BASIC WATER UTILITY MANAGEMENT

A Guide For Local Leaders

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mayors **innovation** project

INTRODUCTION

Water utilities serve an important and prominent societal role, tasked with protecting, effectively distributing, and safely supplying their respective communities with clean drinking water. Effective management of wastewater and stormwater are also necessary to protect and ensure both environmental and human health.

Water utilities (storm, drinking, and wastewater) operations may fall under municipal authority, they may be managed by regional authorities, or by private entities. Different entities may own and manage the distribution, collection, and treatment systems. Knowing what a municipality has authority over will drive what you can impact and which partnerships are essential to build.

Successful equitable provision of these services requires consideration of a number of key elements. These include the creation of a positive internal work culture, effective programming and planning, infrastructure development and maintenance activities, compliance with federal and state law, and engagement with community. In addition to water utilities operating well independently, they need to work congruently with other city departments, other local units of government, the business community, and community groups to understand the on-the-ground needs of the customers they are serving. Access to safe, affordable drinking water is a human right[1] and, as such, it is the duty of the water utility to ensure that this right is protected, upheld, and respected. This report covers the basics of what mayors need to know about their water utilities.

SUMMARY

A strong water system is a critical component of a strong, healthy and sustainable city and mayors need to understand the key components of basic water utility management.

Cities should take a One Water or Integrated Water Management approach.

Elements of a successful system include infrastructure and maintenance, programming and planning, government compliance and utility culture.

Community engagement is a critical component of utility management.

This document was written by Erica DePalma and Howard Neukrug from the Water Center at the University of Pennsylvania, and Matthew Braunginn, Mariah Young-Jones and Satya Rhodes-Conway of the Mayors Innovation Project. Our work on water management is generously supported by the Pisces Foundation, the C.S. Mott Foundation, The Park Foundation, and the Heinz Endowments.

IMPORTANCE OF BUILDING AND MAINTAINING STRONG WATER SYSTEMS

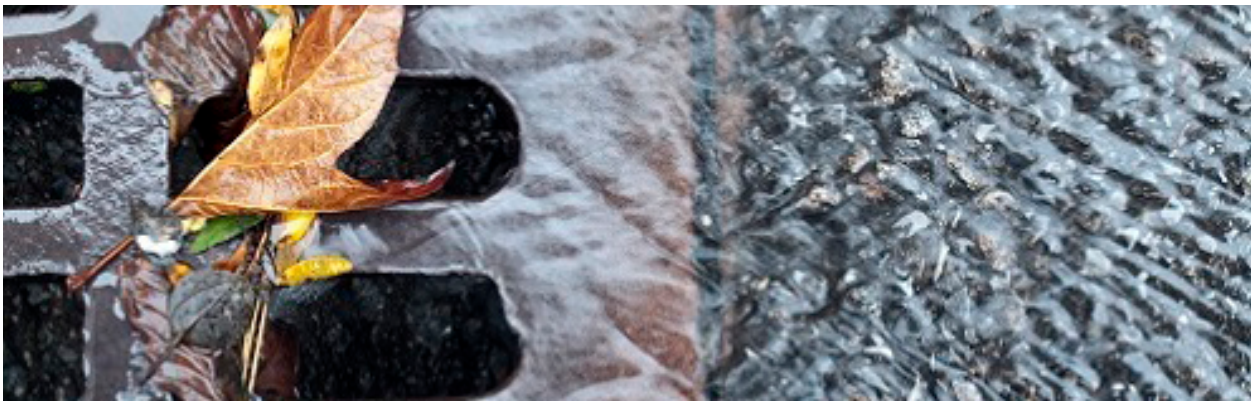
Cities are better off with strong water systems, but these take time, investment, and political will to build and maintain. Many cities are facing aging infrastructure, water quality challenges, combined sewer overflows, and more. These things impact the quality of life of everyone within the city. It is important for mayors to understand the different ways water intersect with their city.

Part of a mayor's job is to understand vital operations of a city—at least in overview. Water utilities and infrastructure are a part of that. Here we present tools to help mayors understand their water systems and utilities better.

