Effective Utility Management

A Primer for Water and Wastewater Utilities

January 2017

United States Environmental Protection Agency

Association of Metropolitan Water Agencies

Association of Clean Water Administrators

ASDWA Association of State Drinking Water Administrators

APWA

American Water Works Association

NACWA

NAWC National Association of Water Companies

Water Environment Federation the water quality people

Water Environment & Reuse Foundation WE&RF

Water Research Foundation

MESSAGE FROM THE EUM UTILITY LEADERSHIP GROUP

DEAR WATER LEADER:

Every day you provide the leadership to deliver vital services that protect public health and support the vitality of your communities, natural environment, and economy; your organizations are truly anchor institutions in your communities. Today's water sector utilities also face a broad range of complex challenges, including rising costs and affordability, aging infrastructure, on-going regulatory requirements, enhanced customer expectations, and rapidly evolving technology. Utilities need a common sense, replicable, and proactive set of approaches to meet these current and future challenges.

Since 2008, a unique coalition representing the "Collaborating Organizations," which include the U.S. Environmental Protection Agency and a growing number of major water sector associations, has supported an approach developed by water sector leaders for water utility management. The approach is based around the Ten Attributes of an Effectively Managed Utility and Five Keys to Management Success—known as Effective Utility Management (EUM). EUM is now the most widely recognized water sector utility management program in the country, and this *Primer* is the foundation of EUM. The *Primer* will help your utility comprehensively assess current operations and identify a path to improving in key areas that are the highest priorities.

EUM, as embodied in this *Primer*, is more relevant than ever before to help meet the challenges that we face. EUM is a starting point for any utility's path to effective and sustainable operations. It can help your utility to respond to and plan for current and future challenges, supporting your mission of being a successful 21st century service provider. The *Primer* allows you to address these challenges in a step-wise process, at a pace that you control based on the capacity of your utility.

Key Messages to the Water Sector

EUM and this *Primer* are the keys to unlock the potential of your utility to protect public health and the environment in the 21st century:

- EUM helps you take a 360-degree look at your utility and then set priorities that work for you and your community.
- It helps you protect your current infrastructure investments and ensure that your workforce is motivated and able to address the challenges that they face every day.
- It moves you from reacting only to the "hot priorities" of the day to proactively planning for the future.
- It helps you engage your staff in the process of assessing and charting your own course for the future.
- It is simple, actionable, affordable, and scalable to meet the needs of all utilities.
- Finally, YOU CAN DO THIS. Staff across all levels of your utility can use the *Primer*, helping them collaborate internally and work with the community to provide affordable and sustainable services.

In closing, thank you for all you do every day. Please consider using the EUM *Primer* and chart a sustainable course for the future. We encourage you to join the growing group of utility leaders implementing EUM!

Sincerely,

THE EUM UTILITY LEADERSHIP GROUP

EUM UTILITY LEADERSHIP GROUP

Colleen Arnold
Aqua America

Shellie Chard
Oklahoma Department of Environmental Quality

Barry Gullet
Charlotte Water

Dan Hartman
City of Golden Public Works

Patrick Kerr
Baton Rouge Water

Ed McCormick
McCormick Strategic Water Management, LLC
(Formerly with East Bay Municipal Utility District)

Tyler Richards
Gwinnett County Department of Water Resources

Frank Roth
Albuquerque Bernalillo County Water Utility Authority

Tom Sigmund
NEW Water

Kathryn Sorensen
Phoenix Water

John Sullivan
Boston Water and Sewer Commission

Diane Taniguchi-Dennis
Clean Water Services

Donna Wies
Donna Wies Consulting
(Formerly with Union Sanitary District)

Tim Wilson
Marshalltown Water

EUM COLLABORATING ORGANIZATIONS

Julia Anastasio
Association of Clean Water Administrators

Adam Carpenter
American Water Works Association

Alison Deines
Water Environment & Reuse Foundation

Chris Hornback
National Association of Clean Water Agencies

Jim Horne
Office of Water
U.S. Environmental Protection Agency

Anne Jackson
American Public Works Association

Carolyn Peterson
Association of Metropolitan Water Agencies

Linda Reekie
Water Research Foundation

Matt Ries
Water Environment Federation

Petra Smeltzer
National Association of Water Companies

Jim Taft
Association of State Drinking Water Administrators

Reference herein to any specific commercial products, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government, and shall not be used for advertising or product endorsement purposes.

This product was developed with assistance from Rob Greenwood, Morgan Torres, and Sarah Shadid with Ross Strategic (www.rossstrategic.com), under contract EP-C-11-009 with the Office of Wastewater Management at U.S. EPA.

TABLE OF CONTENTS

I. Effective Utility Management 1
II. Ten Attributes of an Effectively Managed Utility 4
III. Keys to Management Success 8
IV. Where to Begin: A Self-Assessment Tool 11
V. Getting to Work: Implementation of Effective Utility Management 17
VI. Utility Management Resources 25
VII. For More Information 26
VIII. Appendix A: Key Definitions 28
IX. Appendix B: Self-Assessment 30
X. Appendix C: Attribute-Related Water Utility Measures 35
- Product Quality 35
- Customer Satisfaction 37
- Employee and Leadership Development 38
- Operational Optimization 40
- Financial Viability 41
- Infrastructure Strategy and Performance 43
- Enterprise Resiliency 45
- Community Sustainability 47
- Water Resource Sustainability 49
- Stakeholder Understanding and Support 51

I. Effective Utility Management

The *Effective Utility Management: A Primer for Water and Wastewater Utilities* ("*Primer*") is the foundation of Effective Utility Management (EUM). It is designed to help water and wastewater utility managers make informed decisions and practical, systematic changes to achieve excellence in utility performance in the face of everyday challenges and long-term needs for the utility and the community it serves. It was produced by utility leaders who are committed to helping other utilities improve water and wastewater management. The *Primer* distills the expertise and experience of these utility leaders into a framework intended to help utilities identify and address their most pressing needs through an incremental, continual improvement management approach.

All water and wastewater utilities can benefit from applying this *Primer*. Each utility has unique management opportunities and challenges, and this *Primer* provides a common sense way of assessing, managing, and measuring a utility's performance to address these opportunities and challenges. The steps described in the document and associated resources are relevant to any water or wastewater utility, regardless of size, budget, or other capacity.

The *Primer* has four primary components which, when taken together, form the basis for a complete cycle of effective and sustainable utility management:

- **The Ten Attributes of Effectively Managed Water Sector Utilities (Attributes).** These Attributes provide a clear set of reference points and are intended to help utilities maintain a balanced focus on all important operational areas rather than reactively moving from one problem to the next or focusing on the "problem of the day."
- **Five Keys to Management Success.** These proven approaches help utilities maximize their resources and improve performance. By embedding the Five Keys to Management Success into their workplace culture, utilities create a robust foundation for strong, ongoing performance in the Ten Attribute areas.
- **Where to Begin – A Self-Assessment Tool**. The rigorous and systematic self-assessment tool described in the *Primer* helps utility managers and staff evaluate their operations and identify where to begin improvement efforts. By assessing how a utility performs relative to the Attributes, utility managers can gain a more balanced and comprehensive picture of their organization.
- **Getting to Work – Implementation of Effective Utility Management.** The Implementation section is a central connecting point between multiple elements of Effective Utility Management. It focuses on an overall continual improvement cycle (the "EUM cycle"), and describes how a utility's self-assessment results can lead into a cycle of planning, implementation of effective practices, measuring performance, and making adjustments over time. It includes the following components:
    1. A description of the essential components of the EUM cycle;
    2. A guide for measuring performance;
    3. Resources to support Effective Utility Management implementation; and
    4. Steps for creating an Improvement Plan.

Throughout the *Primer,* utilities will learn about the Ten Attributes of Effectively Managed Utilities and the Five Keys to Management Success, and how these important elements work in tandem to support successful utilities in today's challenging operating contexts.

The Ten Attributes of Effectively Managed Utilities and Five Keys to Management Success

This *Primer* is the product of a decade-long collaboration between the Collaborating Organizations and group of respected water and wastewater utility leaders from across the nation. Originally released in 2008, and updated in 2017 to reflect changes to the context in which water sector utilities operate, the *Primer* is a powerful tool for water sector utilities of all sizes, types, and geographies. A brief history of Effective Utility Management is included on the following page.

A Brief History of Effective Utility Management

MAY 2006

Seven Collaborating Organizations sign a Statement of Intent to establish a framework for working together to advance understanding of the principles and practices of effective utility management, and to encourage and promote their wider application.

MAY 2007

Findings and Recommendations report delivered from a utility Steering Committee to the seven collaborating organizations. The report recommends a variety of activities be initiated, including the development of a stand-alone primer that outlines a strategy for effective utility management.

JUNE 2008

Effective Utility Management: A Primer for Water and Wastewater Utilities is released.

2009 - 2015

The Collaborating Organizations develop and sponsor a wide range of EUM-based workshops, webinars, case examples, and award programs to promote and support EUM implementation by the water sector.

APRIL 2015

The Association of Clean Water Agencies and the Association of State Drinking Water Administrators join as new EUM Collaborating Organization partners.

Collaborating Organizations convene a group of utility leaders to explore how the operating context of water sector utilities has changed since the *Primer* was released in 2008, and to consider refinements to the EUM framework.

FEB 2016

Taking the Next Step: Findings of the Effective Utility Management Review Steering Group report released. The report outlines key operating shifts in the water sector since 2008, and recommends a series of updates to the *Primer.*

JULY–DEC 2016

Collaborating Organizations convene a group of utility leaders to update the *Primer.*

OCT 2016

The Water Research Foundation and the Water Environment & Reuse Foundation join as new EUM Collaborating Organization partners.

JAN 2017

The Collaborating Organizations release the newly updated *Primer.*

2017 & BEYOND

The Collaborating Organizations sponsor ongoing education and promotional efforts to support implementation of EUM by the water sector, including webinars, workshops, and the development of other learning resources.

II. Ten Attributes of an Effectively Managed Utility

The Ten Attributes of an Effectively Managed Utility provide useful and concise goals for water sector utility managers seeking to improve organization-wide performance. The Attributes describe desired outcomes that are applicable to all water and wastewater utilities. They comprise a comprehensive framework related to operations, infrastructure, customer satisfaction, community sustainability, natural resource stewardship, and financial performance.

Water and wastewater utilities can use the Attributes to select priorities for improvement, based on each organization's strategic objectives and the needs of the community it serves. The Attributes are not presented in a particular order, but rather can be viewed as a set of opportunities for improving utility management and operations. **Section IV** provides a basic self-assessment tool to help utilities easily identify their priorities and opportunities based on the Attributes. Over time, utilities will be able to deliver increasingly efficient, high-quality service by addressing more, and eventually all, of the Attributes. **Section V** provides several example performance measures for each of the Attributes.

Ten Attributes of an Effectively Managed Utility

Product Quality

Produces "fit for purpose" water and other recovered resources (e.g., energy, nutrients, biosolids) that meet or exceed full compliance with regulatory and reliability requirements and consistent with customer, public health, ecological, and economic needs. Products include treated drinking water, treated wastewater effluent, recycled water, stormwater discharge, and recovered resources.

Customer Satisfaction

Provides reliable, responsive, and affordable services in line with explicit, customer-derived service levels. Utilizes a mix of evolving communication technologies to understand and respond to customer needs and expectations, including receiving timely customer feedback and communicating during emergencies. Provides tailored customer service and outreach to traditional residential, commercial, and industrial customers, and understands and exercises as appropriate the opportunities presented by emergent customer groups (e.g., high strength waste producers, power companies).

Stakeholder Understanding and Support

Engenders understanding and support from stakeholders (anyone who can affect or be affected by the utility), including customers, oversight bodies, community and watershed interests, and regulatory bodies for service levels, rate structures, operating budgets, capital improvement programs, and risk management decisions. Actively promotes an appreciation of the true value of water and water services, and water's role in the social, economic, public and environmental health of the community. Actively engages in partnerships, involves stakeholders in the decisions that will affect them, understands what it takes to operate as a "good neighbor," and positions the utility as a critical asset (anchor institution) to the community.

