost ($/km) for the total length of CCTV inspection by in-house crews all inclusive of labour, equipment and overhead costs. For CCTV undertaken by an outside company, record the unit cost under "Unit cost of CCTV (contracted services)".				
	Region of Durham	NWWBI-Wastewater Collection - Provide Reliable Service and Infrastructure	Cost of Cleaning Hydraulically/ Length Cleaned																					Unit cost of cleaning with a flusher truck - flushing only	Unit cost of sewer cleaning with a flusher truck - flushing only = Total cost to clean sewers with a flusher truck - flushing only / length of sewer cleaned. Units of $/km.				

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A6. Infrastructure Stability	Region of Durham	NWWBI- Wastewater Treatment - Provide Reliable Service and Infrastructure	Total of Unscheduled Maintenance Work/ Total Maintenance Work																					Urgent Maintenance Hours	Urgent maintenance hours = # of hours spent by maintenance staff on maintenance work that causes you to interrupt your daily schedule but is not captured under emergency work (above). Urgent work may not result in loss of service as the system is protected by equipment redundancy, and maintenance is deployed at the earliest practical convenience. As a guide include work that would cause you to interrupt your daily maintenance plan. Include both internal and external maintenance hours (e.g. some systems outsource all breakdown work therefore they should estimate all maintenance hours, both internal and external). Urgent maintenance hours completed by operations staff should also be included in this section. These hours should include the entire time spent completing work orders. Administration such as ordering parts, recording work order information and updating the maintenance management system should therefore be included as well.				
	Region of Durham	MPMP- Water	Number of Water Main Breaks per 100 KM of Pipe (excluding connections) (MPMP)																										
	Region of Durham	MPMP- Wastewater	Annual Number of Wastewater Main Backups per 100 KM of Wastewater Main (MPMP)																										
	Louisville	Continue renewal in treatment and delivery systems	Implement the Capital Improvement Program				x					x					x						x	Dollars expended	Total Dollars Expended	68.5MM	78.1MM		
	Gwinnett County DWR	Strategic asset management planning						x					x				x					x						See attached SAMPs for large meters, sewage pump stations, force mains, distribution piping, and stormwater. More are in development.	
	Gwinnett County DWR	% Critical assets condition-assessed	Gwinnett balanced scorecard metric - see supporting documentation																										
	Gwinnett County DWR	% Work orders for preventive maintenance	Gwinnett balanced scorecard metric - see supporting documentation																										
	Tualatin Valley	Risk Management Program																											
	MSDGC	Business case evaluation process	The noimination, planning, and implementation of projects is based on a standardized BCE process.				x					x					x					x		% of projects in planning that follow the standardized process.	Total number of projects that follow the standardized BCE process.	100%			
	MSDGC	Risk scores for gravity sewers	Risk scores have been determined for all gravity sewers in the collection system. This has helped MSD prioritize its CIP nominations and better mange its risk.				x					x						x					x	Number of gravity pipes with risk scores.	Total number of gravity pipes that have been assigned a risk score.	100%	100%	Risk spreadsheet, GIS shape file	
	South East Water	Comprehensive Asset register	For each asset we know: Location Physical Attributes Maintenance History					x				x					x					x		Audited Annually		N/A	N/A	Asset Management Plan	
	South East Water	Corporate Risk Management Framework	For each asset class we've defined a risk profile based around the Corporate Framework to establish renewal and scheduled maintenance activities.					x				x					x						x	Audited Annually		N/A	N/A	Asset Management Plan	
	South East Water	Water Reliability Pipeline Forecasting Model	Provides a long term pipeline deterioration forecast and short term prioritisation using deterioration modelling for long term (30 year) asset replacement profiles (PARMS) and risk based analysis for short term prioritisation of works. (WRAP)					x				x						x					x	Long term reviewed annually as part of Asset Management function. Short-term reviewed monthly or more frequently as required.		N/A	N/A	WRAP/PARMS Manuals	
	South East Water	Sewerage blockages	Sewer blockages represent a maintenance event to the business. These events result in a reactive response to rectify the issue and ensure a well maintained system and quality of service. A measure of occurrence helps monitor the need and effectiveness of maintenance programs although blockages are also affected by external and environmental factors					x					x					x					x	Number of blockages on reticulation sewers (per 100km of sewer)		22.8 per 100 kms	17.5 per 100 kms	KPI Reports Montage Montage Reports (Prometheus) Procedures	

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				Process development					Process documentation					Process coverage					Process frequency											
				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A6. Infrastructure Stability	South East Water	Sewer Reliability Pipeline Forecasting Model	Provides a long term pipeline deterioration forecast and short term prioritisation using deterioration modelling for long term (30 year) asset replacement profiles and risk based analysis for short term prioritisation of works. (SARP)					X				X						X					X	Long term reviewed annually as part of Asset Management function. Short-term reviewed monthly or more frequently as required.		N/A	N/A	Sewer Deterioration Model and SARP Manuals	
	South East Water	Condition Assessment Program of Critical Assets	Company has a program of regular condition assessment of critical assets, Large diameter sewers and water mains, sewer rising mains, Sewer pump stations and water storages. Programming is based on risk analysis with condition data then fed back into risk profile to reassess risk of the asset. Extreme risk assets and those at the end of asset life are programmed for renewal. The goal is to renew before failure occurs.				x					x					x					x		No Current Metric		N/A	N/A	Asset Management Plans.	
	South East Water	Unplanned water supply interruptions	To adequately maintain the hydraulic system and measure the amount of reactive maintenance activity in relation to the entire system.					X					X					X					X	Number of unplanned water supply interruptions (per 100km of main)		31.2 per 100 kms	24.8 per 100 kms	KPI Reports Montage Montage Reports (Prometheus) Procedures	
	South East Water	Customers experiencing more than five unplanned water supply interruptions per annum	This is when the customer has NOT received at least 2 days notification of the interruption. All un-notified interruptions caused by third parties should be included. This differs from the Asset Performance definition, which excludes interruptions caused by third parties as this is not necessarily a result of asset failure, as the end result is a loss of service to the customer					X					X					X					X	Number of customers experiencing greater than five unplanned water supply interruptions		150	249	KPI Reports Montage Montage Reports (Prometheus) GIS Procedures	
	South East Water	Average duration of unplanned water supply interruptions	This is when the customer has NOT received at least 2 days notification of the interruption. All un-notified interruptions caused by third parties should be included. This differs from the Asset Performance definition, which excludes interruptions caused by third parties as this is not necessarily a result of asset failure, as the end result is a loss of service to the customer					X					X					X					X	Average duration of unplanned water supply interruptions (minutes)		87.8 mins	88.4 mins	KPI Reports Montage Montage Reports (Prometheus) GIS Procedures	
	South East Water	Average frequency of unplanned water supply interruptions						X					X					X					X	Average frequency of unplanned water supply interruptions (per 1,000 customers)		0.21	0.17	KPI Reports Montage HiAffinity	
	South East Water	Customers receiving more than three sewer blockages	Sewer blockages represent a maintenance event to the business. These events result in a reactive response to rectify the issue and ensure a well maintained system and quality of service. The frequency of these must meet ESC requirements					X					X					X					X	No of Customers receiving more than three sewer blockages per annum		0	0	KPI Reports Montage Montage Reports (Prometheus)	
	South East Water	Sewer spills	The number of sewer spills is an indication of the effectiveness of the wastewater system in relation to its capacity, maintenance and costs. This indicator summarizes the management of Company assets to cope with the risk and occurrence of spills and its impact on the environment and customers					X					X				X					X		No of Sewer Spills (per 100km of sewer)		6.3 per 100 kms	6.2 per 100 kms	KPI Reports Montage Montage Reports (Prometheus)	
	South East Water	Sewer spills to customer property	This measure captures the number of sewer spills within a customer's premises					X					X				X					X		No of sewer spills (to customers properties)		20	24	KPI Reports Montage Montage Reports (Prometheus)	
frastructure Stability	South East Water	Non Revenue Water	To monitor the volume of water that is lost or not accounted for due to infrastructure related leaks.				X					X					X					X		Infrastructure Leakage Index		9.50%	11.30%	KPI Reports Montage Montage Reporting (Prometheus) Tank Cleaning Program Results HiAffinity Data	
	South East Water	Planned water supply interruptions	To adequately maintain the hydraulic system and measure the amount of planned maintenance activity in relation to the entire system.					X					X					X					X	Number of planned water supply interruptions (per 1,000 customers)		6.0 per 100 kms	5.0 per 100 kms	KPI Reports Montage Montage Reporting (Prometheus) GIS Procedures	
	South East Water	Average frequency of planned water supply interruptions						X					X					X					X	Average frequency of planned water supply interruptions (per 1,000 customers)		0.04	0.03	KPI Reports Montage HiAffinity	