WATER SYSTEMS 101

There are five major types of water that moves through a city: drinking, waste, storm, surface, and groundwater. Surface water is the lakes and rivers within a city, and groundwater is the water found underground in the water table. These are both potential sources of drinking water. Drinking water and sewer systems are perhaps the most readily understood because every city has a utility system to treat and purvey clean, safe drinking water, and to convey and treat wastewater before returning it to a surface water body (where it then flows downstream, often becoming drinking water for another city). When considering the centralized components of drinking and wastewater systems, it is important to think not only about the capital-intensive, highly visible treatment plants or pumping stations, but also the hundreds of miles of underground pipes, each of which needs repair and eventual replacement during a typical 75 to 100 year life span.[2]

Both water and wastewater (also referred to as "sewer") pipes come in two basic varieties: **mains**, which have a larger diameter to serve as the artery flowing underneath public streets; and **laterals**, which generally have both a utility-owned length that reaches from the main to the property line as well as a privately-owned length extending into the property. Additionally, an array of distributed tools can positively impact utility systems while being owned and maintained by private property owners, including **rain barrels** (that collect rain water that can be used for irrigation, keeping the rain out of the stormwater system and conserving treated drinking water) and **on-site grey water/ non-potable reuse systems**.



One Water frameworks help cities create more resilient water systems, leverage limited resources more efficiently, and safeguard the important role water serves in our lives.

In addition to providing clean water and reliable wastewater service, cities are also often charged with managing stormwater. With the advent of climate change and extreme storm events, these more intense and/or frequent storms in some areas are creating new challenges and costs. For example, one inch of rainfall over an acre (just under the size of a football field) is equivalent to more than 27,000 gallons of water.[3] The current design standard is a municipal separate storm sewer system (MS4), in which stormwater is conveyed separately from sewage and is discharged, untreated, into waterways or a plot of land. The lack of treatment means that stormwater carries pollutants than can damage ecosystems and human health, while intense storms can introduce such a volume of water into creeks and rivers that harmful erosion or flooding occurs. The other type of centralized stormwater infrastructure is a combined sewer system, where stormwater is conveyed into wastewater pipes for treatment; however, such systems pose a public health risk when intense rainfall overwhelms system capacity and this overflow, now a mix of polluted stormwater and sewage, discharges directly into nearby surface waters. Given the risks in each kind of system, it is critical for any city to consider how distributed tools like green infrastructure (a set of land-based solutions that allow for longer-term storage or short-term retention to encourage infiltration into the ground) can help reduce the volume of stormwater entering a centralized system.

Cities must take care to protect water resources in all forms from pollution and depletion. Not every region has one agency tasked with monitoring storm, surface, and groundwaters. Each of these might be under the purview of a different entity—a city or county department, or a regional authority. However, decisions that are squarely in the wheelhouse of elected city leadership, such as land use patterns, have enormous impacts on these water resources. A city's water system is much more than plants: it is its pipes, its distributed infrastructure, its land use and it depends on myriad decisions that elected officials make.

ALL WATER IS RESOURCE

The One Water approach - sometimes referred to as integrated water management (IWM) - is a set of principles and approaches that recognize all water as a resource. One Water and IWM are used to describe efforts to integrate and optimize urban water systems within the larger context of the city. This concept was developed by the Water Environment & Reuse Foundation; they define it as an approach that "considers the urban water cycle as a single integrated system, in which all urban water flows are recognized as potential resources, and the interconnectedness of water supply, groundwater, stormwater and wastewater is optimized, and their combined impact on flooding, water quality, wetlands, watercourses, estuaries and coastal waters is recognized."[4]

IWM or One Water frameworks help cities create more resilient water systems, leverage limited resources more efficiently, and safeguard the important role water serves in our lives. Some examples of this approach include:

- using green infrastructure to infiltrate water back into the groundwater, but also to beautify a street and calm traffic
- collecting rainwater for use on landscaping while keeping it out of the stormwater system to prevent flooding
- Driving economic development by cleaning up a waterfront and capturing value from that economic activity to keep surface waters clean

Cities should adopt a One Water approach, and look for ways to incorporate this priority across departments, and to cooperate with other jurisdictions across the watershed.