Financial Viability

Understands and plans for the full life-cycle cost of utility operations and value of water resources. Establishes and maintains an effective balance between long-term debt, asset values, operations and maintenance expenditures, and operating revenues. Establishes predictable rates—consistent with community expectations and acceptability—adequate to recover costs, provide for reserves, maintain support from bond rating agencies, plan and invest for future needs, and taking into account affordability and the needs of disadvantaged households. Implements sound strategies for collecting customer payments. Understands the opportunities available to diversify revenues and raise capital through adoption of new business models, including revenues from resource recovery.

Operational Optimization

Ensures ongoing, timely, cost-effective, reliable, and sustainable performance improvements in all facets of its operations in service to public health and environmental protection. Makes effective use of data from automated and smart systems, and learns from performance monitoring. Minimizes resource use, loss, and impacts from day-to-day operations, and reduces all forms of waste. Maintains awareness of information and operational technology developments to anticipate and support timely adoption of improvements.

Employee and Leadership Development

Recruits, develops, and retains a workforce that is competent, motivated, adaptive, and safety-focused. Establishes a participatory, collaborative organization dedicated to continual learning, improvement, and innovation. Ensures employee institutional knowledge is retained, transferred, and improved upon over time. Emphasizes and invests in opportunities for professional and leadership development, taking into account the differing needs and expectations of a multi-generational workforce and for resource recovery operations. Establishes an integrated and well-coordinated senior leadership team.

Enterprise Resiliency

Ensures utility leadership and staff work together internally, and coordinate with external partners, to anticipate, respond to, and avoid problems. Proactively identifies, assesses, establishes tolerance levels for, and effectively manages a full range of business risks (including interdependencies with other services and utilities, legal, regulatory, financial, environmental, safety, physical and cyber security, knowledge loss, talent, and natural disaster-related) consistent with industry trends and system reliability goals. Plans for and actively manages around business continuity.

Infrastructure Strategy and Performance

Understands the condition of and costs associated with critical infrastructure assets. Plans infrastructure investments consistent with community needs, anticipated growth, system reliability goals, and relevant community priorities, building in a robust set of adaptation strategies (e.g., for changing weather patterns, customer base). Maintains and enhances the condition of all assets over the long-term at the lowest possible life-cycle cost and acceptable risk consistent with customer, community, and regulator-supported service levels. Assures asset repair, rehabilitation, and replacement efforts are coordinated within the community to minimize disruptions and other negative consequences.

Community Sustainability

Takes an active leadership role in promoting and organizing community sustainability improvements through collaboration with local partners (e.g., transportation departments, electrical utilities, planning departments, economic development organizations, watershed and source water protection groups). Manages operations, infrastructure, and investments to support the economic, environmental, and social health of its community. Integrates water resource management with other critical community infrastructure, social and economic development planning to support community-wide resilience, support for disadvantaged households, community sustainability, and livability.

Water Resource Sustainability

Ensures the availability and sustainable management of water for its community and watershed, including water resource recovery. Understands its role in the complete water cycle, understands fit for purpose water reuse options, and integrates utility objectives and activities with other watershed managers and partners. Understands and plans for the potential for water resource variability (e.g., changing weather patterns, including extreme events, such as drought and flooding), and utilizes as appropriate a full range of watershed investment and engagement strategies (e.g., Integrated Planning). Engages in long-term integrated water resource management, and ensures that current and future customer, community, and ecological water-related needs are met.

III. Keys to Management Success

The Keys to Management Success represent frequently used management approaches and systems that experience indicates help water and wastewater utilities manage more effectively. They create a supportive context for a utility as it works towards the outcomes outlined in the Attributes, and they can help integrate the utility's improvement efforts across the Attributes. The Keys to Management Success are listed below.

Leadership

Leadership must respond to both internal organizational and broader external community imperatives. It is critical to effective utility management, particularly in the context of leading and inspiring change within an organization and in its surrounding community.

"Leadership" refers both to individuals who can be effective champions for improvement, and to teams that provide resilient, day-to-day management continuity and direction. Effective leadership establishes and communicates a long-term vision for the organization and embodies a commitment to cultivating the organization's culture, helping to ingrain methods to achieve the utility's vision into the organization's day-to-day operations.

Leaders have an important responsibility to engage proactively with stakeholders and community decision makers, promote the utility as a valued, competent, and trustworthy environmental steward and community asset, and collaborate with external partners (including new and nontraditional partners, like the agricultural sector). Leaders should drive an awareness and commitment to workplace safety, organizational diversity, ethical conduct, and positive morale. Leadership further reflects a commitment to organizational excellence, leading by example to establish and reinforce an organizational culture that embraces positive change, providing new opportunities for emerging leaders, and planning for and assuring a seamless transition to new leadership when required. Organizational improvement efforts require a commitment to continual improvement from the utility's leadership, including the celebration of small and large victories for the utility.

Strategic Business Planning

Strategic business planning directs and helps to achieve balance and cohesion across the Ten Attributes. A strategic business plan provides a framework for decision making by:

- Assessing current conditions and conducting a strengths, weaknesses, opportunities, and threats (SWOT analysis);
- Characterizing a continuum of possible and likely future conditions;
- Assessing underlying causes and effects of future conditions; and
- Establishing vision, objectives, strategies, and underlying organizational values.

A successful strategic business plan is dynamic and adaptable, allowing the utility to capitalize on new and emerging opportunities. It is made more robust by engaging with staff and external stakeholders, and by utilizing planning methods that can accommodate and address a variety of future operating scenarios (e.g., managing for uncertainty through "stress testing" a plan's ability to hold up during extreme events, such as extended drought).

A strong plan reflects specific implementation steps that will move a utility from its current level of performance to achieving its vision. Preparation of a strategic business plan involves taking a longer-term view of utility goals and operations and establishing a clear vision and mission. The plan, through engagement with external stakeholders, should reflect key community values, needs, and interests. When developed, the strategic business plan should drive and guide utility objectives, measurement efforts, investments, and operations. A strategic business plan can also help explain the utility's conditions, goals, and plans to staff and stakeholders, stimulate change, and increase engagement and support for improvement efforts. After developing a strategic business plan, it is important that the utility integrates tracking of progress and clear accountability into its management framework, and revisits the plan on a regular basis.

Knowledge Management

Knowledge management is another cornerstone of effective utility management, and is critical to ensuring reliable utility operations. It spans standard operating procedures, human resource management, and business systems and operating systems data integration and utilization to support dependable operations and continual improvement across the Ten Attributes.

By ensuring that processes are well documented through writing down "this is how we do things" and regularly updating standard operating procedures and creating shared knowledge among various employee categories, a utility is able to respond effectively to the inevitable knowledge loss brought on by employee turnover or unexpected absences. An effective knowledge management system is flexible to the use of new and evolving technologies, and should be updated on an ongoing basis. Automated "smart" systems and data integration/management capabilities are an increasingly important aspect of efficient and effective continual improvement management. These systems and capabilities are available across all areas of utility management, and can substantially improve the ability of utilities to track performance in real time, identify variability, and manage performance more effectively and precisely.

Measurement

Measurement is critical to management improvement efforts associated with the Attributes and is the backbone of successful continual improvement management and strategic business planning. A measurement system serves many vital purposes, including focusing attention on key issues, clarifying

> "If you can't measure it, you can't improve it."
>
> *Peter Drucker*

expectations, facilitating decision making, supporting learning and improving, establishing and maintaining accountability, and, most importantly, communicating effectively internally and externally. Always keep in mind the management adage, "If you can't measure it, you can't improve it." Successful measurement efforts should be:

- Carefully select a limited number of performance measures that are used to focus the organization on the achievement of the Strategic Business Plan goals;
- Viewed as a continuum starting with basic internal tracking, and moving to more sophisticated baselining and trend analysis as necessary, with development of key performance indicators, and inclusion of externally oriented measures which address community sustainability interests;
- Informed by staff input, driven by and focused on answering questions critical to effective internal management and external stakeholder needs, including information needed to allow governing bodies to comfortably support large capital investments; and
- Supported by a well-defined decision framework assuring results are evaluated, communicated, and addressed in a timely manner.

Continual Improvement Management

Continual improvement management is usually implemented through a complete, start-to-finish management system, also referred to as a "Plan-Do-Check-Act" framework. Continual improvement plays a central role in effective utility management and is critical to making progress on the Attributes. Continual improvement management includes:

- Conducting an honest and comprehensive self- assessment – informed through staff engagement – to identify management strengths, areas for improvement, priority needs, etc.;
- Conducting frequent sessions among interested parties (stakeholders) to identify improvement opportunities;
- Following up on improvement projects underway;
- Establishing and implementing performance measures and specific internal targets associated with those measures;
- Defining and implementing related operational requirements, practices, and procedures;
- Defining supporting roles and responsibilities to derive clear accountability for conducting assessments and implementing performance improvements;
- Implementing measurement activities such as regular evaluation through operational and procedural audits; and
- Responding to evaluations through the use of an explicit change management process.

Continual improvement management is further supported by gap analysis, establishment of standard operating procedures, internal trend analysis and external benchmarking where appropriate, best practice review and adoption, and other continual improvement tools. It can be used as a framework to help utilities understand improvement opportunities and establish explicit service levels, guide investment and operational decisions, form the basis for ongoing measurement, and provide the ability to communicate clearly with customers and key stakeholders.

IV. Where to Begin: A Self-Assessment Tool

There are many ways to improve utility performance and each utility is unique. Many utilities may choose to start small and make improvements step-by-step, perhaps by working on projects that will yield early successes. Other utilities may choose to take on several improvement efforts simultaneously. Some may prefer to enhance their strengths, while others will prefer to focus on addressing areas for improvement. Each utility should determine for itself the most important issue to address, based on its own strategic objectives, priorities, and the needs of the community it serves.

STEP 1

Candidly Assess Current Conditions

STEP 2

Rank Importance of Each Attribute to Your Entity

STEP 3

Graph Attributes to Determine Importance and Level of Achievement

STEP 4

Choose Attributes

A thorough assessment of current performance based on the Attributes is a useful first step in identifying options for improvement. It also establishes a quantifiable baseline from which to measure progress. As conditions change, future reassessments will reveal new opportunities and new priorities.

The following Self-Assessment tool can help water and wastewater managers use the EUM Attributes to evaluate their utility's current performance against internal goals or specific needs and determine where to focus improvement efforts. While it can be completed initially by an individual manager, it is more effective when used as a vehicle for conversation and consensus building among the utility's management team and key staff. As appropriate, other stakeholders might be invited to participate in the assessment, including oversight bodies, community and watershed interests, and regulatory authorities.

The assessment has four steps: 1) Assess current conditions based on the Attributes; 2) Rank the importance of each Attribute for your utility; 3) Chart the results; and 4) Choose one or more Attributes to focus on. Following completion of the Self-Assessment, a guide for taking action on the results is included in the next section, **Getting to Work: Implementation of Effective Utility Management.**

A blank copy of the Self-Assessment worksheet is available in **Appendix B.**

Step 1: Assess Current Level of Achievement

Using the blank worksheet in **Appendix B**, assess current conditions by rating your utility's systems and approaches and current level of achievement for each Attribute, using a 1 (high achievement) to 5 (low achievement) scale. Consider the degree to which your current management systems effectively support each of the Attributes and their component parts. Consider all components of each Attribute and gauge your rating accordingly. Use these descriptions to guide your rating. You will note that each Attribute has several components represented by the bullet points listed for each.

Your rating can either reflect the lowest level of achievement of all of the bullet points for that Attribute (for example, if you believe that your achievement in one of the bullet points for that Attribute was "5," but another bullet point you rated as "2," your rating for achievement under that Attribute would be "5"), or an average across all of the bullet points for that Attribute. For whatever approach you choose to use when rating, make sure to be consistent in this approach across all Attributes.