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A6. Infra	South East Water	RCM	Reliability Centred Maintenance of mechanical and Electrical Assets, using existing history of breakdowns and repairs, developing a predictive schedule of mechanical and electrical maintenance.			X						X					X					X		Monitor Key Asset availability performance against desired availability.		N/A	N/A	Montage Montage Reporting (Prometheus) Watershed	
	South East Water	Risk Based Programmed Maintenance	Developed detailed schedule of inspection and planned maintenance of civil assets based on risk profile and maintenance history.					X					X					X				X		Percentage of annual program delivered.		100%	95%	Asset Management Plans	

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				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A7. Operational Resiliency	Green Bay MSD	Low Recordable Incidents of Work-Related Injury or Illnesses	Incidence rates can be used to show the relative level of injuries an illnesses and help identify problem areas and prevent work-related injuries and illness																									
	Toronto Water	Work related injuries	Accident report and analysis					x					x				x						x	Lost Time Accidents (LTAs)	Lost Time Accidents (LTAs)	0	27	Data from HR Occ H&S Year to date report of Accidents by injury causes, nature/type, and event/exposure, as well as trends	
	Region of Peel	Low Recordable Incidents of Work-Related Injury or Illnesses	Incidence rates can be used to show the relative level of injuries an illnesses and help identify problem areas and prevent work-related injuries and illness			x					x				x					x				Total Recordable Incident Rate	(Number of work related injuries and illness multiplied by 200,000) divided by employee hours worked. 200,00 hours is a standardized number used by OSHA to normalize data. It represents the equivalent of 100 employees working 40 hours per week, 50 weeks per year, and provides the standard base foe the incidence rates.	N/A	N/A	N/A	Incidence rates based on the OSHA formula are not measured at Peel.
	Region of Peel	Low Recordable Incidents of Work-Related Injury or Illnesses	Incidence rates can be used to show the relative level of injuries an illnesses and help identify problem areas and prevent work-related injuries and illness																					New WSIB Claims per year (includes Health Care and Lost Time Claims)	Claims have declined in Public Works from 2007 to 2009. For 2007 and 2008 there were 14 and 2009 there were 8 for Water staff.	N/A	8	Calculated from Peoplesoft-HRMS	Although there are a variety of measures, at this point this data is not used to develop preventative measures to reduce or eliminate injuries.
	Region of Peel	Low Recordable Incidents of Work-Related Injury or Illnesses	Incidence rates can be used to show the relative level of injuries an illnesses and help identify problem areas and prevent work-related injuries and illness																					Lost Time Injury Rate	LTI Rate (Lost Time Injury Rate) is the number of lost time injuries standardized by the size of the workforce, and is calculated by dividing the number of lost time injuries by the number of employees in the department, multiplied by 100.	N/A	3.9	Calculated from Peoplesoft-HRMS	The Regional rate is 3.9 which is a decline from 2007 and 2008. The LTI rate for Public Works is 3.73. This is not broken down further so there is no information available specific to Water.
	Region of Peel	Low Recordable Incidents of Work-Related Injury or Illnesses	Incidence rates can be used to show the relative level of injuries an illnesses and help identify problem areas and prevent work-related injuries and illness																					Total Days Lost Due to WSIB Claims	Total # Days Lost =Total Hours Lost/(STD HRS/Wk/5)	N/A	62.7	Calculated from Peoplesoft-HRMS	
	Charleston Water	OSHA Incident Rate	Levels indicate the number of OSHA recordable accidents per 100 employees on an annual basis.					x					x					x					x	# Accidents per 100 associates		3.50	3.10	HR reports; Performance Scorecard software	Key Performance Indicator (KPI)
	Charleston Water	OSHA DART Rate	Levels represent the number of OSHA Recordable accidents that incur time away from work, restricted duty, or job transfer per 100 employees.					x					x					x					x	# Accidents per 100 associates		2.50	1.60	HR reports; Performance Scorecard software	Key Performance Indicator (KPI)
	ABCWUA	Employee Health and Safety Severity Rate	Quantify the rate of employee days lost from work due to illness or injury			x						x				x					x			Total workdays away from work and total hours worked by all employees	(Number of work related injuries and illness multiplied by 200,000) divided by employee hours worked. 200,00 hours is a standardized number used by OSHA to normalize data. It represents the equivalent of 100 employees working 40 hours per week, 50 weeks per year, and provides the standard base foe the incidence rates.	223	252	Year-to-date total recordable incidence rate	Injury reduction incentive program developed in 2007
	ABCWUA	Emergency Response Readiness	Total number of training hours on emergency response readiness training for all employees, expressed as hours per employee			x						x			x					x				Total number of training hours for all employees on emergency response readiness training is divided by total employee hours			0.01%	Spreadsheet	No target has been established for this metric as it was obtained for the 2009 QualServe Survey
	Region of Durham	NWWBI - Water Distribution	Labour Issues					x					x					x					x	# of accidents with lost time	Number of accidents, which caused the worker to incur time off work. Exclude accidents incurred during capital construction.				
	Region of Durham	NWWBI - Water Distribution	Labour Issues					x					x					x					x	# of lost hours due to accidents	Total number of hours that field staff were not at work due to accidents. Exclude accidents incurred during capital construction.				
	Region of Durham	NWWBI - Water Distribution - staffing Levels	# of Field FTE's/ 100km length																					# of Field Staff	Full-time equivalent 1 FTE = 2080 hours = 52 x 40 hr week. Therefore, this number is not a measure of effort. It accounts for hours whether worked, taken as vacation or recorded as sick or other leave. Includes both permanent and temporary staff. Contracted FTEs include equivalent FTEs for all staff employed by an outside company.				