ELEMENTS OF A SUCCESSFUL WATER SYSTEM

Culture

A positive working environment fuels good work ethic, collaboration, and sustainable outcomes. Employee morale is crucial in going beyond what is expected of a water utility and in developing innovative advancements that guide our nation away from accepting near-failing water systems. Strong leadership is necessary for employee morale to permeate throughout the entire utility. A crucial role of utility leadership is that of hiring and training new employees. As such, it is key to have a strong human resource department comprised of leaders that are committed to imparting their institutional knowledge to new employees and building the capacity of their colleagues with energy and vision. Water utility staff must be willing to collaborate with departments across the city and with other utilities across their watershed. When water utilities are part of interdepartmental municipal conversations, a city's water concerns are fully integrated into its vision and goal and are not ancillary. Water utilities should also consider participating in regional or watershed based networks to stay abreast of water quality trends in the surrounding areas.

Programming and Planning

Water Quality

Water utilities should adhere to principles for source water protection and treatment regardless of which source or treatment technology. Source water comes from either a surface water or a groundwater supply. Wellhead protection programs are often implemented to protect groundwater drinking water sources, and many utilities relying on groundwater incorporate filtration and treatment at the well site. For unfiltered surface water supply systems, source water protection programs invest in science to ensure that the highest quality of water is provided to the tap. Without the ability to rely on a billion dollar filtration system, water utilities tasked to manage the source waters of an unfiltered system need to understand the hydraulics, fluvial geomorphology, and geologic materials of their systems - in addition to the approval or disapproval of recreational engagement on the surface-water reservoirs. And where restoration projects are needed, water utilities should use stream and groundwater science to inform the engineering behind the project.

For filtered systems, source water protection programs are necessary to ensure the sustainability and longevity of the water supply, especially in urbanized watersheds. If the biggest threat to the water supply system is turbidity or suspended sediment, then both a filtered and an unfiltered system would be tasked with mitigating the deterioration of the natural landscape and supply conduits. In addition to working within the utility via programming to optimize the handling and distribution of high quality water, outside entities can be tasked with fostering highly functioning water utility collaborative. One such example is the Partnership for Safe Water, an unprecedented union of six highly functioning national drinking water organizations with a mission "to improve the quality of water delivered to customers by optimizing water system operations. The Partnership offers self-assessment and optimization programs so that operators, managers, and administrators have the tools to improve performance above and beyond even proposed regulatory levels."[5] Water utilities should strive to uphold and implement the values of the Partnership.

Programming for water quality monitoring and reporting requires qualified personnel within the utility and lab space. They must also possess institutional knowledge on scientific methods and regulations on which to focus and direct funding. Water utilities are tasked with ensuring laboratory adequacy for both quality and capacity. Laboratory staff must be aware of and prepared to detect a variety of contaminants of concern, such as cryptosporidium (often found in private wells), Giardi, THMs/ HAAs, emerging contaminants, corrosion control treatment via zinc orthophosphate, LSLs (lead service lines), and CTs (cancer causing contaminants).[6]

Additionally, water utilities are responsible for writing and distributing yearly reports. These reports include the water quality data obtained from laboratories and other water quality related programming such as source water protection initiatives. A key component to the success of any water utility is transparency. Thus, yearly reports serve as an opportunity for the water utilities to communicate directly to the public why the water is safe to consume, what (if any) are the risks, and what resources are available for customers to make knowledge-based decisions regarding their water consumption habits. In addition to yearly reports, monthly operating reports (MORs) are required for water utilities to be in compliance with the Environmental Protection Agency (EPA) and should be submitted to state EPA offices. The content of MORs includes statistical presentation and analysis of a variety of components regarding the functionality of the water utility. Statistical components of MORs include average, daily, monthly, maximum, and minimum intake information and are computed automatically. Statistical information can also be manually entered and included in the MOR. Examples of manually entered data into the MOR includes water quality data discerned by utility laboratory technology and staff, as well as maintenance and operation information logged by appropriate staff.[7]