Rating	Description
1.	Effective, systematic approach and implementation; consistently achieve goals.
2.	Workable systems in place; mostly achieve goals.
3.	Partial systems in place with moderate achievement, but could improve.
4.	Occasionally address this when specific need arises.
5.	No system for addressing this.

Step 2: Rank Importance of Attributes

Rank the importance of each Attribute to your utility, based on your utility's vision, goals, and specific needs. The ranking should reflect the interests and considerations of all stakeholders (managers, staff, customers, regulators, elected officials, community and watershed interests, and others).

There are Ten Attributes. Considering long-term importance to your utility, rank the most important Attribute 1, the second most important 2, and so on. The least important Attribute would be ranked 10. Your ranking of each Attribute's importance may be influenced by current or expected challenges in that particular area, recent accomplishments in addressing these issues, or other factors. Importance ranking is likely to change over time as internal and external conditions change.

As you fill in numbers on the worksheet in **Appendix B**, please note that your analysis for Step 1 (rating achievement) should be separate and independent from your analysis for Step 2 (ranking importance).

Attribute	Attribute Components
Product Quality (PQ)	• Meets or exceeds regulatory and reliability requirements. • Operates consistent with customer, public health, economic, and ecological needs.
Customer Satisfaction (CS)	• Provides reliable, responsive, and affordable services. • Receives timely customer feedback. • Is responsive to customer needs and emergencies. • Provides tailored customer service and outreach to a range of customer groups (e.g., residential, commercial, industrial, and newly emerging groups such as high-strength waste producers or power companies)
Employee and Leadership Development (ED)	• Recruits, develops, and retains a competent, safety-focused workforce. • Is a collaborative organization dedicated to continual learning, improvement, and adaptation. • Implements procedures for institutional knowledge retention, workplace safety, and continual learning (e.g., standard operating procedures). • Invests in/provides opportunities for professional and leadership development. • Supports an integrated and well-coordinated senior leadership team.
Operational Optimization (OO)	• Conducts ongoing performance improvements informed by performance monitoring. • Minimizes resource use and loss from day-to-day operations. • Is aware of and adopts in a timely manner operational and technology improvements, including operational technology and information technology. • Manages and utilizes data from automated and smart systems.
Financial Viability (FV)	• Understands and plans for full life-cycle cost of utility. • Effectively balances long-term debt, asset values, operations and maintenance expenditures, and operating revenues. • Sets predictable and adequate rates to support utility current needs and plans to invest in future needs, taking into account affordability and the needs of disadvantaged households when setting rates. • Understands opportunities for diversifying revenue and raising capital.
Infrastructure Strategy and Performance (IS)	• Understands the condition of and costs associated with critical infrastructure assets. • Maintains and enhances assets over the long-term at the lowest possible life-cycle cost and acceptable risk. • Coordinates repair efforts within the community to minimize disruptions. • Plans infrastructure investments consistent with community needs, anticipated growth, system reliability goals, and with a robust set of adaptation strategies.
Enterprise Resiliency (ER)	• Works together with staff internally and coordinate with external partners to anticipate and avoid problems. • Proactively establishes tolerance levels and effectively manages risks (including legal, regulatory, financial, environmental, safety, security, cyber, knowledge-loss, talent, and natural disaster-related). • Plans for and actively manages to maintain business continuity.

Attribute	Attribute Components
Community Sustainability (SU)	• Actively leads in promoting and organizing improvements to community and watershed health within utility and with external community partners. • Actively leads in promoting welfare within the community for disadvantaged households. • Uses operations to enhance natural environment. • Efficiently uses water and energy resources, promotes economic vitality, and engenders overall community improvement. • Maintains and enhances ecological and community sustainability including pollution prevention, watershed and source water protection.
Water Resource Sustainability (WS)	• Ensures water availability through long-term resource supply and demand analysis, conservation, fit for purpose water reuse, integrated water resource management, watershed management and protection, and public education initiatives. • Manages operations to provide for long-term aquifer and surface water sustainability and replenishment. • Understands and plans for future water resource variability (e.g., changing weather patterns, including extreme events, such as drought and flooding).
Stakeholder Understanding and Support (SS)	• Engenders understanding and support from oversight bodies, community and watershed interests, and regulatory bodies for service levels, rate structures, operating budgets, capital improvement programs, and risk management decisions. • Actively engages in partnerships and involves stakeholders in the decisions that will affect them. • Actively promotes an appreciation of the true value of water and water services, and water's role in the social, economic, public and environmental health of the community.

Step 3: Graph Results

Graph each Attribute based on your rating and ranking. For example, if you rated Product Quality (PQ) 4 for achievement and ranked it 3 for importance, you would place it on the graph as illustrated below. Similarly, if you rated Customer Satisfaction (CS) 3 for achievement and ranked it 5 for importance, you would place it on the graph as illustrated below. A blank graph is provided in **Appendix B**.

Rating											
	Lower Achievement	5										
		4			PQ							
		3					CS					
		2										
	Higher Achievement	1										
			1	2	3	4	5	6	7	8	9	10
			More Important								Less Important	
			Ranking									

Step 4: Choose Attributes to Focus On

The goal of Effective Utility Management is to establish high-achieving systems and approaches for each Attribute. Ultimately, utilities should strive to improve performance for all Attributes until each can be charted in the lower half of the table (high achieving). Utility managers may wish to focus on one or a few Attributes at a time, aiming to eventually ensure that all Attributes have been addressed and improved upon over time.

Examining the results of the charting exercise in Step 3 can help identify Attributes for focused attention. Attributes that graph into the orange shaded quadrant are both very important (ranked 1-4), and have low achievement (rated 4-5), and would typically be selected as the highest priority Attribute areas for moving forward with improvement actions. Attributes that graph into the yellow shaded area indicate medium importance, and a moderate level of current achievement; these would typically be selected as additional strong candidates for improvement efforts.

Attributes that fall in the lower left-hand quadrant are both important and high-achieving areas for the utility. Some utilities may choose to focus on these areas to continue further improving upon important and high-achieving areas, due to their long-term importance (e.g., water resource adequacy). Specifically examining these areas may also help a utility identify success factors which would be helpful in addressing areas needing improvement. Others may choose to focus on Attributes that would lead to early successes to build confidence

in effecting change, Attributes that maximize benefit relative to the utility's key goals, or Attributes that minimize risks (e.g., fines, penalties, lawsuits, poor public perception).

The choice to embark on improvements in one or more areas is up to the judgment of utility managers, and may also involve consideration of resources (staff and financial), leadership support, and other competing activities. Applying strategic business planning, measurement, and other Keys to Management Success is very important for moving each Attribute over time to the "high-achievement" quadrants.

V. Getting to Work: Implementation of Effective Utility Management

This section focuses on the specific steps that utilities are encouraged to go through to implement Effective Utility Management. The section includes a description of each element of the Effective Utility Management (EUM) cycle, and explains how utilities can take the results of their self-assessment, identify and implement effective practices, measure progress in priority Attribute areas, and do this through an improvement plan.

The EUM self-assessment (see page 11 for more information) serves as a comprehensive starting point for utilities, and the EUM cycle reflects how a utility's self-assessment results can build into a continual improvement management process. **Continual improvement** is one of the five Keys to Management Success for Effective Utility Management, and it operates throughout and supports the entire EUM cycle. The water sector is a rapidly evolving world, and utilities must stay abreast of new technologies, changes in the workforce, transforming customer needs, and much more. To adapt to these shifts, an effective utility must continually assess its performance and priorities, update its strategic plan, and make adjustments where necessary.

Two other Keys are reflected directly in the EUM cycle, **strategic business planning** and **measurement**; these are explained in greater detail later in this section. The two remaining Keys are also important to supporting all aspects of the EUM cycle: **leadership** and **knowledge management**. Leadership can exist at any level of a utility's organizational structure, and can encourage and enable active participation in an Effective Utility Management culture. Knowledge management supports the critical information and operating needs of each step of the cycle of Effective Utility Management. All five of the Keys to Management Success (see page 8 for more information) are integral to Effective Utility Management, and they work in tandem with the Ten Attributes (see page 4 for more information) to support successful utilities.

Beginning with the **self-assessment** exercise in **Section IV**, the EUM cycle is a self-reinforcing progression of assessment, planning, implementation, measurement, and adjusting over time. Each element of the cycle is described below.

Strategic Business Planning

Following completion of the self-assessment, utilities will now have a holistic picture of their current performance and priorities for the future relative to the Ten Attributes. Using these results as a starting point, a utility can begin to move through a strategic business planning process. Strategic business planning provides a framework for decision making and planning for the future. A strategic business plan could include, or be complemented by, an asset management plan and a financial plan for the utility.

Implementation of Effective Practices

After the utility has determined its priority Attribute areas for improvement and established a vision, goals, and objectives for the future through its strategic business plan, it is time to identify and implement effective practices linked to the Attributes in support of these objectives. Effective practices can also be identified in many ways: through learning activities (e.g., conferences, training events, webinars), through interactions and benchmarking activities with other utilities, and through resources created specifically to guide utilities in this area.

Two key resources to help utilities link the Attributes to specific practices are *Moving Toward Sustainability: Sustainable and Effective Practices for Creating Your Water Sector Roadmap,* developed by EPA with extensive input from water sector leaders, and *Performance Benchmarking for Effectively Managed Utilities* (Water Research Foundation), also prepared with extensive utility participation. Both are available at www.WaterEUM.org.

Measurement

To gauge performance and progress on the utility's strategic plan and practice implementation, the next step in the cycle is to establish performance measures relative to key activities. The adage of "you can't improve what you don't measure" applies here. Measurement is a key focus of this *Primer*, with approaches and example measures that utilities can implement addressed in greater depth later in this section and in **Appendix C**.

Reflect and Adjust

At regular intervals, the utility should reflect on its progress toward the goals set forth in its strategic business plan and its improvement plan relative to the Attributes, and determine if adjustments in course are needed, accounting for any changes in the utility's operating context.

Utilities can implement the cycle of Effective Utility Management in a variety of ways. It can be integrated into processes already in place as a part of the utility's operations and management, incorporated into a long-term planning process, or undertaken independently. A short guide for creating an improvement plan based on the self-assessment results follows at the end of this section.

Measuring Performance

Measuring performance is one of the keys to utility management success. This section of the *Primer* provides ideas about how to approach measurement and then offers measures for each Attribute to help utilities understand their current status and measure their progress.

Approaching Measurement

There are two general approaches to performance measurement: internal and external benchmarking. This *Primer* focuses on internal performance measurement. Internal performance measurement focuses on evaluating current internal utility performance status and trends. A robust measurement system will be built around a combination of leading, lagging, and coincidental performance indicators.

- **Leading indicators** provide an indication of the future state of a performance parameter of keen interest to the utility – for example an increase in near misses relative to safety violations can foretell of an increased risk of workplace injuries. Leading indicators provide a utility with the diagnostic ability to proactively manage for its desired performance outcomes. *Leading indicators drive preventative actions.*
- **Lagging indicators** typically reflect a performance parameter of keen interest to a utility (such as compliance rate or water quality conditions) while, at the same time providing performance information that can only be reacted to, making it sometimes challenging to proactively adjust operations before performance moves into an unacceptable range. These indicators, however, are critical to an overall measurement system as they typically focus on key performance outcomes that the utility, by necessity, must document (e.g., compliance with permit limits). *Lagging indicators drive immediate, corrective actions that could have been prevented by using leading and coincidental indicators.*

LEADING, LAGGING, AND COINCIDENTAL INDICATORS

A real-life example of applying indicators when analyzing body mass:
Lagging: At the end of the day, stepping on a scale and recording your weight.
Leading: Tracking the number of calories consumed and the number of calories expended through exercise.
Coincidental: Analyzing the two measurements, calories consumed and calories expended holistically. This will allow you to predict that if calories go up and exercise goes down, you can expect an increase in weight.