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A7. Operational Resiliency	Region of Durham	NWWBI - Water Distribution - staffing Levels	# of O&M FTE's / 100km length																					# of O&M Field Staff	see above				
	Region of Durham	NWWBI - Water Distribution - staffing Levels	# of metering Field Staff/ 1000 Meters																					# of Metering Field Staff	see above				
	Region of Durham	NWWBI - Water Distribution - staffing Levels	# Of Pump Station FTE's / 1000 Total Pump Station Hp																					# of Pump Station Field Staff	see above				
	Region of Durham	NWWBI - Water Distribution - Safe and Productive work Environment	Total Available Field Hours/ Total Paid Field Hours																					Total available hours for actual employees	= Total paid hours – Total unavailable hours. Where total unavailable hours = vacation hours + optional training hours + safety training hours + sick hours + long term leave hours + union paid hours + total # of other paid hours.				
	Region of Durham	NWWBI - Water Distribution - Safe and Productive work Environment	Breakdown of Unavailable Field Hours/ Total Paid Field Hours																					Unavailable Hours - Training, sick, vacation, stat, union, long term, other	see above				
	Region of Durham	NWWBI - Water Distribution - Safe and Productive work Environment	Total Overtime Hours/ Total Paid Field Hours - Indicator of Additional Staff Resource Requirements																					Total overtime hours	Total number of overtime hours recorded for all field staff; do not include overtime hours that are paid in lieu, or that are accrued from working a normal shift on a statutory holiday. If actual hours are not available, calculate as "# of actual field staff x average number of recorded overtime hours per field staff per year less any hours previously described".				
	Region of Durham	NWWBI -Water Treatment	Labour Issues					x					x					x					x	# of accidents with lost time	Number of accidents, which caused the worker to incur time off work. Exclude accidents incurred during capital construction.				
	Region of Durham	NWWBI -Water Treatment	Labour Issues					x					x					x					x	# of lost hours due to accidents	Total number of hours that field staff were not at work due to accidents. Exclude accidents incurred during capital construction.				
	Region of Durham	NWWBI -Water Treatment Safe and Productive work Environment	Total Available Field Hours/ Total Paid Field Hours																					Total available hours for actual employees	= Total paid hours – Total unavailable hours. Where total unavailable hours = vacation hours + optional training hours + safety training hours + sick hours + long term leave hours + union paid hours + total # of other paid hours.				
	Region of Durham	NWWBI -Water Treatment Safe and Productive work Environment	Breakdown of Unavailable Field Hours/ Total Paid Field Hours																					Unavailable Hours - Training, sick, vacation, stat, union, long term, other	see above				
	Region of Durham	NWWBI -Water Treatment Safe and Productive work Environment	Total Overtime Hours/ Total Paid Field Hours - Indicator of Additional Staff Resource Requirements																					Total overtime hours	Total number of overtime hours recorded for all field staff; do not include overtime hours that are paid in lieu, or that are accrued from working a normal shift on a statutory holiday. If actual hours are not available, calculate as "# of actual field staff x average number of recorded overtime hours per field staff per year less any hours previously described".				
	Region of Durham	NWWBI - Wastewater Collection	Labour Issues					x					x					x					x	# of accidents with lost time	Number of accidents, which caused the worker to incur time off work. Exclude accidents incurred during capital construction.				
	Region of Durham	NWWBI - Wastewater Collection - Safe and Productive work Environment	Labour Issues					x					x					x					x	# of lost hours due to accidents	Total number of hours that field staff were not at work due to accidents. Exclude accidents incurred during capital construction.				

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A7. Operational Resiliency	Region of Durham	NWWBI - Wastewater Collection - Safe and Productive work Environment	Total Available Field Hours/ Total Paid Field Hours																					Total available hours for actual employees	= Total paid hours – Total unavailable hours. Where total unavailable hours = vacation hours + optional training hours + safety training hours + sick hours + long term leave hours + union paid hours + total # of other paid hours.				
	Region of Durham	NWWBI - Wastewater Collection - Safe and Productive work Environment	Breakdown of Unavailable Field Hours/ Total Paid Field Hours																					Unavailable Hours - Training, sick, vacation, stat, union, long term, other	see above				
	Region of Durham	NWWBI - Wastewater Collection - Safe and Productive work Environment	Total Overtime Hours/ Total Paid Field Hours - Indicator of Additional Staff Resource Requirements																					Total overtime hours	Total number of overtime hours recorded for all field staff; do not include overtime hours that are paid in lieu, or that are accrued from working a normal shift on a statutory holiday. If actual hours are not available, calculate as "# of actual field staff x average number of recorded overtime hours per field staff per year less any hours previously described".				
	Region of Durham	NWWBI - Wastewater Treatment	Labour Issues					x					x					x					x	# of accidents with lost time	Number of accidents, which caused the worker to incur time off work. Exclude accidents incurred during capital construction.				
	Region of Durham	NWWBI - Wastewater Treatment	Labour Issues					x					x					x					x	# of lost hours due to accidents	Total number of hours that field staff were not at work due to accidents. Exclude accidents incurred during capital construction.				
	Region of Durham	NWWBI - Wastewater Treatment - Safe and Productive work Environment	Total Available Field Hours/ Total Paid Field Hours																					Total available hours for actual employees	= Total paid hours – Total unavailable hours. Where total unavailable hours = vacation hours + optional training hours + safety training hours + sick hours + long term leave hours + union paid hours + total # of other paid hours.				
	Region of Durham	NWWBI - Wastewater Treatment - Safe and Productive work Environment	Breakdown of Unavailable Field Hours/ Total Paid Field Hours																					Unavailable Hours - Training, sick, vacation, stat, union, long term, other	see above				
	Region of Durham	NWWBI - Wastewater Treatment - Safe and Productive work Environment	Total Overtime Hours/ Total Paid Field Hours - Indicator of Additional Staff Resource Requirements																					Total overtime hours	Total number of overtime hours recorded for all field staff; do not include overtime hours that are paid in lieu, or that are accrued from working a normal shift on a statutory holiday. If actual hours are not available, calculate as "# of actual field staff x average number of recorded overtime hours per field staff per year less any hours previously described".				
	City of Calgary	To ensure a safe work environment	Employee days lost to injury or illness			x				x				x							x			Number of current year WCB days lost for the reporting period	To track our performance in ensuring a safe work environment, this measure will track the number of days that employees are on Worker's Compensation Board (WCB) absence due to work-related illness or injury.	TBD	115		
	Louisville	Quality of work life, employee contribution and safety						x					x					x					x	Preventable Vehicular Accident Rate	Preventable vehicular accident rate per 100,000 miles driven	<=.95	0.9		
	Louisville	Quality of work life, employee contribution and safety						x					x					x					x	OSHA recordable Rate	OSHA recordable rate per 200,000 hours worked	<=6.66	6.2		
	Union Sanitary District	Energy co-generation						x					x					x					x	kwh/day generated		11,000 kwh	13,000		
	Union Sanitary District	Solid waste Recycling/Composting	Collection of various waste streams for recycling, food waste composting				x					x					x					x		% solid waste diverted to recycling or composting	Tons diverted/total tons generated		50%	Allied Waste records	
	Union Sanitary District	Class A Biosolids disposal						x					x					x					x	Ave % biosolids disposed of as Class A			50%		