Finance

Utilities should institute a number of key planning initiatives to strengthen their capacity to function effectively. These initiatives include financial, strategic, staffing, and operational planning. Financial planning requires the utility to implement programs that match levels of revenue while establishing an affordability plan. Utilities should form a team to complete the annual budget, determine and implement rates, and develop a five-year financial plan incorporating both budget and revenue sources. The annual budget should address operating budget, current revenue, and budget balance. It should also account for an identified percentage of potential reserves. The rate setting process for a utility should include establishing rate structures, customer wage usage, fixed and variable expenses, appropriate rates, and customer education for support. A utility's long-term financial plan should include a budget projection, a revenue plan to meet budget projections, and identification of key personnel. Additionally, it is imperative for a utility to establish an affordability plan in conjunction with a short and long term financial plan.

To make sure water is affordable to all, cities should explore different ways to make sure rate payers can afford their water bill. Keeping people paying their bills not only keeps money flowing into the utility, it also helps secure the livelihood of households in the prevention of evictions and in keeping people healthy.

The Philadelphia Water Department recently introduced an unprecedented tiered assistance program (TAP) to improve affordability for the city's economically vulnerable population. Constituents living between 0 - 151% of the federal poverty line receive an associated monthly bill cap based off that percentage. This affordability initiative means that customers no longer have to choose what bills to pay. Instead it encourages personal ownership over attaining basic needs and rights.[8] Not every city can pursue a water affordability program like Philadelphia, but a good first step is to explore if state law and other barriers might restrict pursuing this program. If a city can, it is advised they implement a rate based water affordability program.

Other examples of water affordability and assistance programs exist if a rate based program cannot be implemented. The Portland, OR Water Bureau provides a $150 crisis voucher per year to consumers. They also have a discount program for households based upon income level[9]. The difference between a discount and a rate based affordability program, is that an affordability program bases bills on rate payers' income, while assistance program might offers a discount or a rebate from the bill.

Strategic Planning

Utilities should also invest in the development of a strategic plan. First, every utility should have a Director of Strategic Development, or someone who fulfills this function. This position is complementary but different to a Director of Business Development, as the Director of Strategic Development will be more inclined to look beyond profit-driven incentives towards the complete functionality and holistic management of their utility. As the Director of Strategic Development creates and implements the strategic plan, different sectors of the utility are more likely to communicate, understand each other's roles, and more effectively work towards delivering safe and clean drinking water to its customers. Strategic development also involves clear collaborative structures with the Human Resources Department, allowing each employee to feel confident in who they can reach out to for questions and matters of confidence. Another important element of strategic development includes the development and execution of a communications plan. A communications plan aims to relay the performance, success, and transparency of a utility. This

Portland, OR
Source: BES Portland, CC BY-ND 2.0

plan should seek to promote community involvement via buy-in for community programming. A communications plan should ensure that the voices of those who have been historically marginalized, are heard, understood, and attended to. This, in most cases, means intentional outreach to low-income communities and communities of color.

Adequately staffing a utility is crucial to its capacity to function effectively. Staffing includes those employed by the utility in both permanent and contract positions, across blue collar, management, and consulting roles. In order to undertake succession planning, utilities must continuously keep track of employees eligible to retire within the subsequent four years as well as key vacancy opportunities. It is imperative that utilities maintain a productive balance between institutional knowledge and the inevitable energy and new ideas of newly hired staff.

Utilities should also develop adequate emergency plans to address risks of varying degrees of intensity under the context of operating rules and policies. These plans should include employee trainings to be completed within the first two months of employment. All employees must be tested and fully knowledgeable of all emergency actions plans and aware of where all emergency exits are located. Utility employees that will be working in any capacity in the field must be OSHA certified, with yearly re-certifications undertaken. Employees tasked with the handling of hazardous waste materials must be OSHA HAZWOPER certified before the interaction with said materials or working on any hazardous sites.

Government Compliance

In addition to working closely with government agencies such as the EPA and state Department of Environmental Protection (DEP) personnel, water utilities must fully understand and implement the laws, regulations, and guidelines established by these entities. Examples of water quality regulations in the state of Pennsylvania, enforced by the state DEP include: the lead and copper rule, groundwater rule, stage 2 disinfectants/disinfection byproducts rule (stage 2 D/DBP), long term 2 enhanced surface water treatment rule (LT2 ESWTR), radionuclide rule, long term 1 enhanced surface water treatment rule (LT1 ESWTR), filter backwash recycling rule (FBBR), and interim enhanced surface water treatment rule (IESWTR).[10] Other states have comparable regulations.