- **Coincidental indicators** are a form of leading indicator that draws on the behavior of two or more parameters to signal the future state of a key performance parameter (such as phosphorus discharge concentration). These indicators are important to both proactive management of key performance outcomes, but also to conducting root cause analysis when key performance outcomes vary outside of desirable ranges. *Coincidental indicators drive proactive process control actions.*

Benchmarking is the overt comparison of similar measures or processes across organizations to identify best practices, set improvement targets, and measure progress within or sometimes across sectors. A utility may decide to engage in benchmarking for its own internal purposes or in a coordinated fashion with others.

While performance measures should be tailored to the specific needs of your utility, the following guidelines can help you identify useful measures and apply them effectively.

1. Select measures that support the organization's strategic objectives, mission, and vision, as well as the ten Attributes.
2. Select the right number, level, and type of measures for your organization. Consider how measures can be integrated as a cohesive group (e.g., start with a small set of measures across broad categories and increase number and specificity over time as needed), and consider measures that can be used by different audiences within the organization.
3. Measuring performance will not necessarily require additional staff, but will require resources. Allocate adequate resources to get the effort off to a good start, and fine tune over time to balance the level of measurement effort with the benefit to the organization.
4. Develop clear, consistent definitions for each measure. Identify who is responsible for collecting the data, and how the data will be tracked and reported.
5. Engage the organization at all levels in developing, tracking, and reporting measures, but also assign someone in the organization the role of championing and coordinating the effort.
6. Set targets rationally, based on criteria such as customer expectations, improvement over previous years, industry performance, or other appropriate comparisons. Tie targets to improving performance in the Attributes.
7. Select and use measures in a positive way to improve decision making, clarify expectations, and focus attention, not just to monitor, report, and control.
8. When selecting measures, consider how they relate to one another. Look for cause-and-effect relationships; for example, how improvements in product quality could result in increased customer satisfaction.
9. Develop an effective process to evaluate and respond to results. Identify how, when, and to whom you will communicate results.
10. Incorporate the "Plan-Do-Check-Act" cycle approach into evaluating both the specific measures and the system as a whole. Regularly review the performance measurement system for opportunities to improve.

    ... ***and remember to celebrate your measured and documented successes!***

Attribute-Related Measures

The list on the following page provides examples of targeted, Attribute-related measures. Taken as a whole, the measures provide a utility with a cohesive, approachable, and generally applicable starting place for gauging progress relative to the Ten Attributes. The list, for brevity, contains measure "headlines" for each

Attribute. Utilities should also reference information in **Appendix C**, which provides further explanation and, where applicable, example calculations.

You can choose and tailor the measures to your own needs and unique, local circumstances. They are intended for your own internal use, even as certain measures (e.g., those noted as Benchmarking Performance Indicators) can support benchmarking purposes. In these cases, the measures have been selected because they are relevant to the Attributes, have been tested and are in use by utilities, are supported by reference information useful for implementation, and generally can act as a good starting point for Attribute-related progress assessment.

The measures presented are both quantitative and qualitative. Most are quantitative, focus on outcomes typically of interest to utility managers (e.g., compliance rate), and include generally applicable example calculations. The qualitative "measures" encourage active assessment of the practices in place to support effective management in each Attribute area. These are mostly "activity measures" and typically have a "yes/no" format. Like the Attributes themselves, certain measures focus on core utility operations. Several measures reflect emerging utility issues, challenges, or opportunities that have received increasing attention from a growing number of utility managers. Other measures may reflect broader interests that are worthy of consideration from a broader community perspective.

List of Attribute-Related Utility Measures

The list below includes a limited number of example measures that can be used to assess performance in each of the Attribute areas. See **Appendix C** for measure descriptions and details.

Product Quality

1. Regulatory compliance
2. Service delivery

Customer Satisfaction

1. Customer complaints
2. Customer service delivery
3. Customer satisfaction

Employee and Leadership Development

1. Employee retention and satisfaction
2. Management of core competencies
3. Workforce development

Operational Optimization

1. Resource optimization
2. Water management efficiency

Financial Viability

1. Budget management effectiveness
2. Financial procedure integrity
3. Bond ratings
4. Rate adequacy

Infrastructure Stability

1. Asset inventory
2. Asset (system) renewal/replacement
3. Water distribution/collection system integrity
4. Infrastructure planning and maintenance

Enterprise Resiliency

1. Recordable incidents of injury or illnesses
2. Insurance claims
3. Risk assessment and response preparedness
4. Ongoing operational resiliency
5. Operational resiliency under emergency conditions

Community Sustainability

1. Watershed-based infrastructure planning
2. Green infrastructure
3. Greenhouse gas emissions
4. Service affordability
5. Community economic development

Water Resource Sustainability

1. Water supply adequacy
2. Supply and demand management
3. Watershed sustainability

Stakeholder Understanding and Support

1. Stakeholder consultation
2. Stakeholder satisfaction
3. Internal benefits from stakeholder input
4. Comparative rate rank
5. Media/press coverage
6. Partnering in your community

Resources to Support Effective Utility Management Implementation

Effective Utility Management is designed as a broad framework to complement and enhance other prominent utility management initiatives currently in use. In addition to this EUM *Primer*, a wide range of resources exist across the water sector to support each step of the cycle of Effective Utility Management. The resources listed below are examples of materials that can support each step of the EUM cycle.

- **Benchmarking Performance Indicators for Water and Wastewater** (American Water Works Association)
- **Moving Toward Sustainability: Sustainable and Effective Practices for Creating Your Water Utility Roadmap** (U.S. EPA)
- **The Partnership for Clean Water** (American Water Works Association)
- **The Partnership for Safe Water** (American Water Works Association)
- **Performance Benchmarking for Effectively Managed Water Utilities** (Water Research Foundation)
- **Planning for Sustainability: A Handbook for Water and Wastewater Utilities** (U.S. EPA)
- **Resource Guide to Effective Utility Management and Lean: Improving Performance and Addressing Key Management Priorities at Water-Sector Utilities** (U.S. EPA)
- **The Water Resources Utility of the Future: A Blueprint for Action** (National Association of Clean Water Agencies, Water Environment & Reuse Foundation, and Water Environment Federation)

THE DIAGRAM ON THE FOLLOWING PAGE IS A DEPICTION OF HOW EACH RESOURCE FROM THE LIST CAN RELATE TO THE VARIOUS STEPS IN THE CYCLE.

HOW IT FITS TOGETHER

Creating an Improvement Plan

Once you have chosen to improve one or more Attributes, the next step is to develop and implement a plan for making the desired improvements. Improvement plans support the implementation of effective practices in your chosen attribute area(s). An effective improvement plan will:

Set Near- and Long-term Goals	Set goals as part of the improvement plan to help define what is being worked toward. Near- and long-term goals for the utility should be linked to the strategic business plan, asset management plan, and financial plan. Goals should also be "SMART." **S – Specific:** *What exactly will be achieved?* **M – Measurable:** *Can you measure whether you are achieving the objective?* **A – Assignable:** *Can you specify who will be responsible for each segment of the objective?* **R – Realistic:** *Do you have the capacity, funding, and other resources available?* **T – Time-Based:** *What is the timeframe for achieving the objective?*
Identify Effective Practices	Each Attribute area for improvement will be supported by effective practices implemented by the utility. A substantial number of water sector resources exist that detail effective utility practices for each of the Attributes.
Identify Resources Available and Resources Needed	For each practice/activity to be implemented as part of the improvement plan, identify resources (financial, informational, staff, or other) that exist on-hand, and those that are needed, to support implementation.
Identify Challenges	For the overall improvement plan and for specific practices/activities to be implemented, identify key challenges that will need to be addressed.
Assign Roles and Responsibilities	For each improvement action, identify roles and responsibilities for bringing the implementation to completion.
Define a Timeline	Establish start date, milestones, and a completion target for each activity/improvement action.
Establish Measures	Establish at least one (or more) measure of performance for items to be implemented under the improvement plan.

VI. Utility Management Resources

As a companion resource to this Primer, the Collaborating Organizations developed an online Resource Toolbox, which offers additional information and guidance on effective utility management. The Toolbox provides a compilation of resources from the eleven Collaborating Organizations designed to help the water and wastewater utility community further improve the management of its infrastructure.

The Resource Toolbox is organized according to the Ten Attributes of Effectively Managed Water Sector Utilities and five Keys to Management Success, providing a set of resources relevant to each Attribute and Key. The Toolbox also includes information on where to find these resources.

The Resource Toolbox is located at www.WaterEUM.org.

Effective Utility Management for Small and Rural Systems

Small and rural utilities seeking to implement EUM are served by a variety of resources specifically designed for them, including the *Rural and Small Systems Guidebook to Sustainable Utility Management.* The *Guidebook* is a resource jointly developed by EPA and the United States Department of Agriculture (USDA), which adapts the Ten Attributes for use by small and rural systems.

VII. For More Information

This Primer was developed through a collaborative partnership with the following groups. More information about this partnership can be found on their websites or by contacting specific individuals directly.

Association of Clean Water Administrators
Julia Anastasio
Executive Director & General Counsel
1634 I Street NW, Suite 750
Washington DC 20006
janastasio@acwa-us.org
202.756.0600
www.acwa-us.org

American Public Works Association
Anne Jackson
Director of Sustainability
1275 K Street NW, Suite 750
Washington DC 20005
ajackson@apwa.net
202.218.6750
www.apwa.net

Association of State Drinking Water Administrators
Bridget O'Grady
Policy and Legislative Affairs Manager
1401 Wilson Blvd.
Arlington, VA 22209
bogrady@asdwa.org
703.812.9505
www.asdwa.org

American Water Works Association
Cynthia Lane
Director, Engineering and Technical Services
6666 W. Quincy Ave.
Denver, CO 80235
clane@awwa.org
303.347.6176
www.awwa.org

Association of Metropolitan Water Agencies
Carolyn Peterson
Director of Communications and Public Affairs
1620 I Street, NW
Washington DC 20006
peterson@amwa.net
202.331.2820
www.amwa.net

National Association of Clean Water Agencies
Chris Hornback
Chief Technical Officer
1816 Jefferson Place, NW
Washington DC 20036
chornback@nacwa.org
202.833.9106
www.nacwa.org

National Association of Water Companies
Petra Smeltzer
Director of Government Relations
2001 L Street NW, Suite 850,
Washington DC 20036
petra@nawc.com
202.322.8089
www.nawc.org

U.S. Environmental Protection Agency
Jim Horne
Sustainability Program Manager
Office of Wastewater Management
1200 Pennsylvania Avenue, NW
Room 7111 – WJC East
Washington DC 20460
horne.james@epa.gov
202.564.0571
www.epa.gov/sustainable-water-infrastructure

Water Environment Federation
Matt Ries
Chief Technical Officer
601 Wythe Street
Alexandria, VA 22314-1994
mries@wef.org
703.684.2406
www.wef.org

Water Environment & Reuse Foundation
Allison Deines
Director of Special Projects
1199 N Fairfax St, Suite 410
Alexandria, VA 22314-1177
adeines@werf.org
571.384.2116
www.werf.org

Water Research Foundation
Linda Reekie
Research Manager
6666 West Quincy Avenue
Denver, Colorado 80235-3098
lreekie@waterrf.org
303.734.3423
www.waterrf.org

VIII. Appendix A: Key Definitions

Attribute: A basic building block of effective utility management for water sector utilities. Attributes describe characteristics or outcomes of a utility that indicate effective performance.

Benchmarking: The comparison of similar processes or measures across or within organizations and/or sectors to identify best practices, set improvement targets, and measure progress.

Continual Improvement: A systematic approach that supports ongoing efforts to improve products, services, or processes, through incremental steps over time or through "breakthrough" advances all at once.

Effective Utility Management: A comprehensive water sector utility performance assessment and management framework, endorsed by the U.S. Environmental Protection Agency and ten national water sector associations dedicated to improving products and services, increasing community support for water services, and ensuring a strong and viable utility into the future.