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A7. Operational Resiliency	Gwinnett County DWR	Lost hours	Measures the number of hours lost due to sick leave and FMLA for a department vs. total number of available sick leave hours based on the 45 hr/employee county maximum requirement.			x				x					x					x				Lost hours	Measures the year-to-date number of hours lost due to sick leave and FMLA for a department vs. total number of available sick leave hours based on the 45 hr/employee county maximum requirement.	< 24,255 as of April 30.	12,449	See attached excerpts from balanced scorecard.	
	Gwinnett County DWR	Standard operating guidelines					x						x				x					x		NA	Standard operating procedures developed for each of the plants, for Engineering & Construction, and for CIP prioritization.			Standard operating procedures developed for each of the plants (too numerous to attach), for Engineering & Construction (see attached index, routinely updated), and for CIP prioritization (attached).	
	Tualatin Valley	Risk Management Program																											
	South East Water	LTI frequency rate	Rate of work related incidents that result in a fatality, permanent disability or time lost from work of one day/shift or more per million hours worked. (This does not apply to employees/contractors on leave, such as, annual, sick, etc.)					X					X					X					X	Number of LTI's per million hours worked		0 per FTE	1.63 per FTE	KPI Reporting Incident Reporting	
	South East Water	Claims against the business	Claims for damages due to Sewage spill, burst water mains and other property and personal damages			X				X						X						X		$ spent on under deductible claims		N/A	N/A	Software Procedures of external claims manager	
	South East Water	Business Risk Management Framework	Document that describes our Business Risk Management procedures and reporting				X					X					X					X		Effectiveness indicators on key risk that are reported to FA&RM	Multiple key risk indicators reported	N/A	N/A	BS1026, FA&RM, SDC&P, Board and Exec reporting	
	South East Water South East Water South East Water South East Water	Incident Management Plan	Document that describes our response to an Incident, including training and the incidents and alerts portal.				X					X						X				X		Exec reporting of debrief actions. Incidents reported to FA&RM	Report on completeness of debrief actions following events	N/A	N/A	Incident Management Plan	
	South East Water	Treatment Plant Compliance	Effluent Standards specified by the EPA in each of the Sewage Treatment Plant licences if met should not exert any detrimental effect on the environment.					X			X						X			X				No of Analyses complying with licence agreement (as % of samples)		100%	100%		
	South East Water	Total volume of sewage spilled to waterways due to	Sites derived from Sewer Spill SI on Montage, and volumes based on modelling by Network			X					X					X						X		Volume (kL) that spilled to waterways.		5000 kL	8391 kL	KPI Reporting (to Executive, AGB & Board)	
	South East Water	Ammonia loads to waterways	Based on ammonia loads for Recycled Water Treatment Plants, that is discharged to waterways.				X				X						X						X	Ammonia load (tonnes) from all Recycled Water Treatment Plants		14 t	5 t	KPI Reporting (to Executive, AGB & Board)	
	South East Water	Sewer spills contained within five hours	Derived from Sewer Spill SI on Montage.					X					X				X						X	Spills due to blockages in reticulation sewers, that have ceased or been contained within 5 hours.		100%	100%	KPI Reporting (to Executive, AGB & Board) Montage Reporting (Prometheus)	
A8. Community Sustainability	Toronto Water	Environmental stewardship though electrical energy consumption reduction	This measure of monitoring and reducing energy utilization helps with climate change impact to communities				x					x				x				x				Ratio of energy consumption to volume water and wastewater treated, supplied, and collected	Total kwh used for treatment or movement of water or sewer/ Total ML of water and sewer treated, collected, & distributed	TBD	633.4	Data from WTS energy records and plant records for volumes	
	Toronto Water	Beach water quality	Environmental stewardship monitoring through measuring beach water quality for safe swimming and natural habitat				x					x			x					x				Ratio of adverse quality beach postings	Total number of beach postings/ Total number of days beach tested	<20%	28%	Data from Water Infrastructure Management and Toronto Public Health	
	Region of Peel	Greenhouse Gas Emissions	This measure helps drinking and wastewater utilities to understand and reduce their individual contributions to area greenhouse gas emissions.		x					x					x				x					Net greenhouse gas emission		N/A	N/A		Corporate Energy group is in the process of finalizing an emissions formula to begin monitoring of GHGs but this is in development.