At the federal level, two pieces of legislation, The Clean Water Act and The Safe Drinking Water Act, revolutionized the integrity of our water supply and distribution systems. In 1972 The Clean Water Act instituted the basic outline and platform for regulating pollution of United States waterways. The Safe Drinking Water Act quickly followed in 1974, established to specifically ensure potable water safety via partnerships with technical and financially competent entities. Not only did these legal parameters instill tangible means for ensuring the safety of the United States' waterways and drinking water sources, but it challenged the (at that time) current, harmful mindset that our waterways were an appropriate place to dump waste. Water utilities should ensure that they are actively in compliance with both The Clean Water Act and The Safe Drinking Water Act.

Infrastructure and Maintenance

In order for utilities to function optimally, appropriate infrastructure must be installed and effectively maintained. General upkeep of facilities includes visual assessment of infrastructure, as well as backup and redundancy of electricity, pumps and feeds. Major transmission pipes are often prone to failures, leakages, and breaks due to the natural consequences of aging and neglect.

Therefore, pipes need to be actively monitored and maintained. Infrastructure failures can also lead to health risks depending on the material of the city/utility pipes. In order to mitigate such health risks, the water (as a mechanism for the interaction between the chemical compound and the pipe) must be treated with zinc orthophosphate as an effective corrosion inhibitor. General site components to be actively monitored and maintained include wastewater treatment plants, membrane facility, chlorine boosters and reservoirs. An additional challenge that many water utilities face is aging infrastructure. With time, city populations and demand often increase and therefore there is more wear and tear on infrastructure. Additional revenue needs to be generated to tackle the aging infrastructure repair for optimal efficiency.

Cities and utilities should take a smart, integrated approach to infrastructure. This could include planning maintenance and construction in conjunction with other utilities and streets work, or layering funding for water, transportation, and economic development to leverage the multiple benefits of clean surface water or green infrastructure. By investing in integrated solutions like energy efficiency upgrades and green infrastructure, utilities and cities have a chance to save money, and if done right, to see a return on their investment.

A key component of an integrated water approach is how you manage stormwater. Green infrastructure investments can improve stormwater management and can be leveraged to deliver a range of additional benefits to communities including air purification, mitigation of urban heat, island effect reduction, aesthetic improvements, green jobs, and more.

Another facet of integrated water management is reducing greenhouse gas emissions from water utilities and improving their energy efficiency. Water utilities can improve efficiency through infrastructure improvements like leak detection systems, water saving technologies, water conservation incentives, management of wastewater concentration and flows, lightbulb replacement, and upgrades for wastewater plans through pump optimization.[11]. Some cities[12] have been looking at ways to use renewable energy to power water and wastewater utilities too. Using solar or wind to power these facilities might not be feasible for all utilities, but is something every city should take a look into to see if they can adopt this practice.

COMMUNITY ENGAGEMENT

Community engagement is what drives the cohesive relationship between water utilities and community constituents. A water utility needs to actively address issues that often plague communities relating to equitable access and affordability of drinking water. A water utility is also responsible for understanding and addressing community complaints pertaining to taste and odor of tap water, water shut-offs, low pressure, and boil notices.

The United States has seen publicly in places like Flint, MI, what can result of a utility and government that fails to address the continued distribution of less than acceptable drinking water. A lack of transparency to communities can exacerbate problems related to service delivery failure. The failure of the water utility and local government in Flint ultimately resulted in dwindling trust and animosity between parties. This lack of trust did not stay siloed in Michigan, but rather has impacted the perception many city/ utility customers have of tap water across the US. As a result, cities have suffered from unnecessary, negative environmental effects such as excessive usage of single-use plastic water bottles and the financial burden on economically vulnerable communities paying for bottled water. Thus, a water utility is tasked with promoting and ensuring customer confidence in the commodity it provides.