Gap analysis: Defining the present state of an enterprise's operations, the desired or "target" state, and the gap between them.

Knowledge Management: The multi-disciplinary process of creating, sharing, using, managing, and preserving the knowledge and information of an organization.

Life-cycle cost: The total of all internal and external costs associated with a product, process, activity, or asset throughout its entire life cycle – from raw materials acquisition to manufacture/construction/installation, operation and maintenance, recycling, and final disposal.

Performance measurement: Evaluation of current status and trends; can also include comparison of outcomes or outputs relative to goals, objectives, baselines, targets, standards, other organizations' performance or processes (typically called benchmarking), etc.

Operations and maintenance expenditure: Expenses used for day-to-day operation and maintenance of a facility.

Operating revenue: Revenue realized from the day-to-day operations of a utility.

Performance measure: A particular value or characteristic designated to measure input, output, outcome, efficiency, or effectiveness.

Source water protection: Efforts to prevent water quality degradation in streams, rivers, lakes, or underground aquifers used as public drinking water supplies.

Standard operating procedure: A prescribed set of actions to be followed routinely; a set of instructions having the force of a directive, covering those features of operations that lend themselves to a definite or standardized procedure without loss of effectiveness.

Strategic plan: An organization's process of defining its goals and strategy for achieving those goals. This often entails identifying an organization's vision, goals, objectives, and targets over a multi-year period of time, as

well as setting priorities and making decisions on allocating resources, including capital and people, to pursue the identified strategy.

Stewardship: The careful and responsible management of something entrusted to a designated person or entity's care; the responsibility to utilize its resources properly, including its people, property, and financial and natural assets.

Sustainability: The use of natural, community, and utility resources in a manner that satisfies current needs without compromising future needs or options.

Watershed health: The ability of ecosystems to provide the functions needed by plants, wildlife, and humans, including the quality and quantity of land and aquatic resources.

IX. Appendix B: Self-Assessment

Step 1: Assess Current Conditions

Assess current conditions by rating your utility's systems and approaches and current level of achievement for each Attribute, using a 1 (high achievement) to 5 (low achievement) scale. Consider the degree to which your current management systems effectively support each of the Attributes and their component parts. Consider all components of each Attribute and gauge your rating accordingly. Use these descriptions to guide your rating. You will note that each Attribute has several components represented by the bullet points listed for each.

Your rating can either reflect the lowest level of achievement of all of the bullet points for that Attribute (for example, if you believe that your achievement in one of the bullet points for that Attribute was "5," but another bullet point you rated as "2," your rating for achievement under that Attribute would be "5"), or an average across all of the bullet points for that Attribute. For whatever approach you choose to use when rating, make sure to be consistent in this approach across all Attributes. Mark your answers in the Step 1 column of the table on the next page.

Rating	Description
1.	Effective, systematic approach and implementation; consistently achieve goals.
2.	Workable systems in place; mostly achieve goals.
3.	Partial systems in place with moderate achievement, but could improve.
4.	Occasionally address this when specific need arises.
5.	No system for addressing this.

Step 2: Rank Importance of Attributes

Rank the importance of each Attribute to your utility, based on your utility's vision, goals, and specific needs. The ranking should reflect the interests and considerations of all stakeholders (managers, staff, customers, regulators, elected officials, community and watershed interests, and others).

There are Ten Attributes; considering long-term importance to your utility, rank the most important Attribute 1, the second most important 2, and so on. The least important Attribute would be ranked 10. Your ranking of each Attribute's importance may be influenced by current or expected challenges in that particular area, recent accomplishments in addressing these issues, or other factors. Importance ranking is likely to change over time as internal and external conditions change.

Mark your answers in the Step 2 column of the table on the next page. As you fill in numbers, please note that your analysis for Step 1 (rating achievement) should be separate and independent from your analysis for Step 2 (ranking importance).

Attribute	Attribute Components	Step 1: Rate Achievement (1-5)	Step 2: Rank Importance (1-10)
Product Quality (PQ)	• Meets or exceeds regulatory and reliability requirements. • Operates consistent with customer, public health, economic, and ecological needs.		
Customer Satisfaction (CS)	• Provides reliable, responsive, and affordable services. • Receives timely customer feedback. • Is responsive to customer needs and emergencies. • Provides tailored customer service and outreach to a range of customer groups (e.g., residential, commercial, industrial, and newly emerging groups such as high-strength waste producers or power companies)		
Employee and Leadership Development (ED)	• Recruits, develops, and retains a competent, safety-focused workforce. • Is a collaborative organization dedicated to continual learning, improvement, and adaptation. • Implements procedures for institutional knowledge retention, workplace safety, and continual learning (e.g., standard operating procedures). • Invests in/provides opportunities for professional and leadership development. • Supports an integrated and well-coordinated senior leadership team.		
Operational Optimization (OO)	• Conducts ongoing performance improvements informed by performance monitoring. • Minimizes resource use and loss from day-to-day operations. • Is aware of and adopts in a timely manner operational and technology improvements, including operational technology and information technology. • Manages and utilizes data from automated and smart systems.		

Attribute	Attribute Components	Step 1: Rate Achievement (1-5)	Step 2: Rank Importance (1-10)
Financial Viability (FV)	• Understands and plans for full life-cycle cost of utility. • Effectively balances long-term debt, asset values, operations and maintenance expenditures, and operating revenues. • Sets predictable and adequate rates to support utility current needs and plans to invest in future needs, taking into account affordability and the needs of disadvantaged households when setting rates. • Understands opportunities for diversifying revenue and raising capital.		
Infrastructure Strategy and Performance (IS)	• Understands the condition of and costs associated with critical infrastructure assets. • Maintains and enhances assets over the long-term at the lowest possible life-cycle cost and acceptable risk. • Coordinates repair efforts within the community to minimize disruptions. • Plans infrastructure investments consistent with community needs, anticipated growth, system reliability goals, and with a robust set of adaptation strategies.		
Enterprise Resiliency (ER)	• Works together with staff internally and coordinate with external partners to anticipate and avoid problems. • Proactively establishes tolerance levels and effectively manages risks (including legal, regulatory, financial, environmental, safety, security, cyber, knowledge-loss, talent, and natural disaster-related). • Plans for and actively manages to maintain business continuity.		

Attribute	Attribute Components	Step 1: Rate Achievement (1-5)	Step 2: Rank Importance (1-10)
Community Sustainability (SU)	• Actively leads in promoting and organizing improvements to community and watershed health within utility and with external community partners. • Actively leads in promoting welfare within the community for disadvantaged households. • Uses operations to enhance natural environment. • Efficiently uses water and energy resources, promotes economic vitality, and engenders overall community improvement. • Maintains and enhances ecological and community sustainability including pollution prevention, watershed and source water protection.		
Water Resource Sustainability (WS)	• Ensures water availability through long-term resource supply and demand analysis, conservation, fit for purpose water reuse, integrated water resource management, watershed management and protection, and public education initiatives. • Manages operations to provide for long-term aquifer and surface water sustainability and replenishment. • Understands and plans for future water resource variability (e.g., changing weather patterns, including extreme events, such as drought and flooding).		
Stakeholder Understanding and Support (SS)	• Engenders understanding and support from oversight bodies, community and watershed interests, and regulatory bodies for service levels, rate structures, operating budgets, capital improvement programs, and risk management decisions. • Actively engages in partnerships and involves stakeholders in the decisions that will affect them. • Actively promotes an appreciation of the true value of water and water services, and water's role in the social, economic, public and environmental health of the community.		

Step 3: Graph Results

Graph each Attribute based on your rating and ranking.

Rating											
	Lower Achievement	5										
		4										
		3										
	Higher Achievement	2										
		1										
			1	2	3	4	5	6	7	8	9	10
			More Important							Less Important		
			Ranking									

X. Appendix C: Attribute-Related Water Utility Measures

Performance measurement is critical to effectively managing a utility. This section of the *Primer* provides detailed information on a range of measures that utilities can consider, including descriptions and example calculations and questions.

In addition to the example measures described in this section, utilities can reference a variety of resources available to the sector which provide additional specific measures for a variety of practices. Resources available to utilities include:

- **Benchmarking Performance Indicators for Water and Wastewater Utilities** (American Water Works Association)
- **Effective Utility Management Benchmarking Tool** (Water Research Foundation)

For each of the Attributes, a variety of example calculations and questions are provided in this Appendix for use by water sector utilities. This is not meant to serve as an exhaustive list, but rather a starting point for utilities as they begin to think about how performance can be measured for each Attribute.

Product Quality

1. Regulatory compliance

Description: This measure assesses water product quality compliance, particularly with regard to 40 CFR Part 141 (the 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 statute/regulations and permit requirements. The scope can include the quality of all related products, including drinking water, fire suppression water, treated effluent, reused water, and biosolids (EPA 503 Regulations), as well as quality related to operating requirements such as pressure and number of sewer overflows.

Example performance measures:

- Drinking water compliance rate (percent): 100 X (number of days in full compliance for the year ÷ 365 days). *This is a Benchmarking Performance Indicator*.

- Wastewater treatment effectiveness rate (percent): 100 X (365 – total number of noncompliance days ÷ 365 days). *This is a Benchmarking Performance Indicator.*
- Number, type, and frequency of "near (compliance) misses": For example, reaching 80-95% of allowable levels of "X" during reporting period, typically per month. Tracking this type of measure could be used to improve performance in these "near miss" areas before violations occur.

2. Service delivery

Description: This measure assesses delivery of quality service based on utility-established objectives and service level targets.

Example performance measures:

- Drinking water flow and pressure (percent): 100 X [number of customers with less than (flow of "X" gallons per minute (gpm) and pressure of "Y" pounds per square inch (psi)—levels set by utility) ÷ total number of customers] (during reporting period, typically per month).
- Fire suppression water flow and pressure (percent): 100 X [hours of time when (flow of "X" gpm and pressure of "Y" psi—levels set by utility) is available for fire suppression at maximum day demand ÷ total number of hours when fire suppression water should be available at maximum day demand] (during reporting period, typically per month).
- Service interruptions (percent): 100 X (number of active account customers experiencing a service interruption of greater than 1 hour ÷ total number of customers during reporting period) (typically per month). Note: the utility may elect to measure planned and unplanned interruptions separately.
- Water quality goals met/not met: Number of days in reporting period (typically one month) where utility-defined beyond-compliance targets are met/not met.
- Sewer backups (amount and percent): Number of customers experiencing backups each year; 100 X (number of customers experiencing backups each year ÷ total number of customers).
- Sewer overflows: Number of sewer overflows per 100 miles of collection system piping, or number of sewer overflows per million gallons treated.
- Water reuse (amount and percent):
    - Amount: Amount of water supplied that is from reused/recycled sources.
    - Percent: 100 X (amount of water supplied that is from reused/recycled water ÷ total amount of water supplied).
    - Then, as desired, these amounts can be broken into recipients/applications (e.g., irrigation, agriculture, industrial processes, etc.).
- Biosolids put to beneficial use (percent): 100 X (amount of biosolids produced that are put to a beneficial use ÷ total amount of biosolids produced) (in wet tons per year).
- Percent of recovered resources that meet customer specifications or regulatory requirements: 100 X (amount of efficiently recovered material ÷ total amount of potentially recovered material).

Customer Satisfaction

1. Customer complaints

Description: This measure assesses the complaint rates experienced by the utility, with individual quantification of customer service and core utility service complaints (note that "service complaints" would not include routine service requests by customers).[1] As a "passive measure," it will not likely be numerically representative (i.e., a statistically valid customer sample group) and is a "starting point" measure for understanding customer service problems.

Example performance measures:

- Number of complaints per 1,000 customers (or other appropriate value based on size of population served) per reporting period, recorded as either customer service or technical quality complaints.
    - Customer service complaint rate: 1,000 X (customer service associated complaints ÷ number of active customer accounts). *This is a Benchmarking Performance Indicator*.
    - Technical quality complaint rate: 1,000 X (technical quality associated complaints ÷ number of active customer accounts). *This is a Benchmarking Performance Indicator*.