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A8. Community Sustainability	Charleston Water	Environmental Management System (EMS) Audit Findings	Levels measure the total number of EMS audit findings discovered each year by the CWS EMS Internal Auditing Team and the third-party, external auditor.					x					x					x					x	# Audit findings	Audits are conducted based upon the ISO 14001 International Standard for establishing an Environmental Management System (EMS). Formal nonconformance tracking reports are established on all nonconformances, and all findings are stringently tracked and ultimately resolved in a timely manner.	0	1	EMS Audit reports; Monthly Operating Reports (MORs); Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	EMS Improvement Programs Completed	Levels reflect the percent of environmentally-related improvement programs started as compared to those completed.					x					x					x					x	% Complete	# Completed divided by # initiated	100%	97%	EMS Improvement Program Annual Report; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Recycling Program	Levels measure the volume in tons of products recycled by CWS associated within both operations and administration.					x					x					x					x	Tons recycled		81.71	78.63	Spreadsheets; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Energy Usage (in kWh)	Levels reflect the volume of energy used by CWS in all operations and at all facilities.					x					x					x					x	kWh		48091972	47762809	Local electric company report; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Water Consumption (by CWS Operations)	Levels measure the volume of water use that CWS has consumed in one hundred cubic feet (CCF) for all CWS operational facilities where water reduction measures are possible.					x					x					x					x	Hundred Cubic Feet (CCF)		41,577	46,364	Customer Service System database; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Operation Round-up	Levels measure dollars contributed and CWS customers participating each year in "Operation Roundup."					x					x					x					x	Dollars; % participation	This program assists those less fortunate with funds to pay their water/wastewater bill, and/or goes to Water Missions International—a worldwide relief effort organization serving the water and sanitation needs of people in developing countries and disaster areas.	Funds: $30,905; Participants: 2,700	Funds: $31,663; Participants: 4,071	Customer Service reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	United Way Funds Raised & Percent Participation	Levels reflect funds contributed and the percent of participation by CWS associates in supporting and strengthening key communities.					x					x					x					x	Dollars; % participation		Funds: $75,000; Participants: 68%	Funds: $76,745; Participants: 62%	HR reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Day of Caring	Levels reflect the participation of CWS associates in supporting and strengthening our key communities through the United Way "Day of Caring" national event					x					x					x					x	# Associates		50	45	HR reports; Performance Scorecard software	Performance Indicator (PI)
	Charleston Water	Habitat for Humanity	Levels reflect the participation of CWS associates in supporting and strengthening our key communities through the Habitat for Humanity event					x					x					x					x	# Associates		30	31	HR reports; Performance Scorecard software	Performance Indicator (PI)
	ABCWUA	Water Service Affordability	Measure the affordability of water services to customers, as a percentage of household income			x				x					x					x							0.72%	Outside consultant report	Rate Study is performed every two years
	ABCWUA	Wastewater Service Affordability	Measure the affordability of wastewater services to customers, as a percentage of household income			x				x					x					x							0.33%	Outside consultant report	Rate Study is performed every two years
	Region of Durham	NWWBI - Water Utility - Environmental Stewardship	# of days of water restrictions																					Total # of days of water restrictions	Total number of days during the year where the municipality had to impose water use restrictions to manage demand. Includes both mandatory and voluntary restrictions (collect separately the number of each).				
	Region of Durham	NWWBI - Water Utility - Environmental Stewardship	Per capita Average Day Consumption for Residential Customers																					Utility ADD	Average Day Demand (ML/day) for the water utility (excludes volume exported to neighbouring regions/municipalities). Annual average of all daily flows through the water utility i.e. distribution or integrated or transmission system (units used are ML/day)				

Appendix B-2
Leading practice documentation

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				Process development					Process documentation					Process coverage					Process frequency											
				Informal	Aware	Formalized	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
A8. Community Sustainability	Region of Durham	NWWBI - Water Distribution Energy Consumption	Per capita Average Day Consumption for Residential Customers																					Pump Station Energy Consumption	Sum of all energy consumed (Electricity, natural gas, and diesel) in operating and maintaining pump stations in the distribution/transmission system i.e. electricity or diesel for the pumps, and natural gas for heating. This does NOT include energy consumed in operating vehicles.				
	Region of Durham	NWWBI - Water Distribution Protect the Environment	Peaking Factor (MDD/ADD)																					MDD	Maximum volume per day flowing through the distribution/transmission system for any day in the year (units used are ML/day). (Include treated water volume supplied to neighbouring regions/municipalities)				
	Region of Durham	NWWBI -Water Treatment Energy Efficiency	Energy Consumed in kWh/ML Treated																					Energy Consumption	Data on energy consumed in the treatment plant for each energy source (including pumping within the plant of both raw and treated water). Energy sources include electricity, natural gas, oil, propane and diesel.				
	Region of Durham	NWWBI -Water Treatment Energy Efficiency	Breakdown of Energy Consumed in kWh/ML Treated																					Electricity, Natural Gas, Diesel, Propane, Oil	see above				
	Region of Durham	NWWBI-Wastewater Treatment -Energy Efficiency	Energy Consumed in kWh/ML Treated																					Energy Consumption	Sum of the energy consumed in kWh in the operation and maintenance of the wastewater treatment plant. Energy sources include electricity, natural gas, oil, propane, diesel, biogas and steam and are converted to kWh using standard conversions. If any of the specific energy sources are not consumed, then please enter 0 into the cell, otherwise it will be assumed to be used but will show as no data.				
	Region of Durham	NWWBI-Wastewater Treatment -Energy Efficiency	Breakdown of Energy Consumed in kWh/ML Treated																					Electricity, Natural Gas, Diesel, Propane, Oil	see above				
	Region of Durham	NWWBI-Wastewater Treatment -Energy Efficiency	Cost of Energy Purchased / ML Treated																					Total energy purchased	Cost of energy purchased for consumption during the routine operations and maintenance of the wastewater treatment plant. Energy sources that might be purchased include electricity, natural gas, oil, propane and diesel. All energy purchase costs should include the direct cost of energy, its delivery, distribution, taxes, surcharges and similar costs.				
	Region of Durham	OMBI - Water	Percentage of Total Households Serviced by Municipal Water																						# of households with water connections				
	Region of Durham	OMBI - Water	Average Occupancy Ratio = Serviced Population /Serviced Households																										
	Region of Durham	OMBI - Water	Non Revenue Water in Litres per Connection per Day																										
	Region of Durham	OMBI - Water	Average Utilization Rate of Water Treatment Plants																						% Average Capacity Utilization = Average Day Flow ÷ Plant Rated Capacity				
	Region of Durham	OMBI - Water	Demand exceeds 90% of Water Supply																						Peak Capacity Utilization = # Days Plant Operated at > 90% of Plant Rated Capacity				
	Louisville	Actively support employee and corporate participation in establishing and supporting community goals	Minority Spending					x					x					x					x	Minority Spend as % of total	% of Certified Minority Spends as % of total >= 10%	10%	6,8%		