For both calculations, utilities may wish to subcategorize complaints by type and aspect (e.g., customer service into billing, problem responsiveness, interruptions, etc., and technical quality into service deficiencies such as taste, odor, appearance, flow/pressure, etc.) and by type of customer (e.g., residential, industrial, commercial, etc.)

2. Customer service delivery

Description: This measure requires the utility, based on internal objectives and customer input, to set desirable customer service levels, then determine an appropriate (target) percentage of time to meet the performance levels. Once established, the utility can track how often it meets the service levels, helping the utility to determine how well customer needs are being satisfied (e.g., have 95 percent of service calls received a response within 60 minutes). A utility can average across individual measures to determine the overall percentage of service level commitments met.

Example performance measures:

- Call responsiveness (percent): 100 X (number of calls responded to within "X" minutes ÷ total number of calls during reporting period) (typically per month).
- Error-driven billing adjustment rate (percent): 100 X (number of error-driven billing adjustments during reporting period ÷ number of bills generated during reporting period). *This is a Benchmarking Performance Indicator*.
- Service start/stop responsiveness (percent): 100 X (number of stop/start service orders processed within "X" days ÷ total number of stop/start service orders during reporting period).

[1] From AWWA and AwwaRF, *Selection and Definition of Performance Indicators for Water and Wastewater Utilities*, p. 41. 2004. Note: This material is copyrighted and any reprinting must be by permission of the American Water Works Association.

- First call resolution (percent): 100 X (number of calls for which problem was resolved/fixed/scheduled to be fixed at the time of the first call ÷ total number of calls during reporting period).

3. Customer satisfaction

Description: This is an overarching customer satisfaction measure based on requested customer feedback (surveys), not calls received or internal customer satisfaction service level commitments. A utility can measure customer satisfaction immediately after service provision or use a periodically performed, more comprehensive customer satisfaction survey. After-service surveys are simpler and easier for the utility to develop and implement without professional advice, but they tend to over represent the most satisfied (e.g., those who just received service) and the most dissatisfied (e.g., those who just called with complaints) customers. Comprehensive surveys can provide statistical validity enabling extrapolation to the population served. A utility can verify survey information through customer conversations, either as follow up to a survey, during public meetings or focus groups, or by some other method (e.g., individual telephone calls).

Example performance measures:

- Overall customer satisfaction: Percent of positive or negative customer satisfaction survey responses based on a statistically valid survey or on an immediately after-service survey. Satisfaction responses can be divided into categories such as: highly satisfied/satisfied/moderately satisfied/unsatisfactory; exceeding expectations/meeting expectations/not meeting expectations; numerical scales (e.g., 1-5); or other divisions. Customer satisfaction information is often also gathered and assessed by topic areas such as product quality, service reliability, billing accuracy, customer service, costs/rates/value, crew courtesy, notification around street construction/service interruptions, etc.

Employee and Leadership Development

1. Employee retention and satisfaction

Description: This measure gauges a utility's progress toward developing and maintaining a competent and stable workforce, including utility leadership.

Example performance measures:

- Employee turnover rate (percent): 100 X (number of employee departures ÷ total number of authorized positions per year). Can be divided into categories such as:
    - Voluntary turnover (percent): 100 X (number of voluntary departures ÷ total number of authorized positions per year). (Perhaps the best indicator of retention problems.)
    - Retirement turnover (percent): 100 X (number of retirement departures ÷ authorized positions per year). (Measures vulnerability to loss/retention of institutional knowledge.)
    - Experience turnover (percent): 100 X (number of years of experience represented by all departures ÷ total years of experience with the organization) (at the beginning of the year). (These are harder data to collect but provide a good assessment of institutional knowledge loss potential and therefore the need to retain/capture institutional knowledge.)

- Employee job satisfaction (percent): 100 X (number of employees with "X" job satisfaction level ÷ total number of employees) (based on implementation and monitoring over time of a comprehensive employee survey). Can be divided into work type or job classification categories, etc., and cover overall satisfaction and topics deemed relevant to longer-term employee satisfaction and retention, such as:
    - Compensation and benefits
    - Management
    - Professional development and long-term advancement opportunities
    - Work and teamwork
    - Procedures
    - Fairness and respect
    - Communication
    - Positive work environment
    - Recognition for achievements
- Employee salary competitiveness relative to market rate: Average percentile rank of employee salaries compared to salaries in surrounding service areas, as determined by a market rate comparison.

2. Management of core competencies

Description: This measure assesses the utility's investment in and progress toward strengthening and maintaining employee core competencies.

Example performance measures:

- Presence of job descriptions and performance expectations: Percentage of classifications with current job descriptions and related performance expectations.
- Training hours per employee: Total of qualified formal training hours for all employees ÷ total FTEs (FTE = 2,080 hours per year of employee time equivalent) worked by employees during the reporting period. *This is a Benchmarking Performance Indicator*.
- Certification coverage (percent): 100 X (number of certifications achieved or maintained ÷ number of needed certifications per year) (across the utility).
- Employee evaluation results (assumes utility evaluates employee performance in a routine way and documents results): Results of employee evaluations (e.g., employee growth not clearly demonstrated, employee growth only demonstrated in certain areas or for certain labor categories, etc.).
- Presence of employee-focused objectives and targets: Percentage of employees with written employee-focused organizational objectives and targets.(Targets could be, for instance, related to quantity, quality, timeliness, or cost. A timeliness target could, for example, relate to the number of hours it takes on average to complete a routine task.)

3. Workforce development

Description: This measure assesses utility long-term workforce succession planning efforts to ensure critical skills and knowledge are retained and enhanced over time, particularly in light of anticipated retirement

volume in coming years. Focus is on preparing entire groups or cohorts for needed workforce succession, including continued training and leadership development.

Example performance measures:

- Key position vacancies: Average time that critical-skill positions are vacant due to staff departures per vacancy per year.
- Key position internal/external recruitment (percent): 100 X (number of critical-skill positions that are filled internally (through promotion, transfer, etc. rather than outside recruitment) versus filled through outside recruitment ÷ total number of positions filled per year). (This will help the utility to understand if internal workforce development is covering long-term succession needs.)
- Long-term succession plan coverage (percent): 100 X (number of employees (or cohorts, work units, etc.) covered by a long-term workforce succession plan that accounts for projected retirements and other vacancies in each skill and management area ÷ total number of employees) (or cohorts, work units, etc.).
- Internal leadership development:
    - Percentage of staff and leadership positions with defined competencies.
    - Are internal or external leadership development/training/skills development opportunities provided to employees (yes/no)?

Operational Optimization

1. Resource optimization

Description: This measure examines resource use efficiency, including labor and material per unit of output or mile of collection/distribution system.

Example performance measures:

- Customer accounts per employee: Number of accounts ÷ number of FTEs. (FTE = 2,080 hours per year of employee time equivalent.) *This is a Benchmarking Performance Indicator*.
- MGD water delivered/processed per employee: Average MGD delivered/processed ÷ FTEs per year. *This is a Benchmarking Performance Indicator*.
- Chemical use per volume delivered/processed: Amount of chemicals used ÷ MG delivered/processed during reporting period. (Alternatively can use dollar amount spent on chemicals ÷ MG delivered/processed; in this case a rolling average for amount spent would account for periodic bulk purchases.)
- Energy use per volume delivered/processed: KWH ÷ MG delivered/processed during reporting period. (Alternatively can use dollar amount spent on energy ÷ MG delivered/processed.)
- O&M cost per volume delivered/processed: Total O&M cost ÷ MG delivered/processed during reporting period.

A utility can also apply the above resource use per volume delivered/processed calculations to resource use per mile (or 100 miles) of collection/distribution system, (i.e., chemical use per mile, energy use per mile, or O&M cost per mile).

2. Water management efficiency

Description: This measure assesses drinking water production and delivery efficiency by considering resources as they enter and exit the utility system.

Example performance measures:

- Production efficiency: Ratio of raw water volume taken into the treatment system to treated water produced.
- Meter function (percent): 100 X (total number of active billable meters minus stopped or malfunctioning meters ÷ total number of active billable meters).

Financial Viability

1. Budget management effectiveness

Description: This measure has short-term and long-term aspects. The short-term calculations are commonly used financial performance indicators, and the long-term calculation is a more comprehensive analytical approach to assessing budget health over the course of several decades.

Example performance measures:

Short-term (typically per year):

- Revenue to expenditure ratio: Total revenue ÷ total expenditures.
- O&M expenditures (percent): 100 X (O&M expenditures ÷ total operating budget).
- Capital expenditures (percent): 100 X (capital expenditures ÷ total capital budget).
- Debt ratio: Total liabilities ÷ total assets. Total liabilities are the entire obligations of the utility under law or equity. Total assets are the entire resources of the utility, both tangible and intangible. Utilities often have different debt-risk acceptability levels, thus the ratio itself should be considered within each utility's unique circumstances. *This is a Benchmarking Performance Indicator*.
- Current level of operating reserves as a percentage of goal.

Long-term:

- Life-cycle cost accounting: Has the utility conducted a life-cycle cost accounting analysis[2] that explicitly incorporates accepted service level risks, asset condition, budget needs based on the values (net present values) of utility current and future assets, etc., and made financial and budget management decisions accordingly (yes/no)?

[2] Section 707 of Executive Order 13123 defines life-cycle costs as, "…the sum of present values of investment costs, capital costs, installation costs, energy costs, operating costs, maintenance costs, and disposal costs over the life-time of the project, product, or measure." Life-cycle cost analysis (LCCA) is an economic method of project evaluation in which all costs arising from owning, operating, maintaining, and disposing of a [facility/asset] are considered important to the decision. LCCA is particularly suited to the evaluation of design alternatives that satisfy a required performance level, but that may have differing investment, operating, maintenance, or repair costs; and possibly different life spans. LCCA can be applied to any capital investment decision, and is particularly relevant when high initial costs are traded for reduced future cost obligations. See also: https://energy.gov/nepa/downloads/eo-13148-greening-government-through-leadership-environmental-management-2000, http://www.wbdg.org/resources/lcca.php.

2. Financial procedure integrity

Description: This measure gauges the presence of internal utility processes to ensure a high level of financial management integrity.

Example performance measures:

- Number of control deficiencies and material weaknesses reported on annual audits.
- Does the utility have financial accounting policies and procedures (yes/no)?
- Are financial results and internal controls audited annually (yes/no)?
- Have the number of control deficiencies and material weaknesses been reduced from previous audits (yes/no)?
- Does the utility have a formal policy for the bill collection process (yes/no)?

3. Bond ratings

Description: This measure uses bond ratings as a general indicator of financial viability; however, they are not always within a utility's control and are less important if a utility is not participating in capital markets. Smaller utilities often struggle to obtain high ratings. Even though a higher bond rating is desirable and this provides a general indicator of financial health, the bond rating should not be considered alone. It should be considered in light of other factors such as the other measures suggested for this Attribute.

Example performance measure:

- Bond ratings.
- Change in bond ratings: Does the change reflect the utility's financial management in a way that can and should be acknowledged and, if need be, addressed?

4. Rate adequacy

Description: This measure helps the utility to consider its rates relative to factors such as external economic trends, short-term financial management, and long-term financial health. It recognizes that a "one size fits all" calculation would not be realistic due to each utility's unique situation and the number of variables that could reasonably be considered. The following three questions prompt assessment of key components of rate adequacy.

Example performance measures:

- How do your rate changes compare currently and over time with the inflation rate and the Consumer Price Index (CPI) or Consumer Price Index for All Urban Consumers (CPI-U)? (Rate increases below CPI for very long may suggest rates are not keeping up with utility costs.) (Using a rolling rate average over time will adjust for short-term rate hikes due to capital or O&M spending needs.)
- Have you established rates that fully consider the full life-cycle cost of service and capital funding options? (See the life-cycle cost accounting discussion, above.)
- Does your utility maintain a rate stabilization reserve to sustain operations during cycles of revenue fluctuation, in addition to 60- (or 90-) day operating reserves?

Infrastructure Strategy and Performance

1. Asset inventory

Description: This measure gauges a utility's efforts to assess assets and asset conditions, as the first steps towards building a comprehensive asset management program.

Example performance measures:

- Inventory coverage (percent): 100 X (total number of critical assets inventoried within a reasonable period of time (e.g., 5-10 years) ÷ total number of critical assets). A utility will need to first define what it considers to be a critical asset. Typically, critical assets are those that you decide would have major consequences if they were to fail (major expense, system failure, safety concerns, etc.). A complete inventory will involve understanding the following for each asset:
    - Age and location;
    - Asset size and/or capacity;
    - Valuation data (e.g., original and replacement cost);
    - Installation date and expected service life;
    - Maintenance and performance history; and
    - Construction materials and recommended maintenance practices.[3]
- Condition assessment coverage (percent): 100 X (total number of critical assets with condition assessed and categorized into condition categories within a reasonable period of time (e.g., 5-10 years) ÷ total number of critical assets). Condition categories could include: unacceptable, improvement needed, adequate, good, and excellent to reflect expected service levels and acceptable risks.

2. Asset (system) renewal/replacement

Description: This measure assesses asset renewal/replacement rates over time. The measure should reflect utility targets, which will vary depending on each utility's determinations of acceptable risks for different asset classes. An asset class may consist of a cohort of pipe based on age/material, or a particular component of plants or lift stations. Generally, an asset class would have an expected service life, and this should be factored into calculations for an appropriate asset renewal/replacement rate. Decisions on asset replacement typically factor in internally agreed-upon risks and objectives, which may differ by asset class and other considerations. For instance, a utility may decide to run certain assets to failure based on benefit-cost analysis.

Example performance measures:

- Asset renewal/replacement rate (percent): 100 X (total number of assets replaced per year for each asset class ÷ total number of assets in each asset class). For example, a two percent per year replacement target (50-year renewal) for a particular asset class could be identified as the basis for performance monitoring.

  — or —

[3] From the U.S. General Accounting Office, *Water Infrastructure: Comprehensive Asset Management Has Potential to Help Utilities Better Identify Needs and Plan Future Investments*. GAO-04-461. March 2004. Available: http://www.gao.gov/new.items/d04461.pdf.

- Asset (system) renewal/replacement rate: 100 X (total actual expenditures 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). *This is a Benchmarking Performance Indicator*.

3. Water distribution/collection system integrity

Description: For drinking water utilities, this measure quantifies the number of pipeline leaks and breaks. Distribution system integrity has importance for health, customer service, operational, and asset management reasons. For wastewater utilities, this measure examines the frequency of collection system failures. When tracked over time, a utility can evaluate whether its failure rate is decreasing, stable, or increasing. When data are maintained to characterize failures by pipe type and age, type of failure, and cost of repairs, decisions regarding routine maintenance and replacement/renewals can be better made.

Example performance measure (drinking water utilities):[4]

- Non-revenue water (NRW): Water supplied to the network that does not return revenue to the utility, including unbilled authorized consumption, apparent losses (theft, customer metering inaccuracies, systematic data handling errors), and real losses (leakage from the pipe network and distribution storage) as defined in the AWWA M36 Manual. May be expressed as volume or value:
    - Volume:
        - Total volume for audit year; and/or
        - Volume per connection per year; and/or
        - Volume per connection per day.
    - Value:
        - Total cost of NRW by total cost of water system operations; and/or
        - Cost of NRW per connection per year.
- Infrastructure leakage index (ILI): Current Annual Real Loss ÷ Unavoidable Annual Real Loss (at current average system operating pressure. Measure would be expressed as a unitless ratio. *Automatic derivation of this measure provided in the AWWA Free Water Audit Software from annual water audit inputs.*
- Audit Validation Level: Level of validation (self-reported, 1, 2 or 3) conducted on the most recent water audit, as defined by Water Research Foundation Project 4639A.[5]

Example performance measure (wastewater utilities):

- Collection system failure rate (percent): 100 X (total number of collection system failures ÷ total miles of collection system piping per year). *This is a Benchmarking Performance Indicator*.

4. Infrastructure planning and maintenance

Description: This measure addresses planning for future infrastructure needs and ongoing maintenance for existing infrastructure, which is critical to overall infrastructure strategy and performance. Planned maintenance includes both preventive and predictive maintenance. Preventive maintenance is performed

[4] For more information, visit: http://www.awwa.org/store/productdetail.aspx?productid=51439782 and http://www.awwa.org/resources-tools/water-knowledge/water-loss-control.aspx.
[5] For more information, visit: *http://www.waterrf.org/Pages/Projects.aspx?PID=4639*

according to a predetermined schedule rather than in response to failure. Predictive maintenance is initiated when signals indicate that maintenance is due. All other maintenance is categorized as corrective or reactive.

Example performance measures:

This measure can be approached in different ways. Calculating costs may be preferable to encourage business decisions based on total cost; however, the reliability of costs is uncertain. Hours are likely to be less variable than costs, but not all utilities track hours. Thus, cost and hours ratios are desirable, where possible.

- Planned maintenance ratio by hours (percent): 100 X (hours of planned maintenance ÷ (hours of planned + corrective maintenance)). *This is a Benchmarking Performance Indicator*.
- Planned maintenance ratio by cost (percent): 100 X (cost of planned maintenance ÷ (cost of planned + corrective maintenance)). *This is a Benchmarking Performance Indicator*.
- Is there a formal process to prioritize infrastructure needs/future investments and allocate the necessary funding (yes/no)?
- Is there a formal process for identifying areas of uncertainty and building in needed flexibility during the infrastructure planning phase (yes/no)?

Enterprise Resiliency

1. Recordable incidents of injury or illnesses

Description: This measure addresses incidence rates, which can be used to show the relative level of injuries and illnesses and help determine problem areas and progress in preventing work-related injuries and illnesses.

Example performance measure:

The U.S. Bureau of Labor Statistics has developed instructions for employers to evaluate their firm's injury and illness record. The calculation below is based on these instructions, which can be accessed at: http://www.bls.gov/iif/osheval.htm. The 200,000 hours used in the formulas below represent the equivalent of 100 employees working 40 hours per week, 50 weeks per year, and provides the Bureau of Labor Statistics' standard base for the incidence rates.

- Total recordable incident rate: (Number of work-related injuries and illnesses X 200,000) ÷ employee hours worked.
- Number of near misses: A "near miss" is an unsafe situation or condition where no personal injury was sustained and no property was damaged, but where, given a slight shift in time or position, injury and/or damage could have occurred.

2. Insurance claims

Description: This measure examines the number, type, and severity of insurance claims to understand insurance coverage strength/vulnerability.

Example performance measures:

- Number of insurance claims: Number of general liability and auto insurance claims per 200,000 employee hours worked.

- Severity of insurance claims: Total dollar amount of general liability and auto insurance claims per 200,000 employee hours worked.

3. Risk assessment and response preparedness

Description: This measure asks whether utilities have assessed their all-hazards (natural and human-caused) vulnerabilities and risks and made corresponding plans for critical needs. Risk assessment in this context includes a vulnerability assessment regarding, for example, power outages, lack of access to chemicals, cybersecurity, extreme weather events, curtailed staff availability, etc.

Example performance measures:

- Emergency Response Plan (ERP) coverage and preparedness:
    - Does the utility have an ERP in place (yes/no)?
    - Number and frequency of ERP exercises per year: 100 X (number of critical employees who participate in ERP exercises ÷ total number of critical employees).
    - Frequency with which the ERP is reviewed and updated.
    - Does the utility discuss/coordinate ERP with other agencies/departments (e.g., city, state, police, fire, public health) (yes/no)?
- Vulnerability management: Is there a process in place for identifying and addressing system deficiencies (e.g., deficiency reporting with an immediate remedy process, established intervals between comprehensive vulnerability assessments) (yes/no)?

4. Ongoing operational resiliency

Description: This measure assesses a utility's operational reliability during ongoing/routine operations.

Example performance measure:

- Uptime for critical utility components on an ongoing basis (percent): 100 X (hours of critical component uptime ÷ hours that critical components have the physical potential to be operational). Note: a utility can apply this measure on an individual component basis or summed across all identified critical components. Also, a utility can make this measure more precise by adjusting for planned maintenance periods.
- Cybersecurity:
    - Does the utility document and periodically review network architecture (including defining network boundaries and network asset inventory)? (yes/no) *This is a Benchmarking Performance Indicator.*
    - Does the utility implement formal, written cybersecurity policies that include specific operational aspects associated with service delivery and assurance (not enterprise)? (yes/no) *This is a Benchmarking Performance Indicator.*

5. Operational resiliency under emergency conditions

Description: This measure assesses the operational preparedness and expected responsiveness in critical areas under emergency conditions.

Example performance measures (all apply to emergency conditions and, where relevant, factor in anticipated downtimes relative to required/high demand times):

- Power resiliency: Period of time (e.g., hours or days) for which backup power is available for critical operations (i.e., those required to meet 100 percent of minimum daily demand). (Note: "minimum daily demand" is the average daily demand for the lowest production month of the year.)
- Treatment chemical resiliency: Period of time (e.g., hours or days) minimum daily demand can be met with water treated to meet SDWA standards for acute contaminants (i.e., E.coli, fecal coliform, nitrate, nitrite, total nitrate and nitrite, chlorine dioxide, turbidity as referenced in the list of situations requiring a Tier 1 Public Notification under 40 CFR 141.202), without additional treatment chemical deliveries. (Note: "minimum daily demand" is the average daily demand for the lowest production month of the year.)
- Critical parts and equipment resiliency: Current longest lead time (e.g., hours or days) for repair or replacement of operationally critical parts or equipment (calculated by examining repair and replacement lead times for all identified critical parts and equipment and taking the longest single identified time).
- Critical staff resiliency: Average number of response-capable backup staff for critical operation and maintenance positions (calculated as the sum of all response-capable backup staff ÷ total number of critical operation and maintenance positions).
- Treatment operations resiliency (percent): Percent of minimum daily demand met with the primary production or treatment plant offline for 24, 48, and 72 hours. (Note: "minimum daily demand" is the average daily demand for the lowest production month of the year.)
- Sourcewater resiliency: Period of time (e.g., hours or days) minimum daily demand can be met with the primary raw water source unavailable. (Note: "minimum daily demand" is the average daily demand for the lowest production month of the year.)

Community Sustainability

1. Watershed-based infrastructure planning

Description: This measure addresses utility efforts to consider watershed-based approaches when making management decisions affecting infrastructure planning and investment options. Watershed protection strategies can sometimes, for example, protect source water quality limiting the need for additional or enhanced water treatment capacity.

Example performance measure:

- Does the utility employ alternative, watershed-based approaches to align infrastructure decisions with overall watershed goals and potentially reduce future infrastructure costs (yes/no)? Watershed-based approaches include, for example: centralized management of decentralized systems; stormwater management; source water protection programs; and conjunctive use of groundwater, source water, and recycled water to optimize resource use at a basin scale. (See also "green infrastructure" below.)

2. Green infrastructure

Description: This measure addresses green infrastructure, which includes both the built and natural/unbuilt environment. Utilities may promote source water protection and conservation green infrastructure approaches in support of water conservation (e.g., per capita demand reduction) and water quality protection objectives. Green infrastructure approaches can include: low-impact development techniques (e.g., minimization of impervious surfaces, green roofs); protection of green spaces and wildlife habitat; incentives for water-efficient domestic appliance use and landscaping; green building standards such as those promoted through the Leadership in Energy and Environmental Design (LEED) program; management of energy, chemical, and material use; etc.[6] Utilities often coordinate these efforts with community planning offices.