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A8. Community Sustainability	Louisville	Actively support employee and corporate participation in establishing and supporting community goals	Women Spending					x					x					x					x	Women Spend as % of total	% of Certified Women Spends as % of total >= 5%	5%	7.30%		
	Louisville	Actively support employee and corporate participation in establishing and supporting community goals	Community Stewardship			x						x				x			x					Management participation	Community stewardship participation	100%	51%		
	Tualatin Valley	CIP Sustainability Review																											
	Tualatin Valley	Employee Recycling Benefit																											
	South East Water	Watershed-Based Infrastructure Planning	Not required for SEW. More a wholesaler (Melbourne Water) function	N/A																					N/A		N/A	N/A	
	South East Water	Water Efficiency Program	Working with customers (both Residential & Commercial) to reduce water usage					X					X				X					X		N/A		N/A	N/A	KPI Reporting Consumption per Capita Joint Metropolitan Water Efficiency Program Document	
	South East Water	Biodiversity Program	Strategic Plan in place for Biodiversity Master Plan which identifies significant sites			X					X					X					X			N/A		N/A	N/A		Progression against the implementation plan
	South East Water	Environmental Management System	The EMS is that part of the overall integrated management system which includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the organisation's Management Systems Policy. The EMS is one of the tools providing a structured process for continual improvement of environmental performance.					X					X					X				X		EMS Certification	Audited annually	Achieve Certification	Certification Achieved		
	South East Water	Greenhouse Gas Emissions	To measure emissions of carbon dioxide equivalents and the mitigation of those emissions with an aim for long term reductions in net emissions.					X					X					X					X	Tonnes of CO2 per annum		39,200 net tonnes	31,494 net tonnes	KPI Reporting DSE, ESC, EPA, NGERS Reporting Greenhouse Gas Reporting Tool	
	South East Water	Total energy purchased	To monitor energy use across the organisation and improve energy efficiency of our operations				X				X							X					X	GJ per annum		103,248 GJ	103,474 GJ		Reported to NGERS - mandatory reporting
	South East Water	Hardship Program	Company's hardship policy details the practical payment and hardship assistance options available to its customers experiencing financial difficulties. The policy outlines the minimum standards we will adopt in relation to managing customers experiencing financial difficulties, the rights of customers experiencing financial hardship and Company's obligations to customers experiencing financial hardship.					X					X				X						X	N/A		N/A	N/A		Average of $342 provided to 600 Grants
A9. Water Resource Adequacy	Green Bay MSD	Long-term ambient water quality	Measure quality of the surface water the WWTP discharges into to determine our impact and overall improvements				x					x					x					x		Sechi disk, phosphorus, nitrogen measurements	Data is used by University's to present long-term health status of the watershed			Annual data report	
	Toronto Water	Wastewater treatment environmental impact to water supply sources	Maintain limited environmental impact to water supply sources from backups and overflows				x					x					x						x	Percentage of Wastewater estimated to have bypassed treatment	Estimated megalitres of untreated wastewater/ Total megalitres of treated wastewater plus estimated megalitres of untreated wastewater	0	0.64%	Data from OMBI database & dictionary	
	Toronto Water	Water efficiency for minimizing expansion	Measure source water resource management by implementing Water Efficiency Plan measures to reduce water demand				x					x				x				x				Ratio of water delivered to population served	Total volume of water delivered to customers/ Population of residential customers	225	150		
	Region of Peel	Long-term water supply adequacy	Peel has access to an abundant supply of lake water although water supply is reviewed through the master plan process using a 25 year period. For the groundwater system, wells are established based on sustainable rates. Permits to take water are now based on this method only. Although well quality may be impacted in the future, all wells are now built based on sustainability.				x					x					x					x		Projected years of sufficient water supply	Statistical forecasting and simulation modeling can be used for such long-term projections	N/A	25 years for Lake Based system	Water Distribution System and Supply Master Plan 2007	The master plan looks at supply and demand over a 25 year period, in alignment with the outlook in the Region's Official Plan.
	ABCWUA	Available Future Water Supply	Number of years in the future for which projected supply exceeds projected demand expressed as years into the future from current year					x					x				x						x	Available Future Water Supply = Future Year When Demand Exceeds Supply – Current Year	Statistical forecasting and simulation modeling can be used for such long-term projections		40	40-Year Water Development Plan & Water Resources Management Strategy	State law limits to a 40-year planning horizon

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A9. Water Resource Adequacy	ABCWUA	Current Water Demand	Measure the current average annual water demand compared to available supply, expressed as a percentage					x					x				x						x	Most recent five-year average water demand is divided by average available water supply			33.5%		No target has been established for this metric as it was obtained for the 2009 QualServe Survey
	ABCWUA	Water Conservation Savings	Measure water savings by comparing the annual consumption and account growth by customer class and system-wide per capita usage					x					x				x						x	Gallons per person per day (GPCD)	Reduce water consumption to extend water resources and minimize environment impacts	155	157	Billing System (Oracle CC&B); Spreadsheet	Long range goal is 150 gpcd by 2014
	Region of Durham	NWWBI - Water Utility - Provide Adequate Capacity	# of Hours of Treated Water Storage Capacity at Average Day Demand																						Sum of treated water storage capacity (owned and operated) within pipe system, i.e. sum of all reservoir capacities within transmission/integrated/distribution system (units ML). Treated water that would be available in an emergency. Sum of treated water storage capacity (owned and operated) within all utility treatment plants (even if some are not benchmarked) (units ML). Treated water that would be available in an emergency.				
	Region of Durham	NWWBI - Water Treatment - Provide Adequate Capacity	# of days that plant operated at > 90% capacity																					# of days that plant operated at > 90% capacity	Number of days that the treatment plant operated at greater than 90% of its maximum rated treatment capacity (only required for filtered systems as data is not graphed for unfiltered systems).				
	Region of Durham	NWWBI - Water Treatment - Provide Adequate Capacity	# of days that plant operated at > 100% capacity																					# of days that plant operated at > 100% capacity	Number of days that the treatment plant operated at greater than 100% of its maximum rated treatment capacity (only required for filtered systems as data is not graphed for unfiltered systems).				
	Region of Durham	NWWBI - Water Treatment - Provide Adequate Capacity	Average Day Demand (ML/day) / Existing Water License Capacity																					Water license existing maximum capacity	Existing maximum capacity of the water license, measured in daily flow (ML/day). If the capacity is provided in annual volume (ML), then divide by 365 days to provide the value in ML/day. For multiple surface water sources (or groundwater sources), the total capacity for all surface water sources (or groundwater sources) should be recorded.				
	Region of Durham	NWWBI - Wastewater Collection - Provide Adequate Capacity	# of connections with sanitary flooding/ 1000 connections																					Total # of connections with sanitary flooding	Total # of connections with sanitary flooding caused by a backup of sewage in the collection system or other non-rainfall related failure, for which the municipality was responsible .				
	Region of Durham	NWWBI - Wastewater Collection - Provide Adequate Capacity	Breakdown of connections with sanitary flooding by causes/ 1000 connections																						see above				
A9. Water Resource Adequacy	Region of Durham	NWWBI - Wastewater Collection - Provide Adequate Capacity	# of reported Overflows due to capacity/ 100 km length																					Total # of reported overflows	The number of times an overflow from the collection system has to be reported to the regulatory agency, also called sanitary sewer overflows (SSOs). Combined sewerage overflows to an outfall are not included in the number of reported overflows nor are any overflows allowed by the regulatory agency. However, occurrences when a combined sewer system has an overflow that is not from an outfall pipe, e.g. from a manhole, should be included. Should be a sum of all reported overflows due to internal blockage, external blockage, capacity limitations, pump station failures and other.				
	Region of Durham	NWWBI - Wastewater Collection - Provide Adequate Capacity	Breakdown of reported Overflows by cause/ 100 km length																						see above				
	Region of Durham	NWWBI - Wastewater Treatment - Provide Adequate Capacity	% of time WWTP operates with no remaining system redundancy																										
	Region of Durham	NWWBI - Wastewater Collection - Provide Adequate Capacity	% of Design AAF Utilized																										

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				Informal	Aware	Formulated	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual		
	City of Calgary	Reduce per capita water consumption	Number of water meters installed in flat rate residences annually					x					x					x					x		Universal metering has been proven effective at reducing water consumption because it allows us to track the amount of water customers use each month. Customers on a water meter use up to 60% less water on a flat rate account. The long-term target is to have 100% of residential accounts on meters by the end of 2014. (This measure tracks residential accounts only. 100% of industrial, commercial and institutional accounts are metered).	8,000	8,000		
	City of Calgary	Reduce demand for water in line with '30 in 30' water efficiency goal	Average daily per capita water consumption (Lpcd)			x					x						x					x		((Total demand for Calgary & Region)/ # of days)/Calgary and Regional population	30 in 30' is a plan comprised of numerous programs to bring Calgary's overall water demand down to 350 lpcd in the next 30 years	N/A	396		Note: No 2010 target that includes both City and regionally serviced customers (approx. 70k pop.) has been developed. City only target of 464 Lpcd
	Gwinnett County DWR	Long-term water supply adequacy	Gwinnett is a litigant in the ACF water wars, which began in 1990. See attached report from Fitch rating agency for a synopsis.					x					x					x					x	Still withdrawing water from Lake Lanier without curtailment by federal courts.	11th Circuit overruled the attached July 2009 District Court order.	100% of demand.	Current actual allocation is 0% of current and future demand.	See attached July 2009 District Court order. Legal briefs to bulky and too numerous to attach.	Lake Lanier is a Corps of Engineers reservoir with over 1,000,000 acre feet in the conservation pool. Beginning the 1970s, Gwinnett ratepayers have invested over $1,000,000,000 in the infrastructure to withdraw from and return reclaimed water to Lake Lanier. We're not walking away from this riparian source of water.
A9. Water Resource Adequacy	Gwinnett County DWR	% Real water losses	Gwinnett balanced scorecard metric					x					x				x					x		% Real water losses	Real losses are defined by IWA as physical water losses from a pressurized system and the utility's storage tanks up to the customer meter. Real water loss is the annual wet volume lost through all types of leaks, bursts and overflows. Real losses are thus distinct from apparent losses. This KPI presents real loss as a percentage. The numerator is the 12-month rolling total of real losses. The denominator is the 12-month rolling total of water produced and supplied to the system. Data source is the IWA water audit worksheet as maintained by the water loss task force. Specifically, the contents of cell G52 on the 12-month rolling average reporting worksheet (as adjusted to account for production meter accuracy) divided by the contents of cell G19(as adjusted to account for production meter accuracy.	7	6.7	IWA water audit worksheet	Excessive real losses constitute system inefficiency and are contrary to conservation mandates. Expect real losses to become a regulatory parameter in the next few years
	Gwinnett County DWR	Usage per single family household	Gwinnett balanced scorecard metric																										
	Gwinnett County DWR	% Chattahoochee basin returns	Gwinnett balanced scorecard metric																										
	Tualatin Valley	Tualatin Basin Supply Plan																											
	Tualatin Valley	Joint Water Commission																											
	South East Water	Total per capita consumption	Consumption data is used in conjunction with population data to derive Total per capita consumption				X				X							X					X	Historical Data Comparison	Although there are no targets set, these figures are compared to historical data to enable monitoring of levels of success	N/A	N/A		
	South East Water	T155	State Government initiative to reduce water usage by setting a Target of 155L/day per person consumption					X					X					X					X	Average amount of Daily Water Use (per customer)		155L/day	Not Reported	Brochures Newspaper/Television/Radio Advertising Guidelines	The T155 Initiative was discontinued upon change of State Government during the 2010/11 Financial year. Note: The T155 Target was met in the previous year of 2009/10
	South East Water	Total potable substitution	DSE Sets long term target of 10 GL potable substitution by 2030 for combined Metro Water Businesses				X						X					X					X	10 GL / year potable		10 GL	172	Metropolitan Reuse and Recycling Plan 2009-2013	

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				Informal	Aware	Formalized	Advanced	Robust	None	Minimal	Moderate	Complete	Robust	Sparse	Limited	Moderate	Predominant	Total	Rare	Occasionally	Often	Usually	Always	Metric (used to track effectiveness)	Detailed description	Target	Actual	Supporting documentation (workflows, procedures etc. with hyperlink to actual document)	Comments
A10. Stakeholder Understanding & Support	Green Bay MSD	High Stakeholder Satisfaction	Addresses stakeholder perceptions of utility. This is measured through surveys sent to stakeholders.		x					x				x					x					Satisfaction with specific issues	Percentage of stakeholders who annually rate specific activities of the utility as positive	80%	Unknown	Periodic stakeholder survey results summary reports	
	Toronto Water	Customer service satisfaction	Measures the overall satisfaction levels of customers for continuous service delivery improvement		x					x						x			x					Customer survey satisfaction level	Number of Favourable Satisfaction Scores/ Number of Surveys	TBD	3.8	Independent customer survey for specific issues: leaks, locates, turn ons/offs, blocked drains, water meters, water main relining	Historically surveys have been done periodically using external survey consultants. Future survey and method is being reviewed.
	Region of Peel	High Stakeholder Satisfaction	This measure addresses stakeholder perceptions of the utility. Stakeholder satisfaction can be measured through surveys sent or distributed to stakeholders.		x					x					x					x				Client Satisfaction Index	Satisfaction based on a scale of 0 to 10	N/A	7.8	http://www.peelregion.ca/reports/PDF/2010-client-satisfaction-report.pdf	An external client satisfaction survey was completed for 1200 residents for 2008 and 2009. The survey is for all Peel services and there only a few questions specific to water. Residents are asked about the taste, odour and pressure of their water and about their water bill.
	ABCWUA	Customer Opinion Survey	Measure customer opinions and perceptions of the utility					x					x					x					x	Random sample of 500 residential/100 commercial customers by telephone interview	In depth survey with 50 questions with many tied to performance metrics in Performance Plan			Biennial survey conducted by research/polling firm	
	ABCWUA	Stakeholder Outreach Index	Based on a self-assessment checklist, a stakeholder outreach index is calculated		x						x				x					x				Based on a self-assessment checklist, a stakeholder outreach index is calculated	Biennial Customer Opinion Survey; Annual Water Quality Report, Newspaper Inserts, Monthly Bill Messages and/or Inserts		75%		No target has been established for this metric as it was obtained for the 2009 QualServe Survey
A10. Stakeholder Understanding & Support	ABCWUA	Monthly residential water service	Bill amount for monthly residential water service for a customer using 7,500 gallons per month					x					x					x				x		Bill amount for monthly residential water service for a customer using 7,500 gallons per month	Provide affordable water and legally justifiable rates to our customers	TBD 6/22/11	$24.40	Rate Ordinance	No Rate Increase since 2004; 5% planned for 7/1/2012; and 5% planned for 7/1/2014
	ABCWUA	Average residential water bill	Average residential water bill amount for one month of service					x					x					x				x		Average residential water bill amount for one month of service	Provide affordable water and legally justifiable rates to our customers	TBD 6/22/11	$30.04	Rate Ordinance	No Rate Increase since 2004; 5% planned for 7/1/2012; and 5% planned for 7/1/2014
	ABCWUA	Monthly residential sewer service	Bill amount for monthly residential wastewater service for a customer using 7,500 gallons of water per month					x					x					x				x		Bill amount for monthly residential wastewater service for a customer using 7,500 gallons of water per month	Provide affordable water and legally justifiable rates to our customers	TBD 6/22/11	$15.30	Rate Ordinance	No Rate Increase since 2004; 5% planned for 7/1/2012; and 5% planned for 7/1/2014
	ABCWUA	Average residential sewer bill	Average residential wastewater bill amount for one month of service					x					x					x				x		Average residential wastewater bill amount for one month of service	Provide affordable water and legally justifiable rates to our customers	TBD 6/22/11	$13.74	Rate Ordinance	No Rate Increase since 2004; 5% planned for 7/1/2012; and 5% planned for 7/1/2014
	Louisville	Strengthen business partnerships and key relationships	ORSANCO					x					x					x					x	No metrics					
	Louisville	Strengthen business partnerships and key relationships	Customer Advisory Groups					x					x					x					x	Quarterly meetings held	Quarterly meeting held with group	4	4		
	South East Water	High Stakeholder Satisfaction	This measure addresses stakeholder perceptions of the utility. Stakeholder satisfaction can be measured through surveys sent or distributed to stakeholders.	X					X					X					X					Overall Satisfaction	Percentage of stakeholders who annually rate the overall job of the utility as positive	80%	84%	Annual stakeholder survey results summary report	
	South East Water	Customers and Community Engagement	Measures the quality of our community engagement processes - that is, the planning, implementation and evaluation of the was in which we consult / engage with our stakeholders and the community in key strategic and capital delivery projects.					X				X					X				X			The Stakeholder Relationships program has been developed and is being rolled out. Over the next 12 months, KPIs will be established to measure the frequency, type and quality of contact with stakeholders as well as the issues that arise and the responses to these issues. PULSE will be instrumental in capturing this information and will be fully operational in 12 months.	A scorecard is used to assess the quality of the community engagement process (the process for engaging with our stakeholders and community in key decision making processes). As part of this, all contact and feedback with stakeholders are recorded in Consultation Manager (a software package designed to record engagement activities and feedback throughout the project). In addition, surveys are distributed to community members at the end of a all of our projects to obtain feedback about their experience of the project.	80%	90%		