Example performance measures:

- Has the utility explored green infrastructure approaches and opportunities that are aligned with the utility's mandate, goals, and objectives and community interests (yes/no)?
- Does the utility have procedures that incorporate green infrastructure approaches and performance into new infrastructure investments (yes/no)?

3. Greenhouse gas emissions

Description: This measure will help drinking and wastewater utilities to understand and reduce their individual contributions to area greenhouse gas emissions. Trends indicate that water utility emissions of these gases will likely be of interest to stakeholders. Monitoring of these emissions is becoming more common among water sector utilities, and some utilities are beginning voluntary efforts to reduce their emissions (e.g., through production of reusable methane energy by wastewater utilities).

Example performance measures:

- Net (gross minus offsets) greenhouse gas emissions in tons of carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), and, as applicable, hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). Start by establishing an emissions baseline and then track emission trends in conjunction with minimizing/reducing emissions over time, where possible.[7] Emissions inventories often incorporate indirect emissions such as those generated during the production and transport of materials and chemicals.
- Percent of utility energy demand met by renewable energy resources.

4. Service affordability

Description: This measure addresses drinking water and wastewater service affordability, which centers on community members' ability to pay for water services. The true cost of water/wastewater services may be higher than some low-income households can afford, particularly when rates reflect the full life-cycle cost of water services. To the extent possible within its operating and regulatory contexts, the utility will want to

[6] For more information about green infrastructure, visit https://www.epa.gov/npdes/green-infrastructure.

[7] EPA's industry-government "Climate Leaders" partnership involves completing a corporate-wide inventory of their greenhouse gas emissions. Information and related guidance is available at http://www.epa.gov/stateply/index.html.

consider and balance keeping water services affordable while ensuring the rates needed for long-term infrastructure and financial integrity.

Example performance measures:

- Bill affordability (households for which rates may represent an unaffordable level) (percent): 100 X (number of households served for which average water bill is > "X" percent (often 2-2.5%) of median household income[8] ÷ total number of households served).

Coupled with:

- Low-income billing assistance program coverage (percent): 100 X (number of customers enrolled in low-income billing assistance program ÷ number of customers who are eligible for enrollment in low-income billing assistance program). (The utility can try to increase participation in the program for eligible households that are not participating).

5. Community economic development

Description: This measure assesses the extent to which utility operations play a role in local economic development (e.g., by attracting new employers to the area, enabling residential or commercial growth, or through job creation).

Example performance measures:

- Change in tax base (dollars or percent change) related to new water infrastructure.
- Number of jobs created by utility infrastructure investments. Jobs may be:
    - Internal to the utility;
    - Contracted by the utility; or
    - Through a new employer brought to the community as a result of utility infrastructure.
- Green infrastructure economic benefits:
    - Crime reduction (percent change); and
    - Increase in local property values (percent change).

Water Resource Sustainability

1. Water supply adequacy

Description: This measure assesses short-term and long-term water supply adequacy and explores related long-term supply considerations.

Example performance measures:

- Short-term water supply adequacy: Period of time for which existing supply sources are adequate. This can be measured as a ratio of projected short-term (e.g., 12-month rolling average) monthly

[8] This calculation focuses on identifying low-income households based median household incomes (MHI); however, MHI is not strongly correlated with the incidence of poverty or other measures of economic need. Further, populations served by small utilities in rural settings tend to have lower MHI and higher poverty rates, but fewer options for diversifying water/wastewater service rates based on need compared to larger municipal systems.

supply to projected short-term monthly demand. Often an index or scale is used, for example, short-term supply relative to severe drought (assigned a "1") to abundant supply conditions (assigned a "5").

- Long-term water supply adequacy: Projected future annual supply relative to projected future annual demand for at least the next 50 years (some utilities project out as far as 70-80 years). Statistical forecasting and simulation modeling and forecasting techniques are typically used for such long-term projections. Analysis variables in addition to historical record (e.g., historical and year-to-date reservoir elevation data), forecasted precipitation, and flows (including surface and groundwater, as applicable) can include:
    - Future normal, wet, dry, and very dry scenarios;
    - Anticipated population changes;
    - Future service areas;
    - Availability of new water supplies including both traditional, and alternative supplies, such as recycled water, groundwater banking, desalinization, or groundwater highest and best use; and
    - Levels of uncertainty around the above.
- Water Reuse (water beneficially reused):
    - Amount (percentage or gallons) of reclaimed water used in place of fresh water or drinking water for non-potable uses.
    - Amount (percentage or gallons) of reclaimed water used for potable purposes.
    - Amount (gallons or acre feet) of reclaimed water added to drinking water reservoir(s).
    - Area (acres) of land irrigated using only recycled water.

2. Supply and demand management

Description: This measure explores whether the utility has a strategy for proactive supply and demand management in the short and long terms. Strategy needs will depend on community circumstances and priorities, anticipated population growth, future water supply in relation to anticipated demand, demand management and other conservation options, and other local considerations.

Example performance measures:

- Does the utility have a demand management/demand reduction plan (yes/no)? Does this plan track per capita water consumption and, where analytical tools are available to do so, accurately attribute per capita consumption reductions to demand reduction strategies (such as public education and rebates for water-efficient appliances) (yes/no)?
- Do demand scenarios account for changes in rates (which can change for many reasons) and conservation-oriented, demand management pricing structures (yes/no)?
- Does the utility have policies in place that address, prior to committing to new service areas, the availability of adequate dry year supply (yes/no)? Alternatively, does the utility have a commitment to denying service commitments unless a reliable drought-year supply, with reasonable drought use restrictions, is available to meet the commitment (yes/no)?

3. Watershed sustainability

Description: This measure explores whether the utility has a strategy for proactive watershed management and/or partnerships to ensure an effective integration of utility and watershed investments and practices, to achieve overall optimized performance for the community and the utility.

Example performance measures:

- Amount of pollutants/contaminants managed through source control practices (avoiding the need for treatment plant upgrades, etc.).
- Has the utility developed a source water protection plan (yes/no)?
- Does the utility partner with regional stakeholders to protect and enhance its watershed (yes/no)?
- Percent of wet weather impacts (e.g., flooding, CSOs, SSOs, gallons of infiltrated water not reaching collection systems) managed through watershed (natural treatment) processes: 100 X (Number of wet weather impacts managed through watershed processes ÷ total number of wet weather impacts).
- Area (in acres) of enhancements to wetland areas for treatment/storage of wet weather flows.
- Amount of nutrient removal via watershed approaches:
    - Cost savings derived from nutrient control through watershed processes as an alternative to treatment plant nutrient removal; and
    - Percent of nutrient removal requirements met through watershed processes rather than treatment at the plant.
- Environmental benefits:
    - Amount of movement or reduction of saltwater front (in feet).
    - Amount of avoided freshwater diversion from sensitive ecosystems.

Stakeholder Understanding and Support

1. Stakeholder consultation

Description: This measure addresses utility actions to reach out to and consult with stakeholders about utility matters, including utility goals, objectives, and management decisions.

Example performance measures:

- Does the utility identify stakeholders, conduct outreach, and actively consult with stakeholders about utility matters (yes/no)? Elements of this plan can include:
    - Number of active contacts with stakeholders in key areas (e.g., from local government, business, education, non-governmental groups)?
    - Does the utility actively seek input from stakeholders (yes/no)?
    - Frequency with which the utility actively consults with stakeholders. This measure should go beyond counting the number of calls or times information is sent out or posted on websites to items such as number of stakeholder outreach and education activities, number of opportunities for stakeholders to provide input, participation of stakeholders on utility committees, etc.
- Does the utility actively consider and act upon stakeholder input (yes/no)?

2. Stakeholder satisfaction

Description: This measure addresses stakeholder perceptions of the utility. Stakeholder satisfaction can be measured through surveys sent to stakeholders, formal feedback surveys distributed to stakeholders at events, etc.

Example performance measures:

- Overall satisfaction (percent): 100 X (number of stakeholders who annually rate the overall job of the utility as positive ÷ total number of stakeholders surveyed).
- Responsiveness (percent): 100 X (number of stakeholders who annually rate utility responsiveness to stakeholder needs as positive ÷ total number of stakeholders surveyed).
- Message recollection for outreach programs targeted to specific stakeholder groups (percent): (a) 100 X (number of stakeholders who recall key messages ÷ total number of stakeholders surveyed); and (b) 100 X (number of stakeholders who recall the message source (TV, utility mailers, newsletters, etc.) ÷ total number of stakeholders surveyed).

3. Internal benefits from stakeholder input

Description: This measure addresses the value utility employees believe stakeholder engagement has provided to utility projects and activities. Measurement by the utility can focus on surveying utility employees running projects that have stakeholder involvement.

Example performance measures:

- 100 X (number of utility projects or activities where stakeholders participated and/or provided input for which utility employees believe there was value added as a result of stakeholder participation and input ÷ total number of projects where stakeholders participated and/or provided input).
- Overall value added (percent): 100 X (number of utility employees who rated their overall sense of value added from stakeholder participation and input as (high value added, some value added, little value added, no value added) ÷ total number of utility employees surveyed).

4. Comparative rate rank

Description: This measure depicts how utility rates compare to similar utilities (e.g., utilities of the same type (drinking water, wastewater) that are similar in terms of geographic region, size of population served, etc.). A utility can use the measure internally or to educate stakeholders. It should be noted that the lowest rate is not necessarily best (see Financial Viability). When comparing rates with other utilities, it is important to make sure to account for other variables that can affect rates to ensure that you are comparing “apples to apples.” For example, when comparing a wastewater collection and treatment utility's rates to a utility providing treatment only, include the average rate of the separate wastewater collection utility in a combined rate.

Example performance measure:

- Typical monthly bill for the average household as a percentage of typical monthly bills for similar utilities.

5. Media/press coverage

Description: This measure captures media portrayal of the utility (newspaper, TV, radio, etc.) in terms of awareness, accuracy, and tone.

Example performance measures:

- Amount of coverage: Total number of media stories (social media, newspaper, TV, radio, etc.) concerning the utility per year.
- Media coverage tone (percent): 100 X (number of media stories concerning the utility that portray the utility in a positive way ÷ total number of media stories concerning the utility) per year.
- Media coverage accuracy (percent): 100 X (number of media stories that accurately describe the utility ÷ total number of media stories concerning the utility) per year.
- Number of outreach events conducted to build support for utility, value of water, and value of water services.

6. Partnering in your community

Description: This measure assesses how the utility actively engages with community organizations to advance important initiatives, engage partners in decision making, and to position the utility as an anchor institution in the community. Partnering in this manner can result in many different types of benefits for the utility and the community, including the increased understanding and support for utility needs and the value of water and water services to the community.

Example performance measures:

- Performance improvements resulting from a partnership (e.g., reduced volume of flooding or greenhouse gas emissions).
- Number and type of specific projects completed associated with partnerships (e.g., rain gardens installed, innovative technologies implemented, innovative practices adopted).
- Level of partner/community support for utility and the value of water (e.g., number of community members/partners participating in utility events or providing positive feedback for utility services).

ADDITIONAL ATTRIBUTE-SPECIFIC MEASUREMENT RESOURCES

The following resources provide additional measures that are specific to various Attributes. The list is not meant to be exhaustive, but rather, serves as a starting place for utilities seeking additional resources for measures.

- **The Energy Roadmap** (Water Environment Federation)
- **National Biosolids Partnership** (Water Environment Federation)
- **The Nutrient Roadmap** (Water Environment Federation)
- **On-Demand WasteWater Library (OWWL)** (Water Environment Federation)
- **The Value of Water** (http://thevalueofwater.org/)
- **Work for Water** (American Water Works Association and Water Environmental Federation)
- **Water Advocates** (Water Environment Federation)
- **AWWA Water and Wastewater Rate Survey** (American Water Works Association) *subscriber only*
- **AWWA Compensation Survey** (American Water Works Association) *subscriber only*
- **NACWA Financial Survey** (National Association of Clean Water Agencies)

Effective Utility Management: A Primer for Water and Wastewater Utilities

January 2017