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	South East Water	Customer Survey	Measures the overall level of community satisfaction with the works undertaken including the engagement process.					X				X					X					X		A survey is distributed to customers at the completion of capital works projects to obtain feedback about the customers level of satisfaction with the works conducted and the engagement / communications process.		70%	84		
	South East Water	Reputation survey	Measures the level of satisfaction that stakeholders have with Company. Survey conducted bi-annually with a cross section of our key stakeholders.					X					X					X						X	Other KPIs may emerge to measure stakeholder satisfaction as the Stakeholder Relationships Program is rolled out This should become clearer in the next 12 months.		76	75.5	Actual score is from 2009/10 as the survey is conducted bi-annually.	
A10. Stakeholder Understanding & Support	South East Water	Potential KPI	None. However a survey instrument has been developed and administered for the Chapel Street project.																					We do not currently have a KPI to measure this however we have conducted surveys with internal staff to assess this in the past for the Chapel Street project. We will consider incorporating this as part of the community engagement score process to ensure we can capture the benefits experienced / perceived by our internal staff as a result of engaging with stakeholders.	The survey instrument has been developed and administered for one capital deliver project (Chapel Street). A benchmark score could be established as well as a process for ongoing testing of internal views as part of community engagement projects.	N/A	N/A		
	South East Water	Media Coverage	We monitor online, print and broadcast media coverage of Company and related water industry topics and analyse identified media for Company mentions.				X				X						X					X		Three Company generated pieces of media coverage per month (monitored on a quarterly basis)		3 per month	New KPI recently introduced - actuals to be determined		
	South East Water	Company Key Messages	We monitor online, print and broadcast media coverage of Company and related water industry topics and analyse identified media for Company key messages.				X				X						X					X		70 percent of Company generated media coverage contain Company key messages (monitored on a quarterly basis).		70%	New KPI recently introduced - actuals to be determined		

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K1. Leadership	Charleston Water	Prestigious Awards Received	Levels reflect the number of awards, honors, and recognitions received by CWS per year.					x					x					x					x	# Awards received annually	Awards received are typically national and industry-related recognitions	N/A	13	Awards	Performance Indicator (PI)
	Charleston Water	Major Innovations Implemented and Integrated	Levels reflect the number of major, corporate-level projects implemented with the goal of integrating the programs across all applicable departments.					x					x					x					x	# Major projects implemented; % integrated		#: 10; % Integrated: 100%	#: 11; % Integrated: 91%	Spreadsheet; Performance Scorecard software	Performance Indicator (PI)
K2. Strategic Business Planning	Charleston Water	Strategic Plan Progress (% Complete)	Levels reflect the percent of strategic goals accomplished on an annual basis as compared to those targeted.					x					x					x					x	% Annual goal complete		100%	119%	Strategic Plan Progress Reports (quarterly); Performance Scorecard software	Performance Indicator (PI)
A1. Product Quality	MSDGC	Water Quality Compliance	Water product quality complies with National Primary Drinking Water Regulations, the National Pollutant Discharge Elimination System, and any other relevant federal (Clean Water Act, Safe Drinking Water Act, etc.) or state statue/regulations and permit requirements.				x					x					x					x		Days per year in full compliance	Water quality monitoring is conducted daily and logged to determine if water quality complies with water quality requirements	365	355	Quarterly reports documenting year to date compliance submitted to regulating agency (e.g. state/federal).	A daily average is recorded by utility. More frequent water quality reporting (e.g. monthly) may be required by regulating agency.
		Enforcement	MSD takes Enforcment in accordance with Enforcement Response Plan					x			x						x					x		# flagged uncited violations	Database flags violations and enforcment action is tracked	<10	8	Reports from iPacs database	
		Industrial Permits	All Significant Industrial Users have accurate and active permits					x			x							x					x	Permits issued on time	Database creates permit tasks that must be completed prior to permit finalized and approved.	100%		Reports from iPacs database	
		Inspection of industrial users	All permitted industrial users are inspected annually					x				x						x					x	Required count vs. completed	Database creates inspection tasks that must be scheduled and completed within the calendar year.	100%	100%	Reports from iPacs database	
		Industrial discharge sampline	All Significant Industrial Users are sampled at least annually for all required pollutants and surcharge sampling.					x		x								x					x	# sample events complete vs required	Each industry has sample requirements per their permit that must be scheduled and sampled within the required timeframe (annually, semi-annually etc)	100%	98%	Reports from iPacs database	