Utilities, at a minimum, need to have a solid communications plan that allows them to frequently reach their constituents with clear, honest information. This kind of ongoing education and transparency will help when there is a crisis to communicate about. But simply disseminating information isn't enough—cities and utilities should develop ways to proactively invite community engagement with the utility so they are aware of any concerns or problems and can address them.

CONCLUSION

Mayors need to be engaged with the high-level operation of their water system. Take the time to understand the current situation, and if necessary, take steps to move toward a more integrated water management approach with a focus on sustainability and community engagement.

RESOURCES

Integrated Water Management: A Guide for City Leaders (Mayors Innovation Project, 2016). This report provides an overview of the potential for IWM in cities from the big-picture framework down to examples of tools used by cities on the ground. IWM includes tools like protection of natural lands near waterways, conservation, capture of rain as a resource, an end to "waste" water, and planning for climate resilience.

The City Upstream and Down: How Integrated Water Management Can Help Cities Thrive (American Rivers 2016). This report provides insight from expert city leaders nationwide on how elected officials and utility leaders can best collaborate to implement IWM in cities.

Pathways to One Water (Water Environment Research Foundation 2015). This brief provides numerous examples of cities transforming how water is managed, breaking down water management integration through a multi-strategy approach.

The Value of Green Infrastructure (Center for Neighborhood Technology & American Rivers 2010). A comprehensive overview of various green infrastructure tools and their multiple co-benefits, with metrics to quantify benefits by technical and financial standards.

Drinking Water Infrastructure: Who Pays and How (And For What?) (American Rivers 2013). A primer on financing drinking water infrastructure as well as critical insight about how to balance conservation, the need for revenue, and affordability for ratepayers.

Integrated Urban Water Management for Planners (Water Research Foundation & American Planning Association 2014). Written from a land use planning perspective, this brief offers a different take on the potential synergy and benefits of integration for water management.

ENDNOTES

1. On July 28th, 2010 the United Nations General Assembly declared that water and sanitation are essential to the realization of human rights via Resolution 64/292.
2. ASCE, "Drinking Water."
3. U.S. Geological Survey, "Rain and Precipitation," available at https://water.usgs.gov/edu/earthrain.html.
4. Water Environment Research Foundation, "Pathways to One Water: A Guide for Institutional Innovation" (2015), page 3, available at http://www.mayorsinnovation.org/images/uploads/pdf/7_-_Pathways_to_One_Water.pdf.
5. Department of Environmental Protection "Partnership for Safe Water" available at: https://www.dep.pa.gov/Business/Water/BureauSafeDrinkingWater/Partnership/Pages/default.aspx (last accessed March 1, 2019)
6. US Environmental Protection Agency "Water Quality Standards Regulations: Pennsylvania" available at: https://www.epa.gov/wqs-tech/water-quality-standards-regulations-pennsylvania (last accessed March 1, 2019)
7. Colorado Department of Public Health and Environment "Drinking water monthly operating reports (MORs)" available at: https://www.colorado.gov/pacific/cdphe/mors (last accessed March 1, 2019)
8. City of Philadelphia "Philadelphia Launches New, Income-Based, Tiered Assistance Program" available at: https://www.phila.gov/press-releases/mayor/philadelphia-launches-new-income-based-tiered-assistance-program/ (last accessed March 1, 2019)
9. City Of Portland, Oregon "Sewer, Stormwater And Water Financial Assistance Application" available at: https://www.portlandoregon.gov/water/article/622253 (last accessed March 1, 2019)
10. Department of Environmental Protection "Water Quality" available at: https://www.dep.pa.gov/Business/Water/CleanWater/WaterQuality/Pages/default.aspx (last accessed March 1, 2019)
11. Neal Elliott (August 23, 2018) "Municipal Strategies for Energy Savings in Drinking Water & Wastewater Treatment" Presentation to the Mayors Innovation Project. Available at: https://www.mayorsinnovation.org/images/uploads/pdf/3_-_Elliott.pdf
12. City of West Lafayette, IN "Bio Energy Project Description: Available at: https://www.purdue.edu/discoverypark/energy/assets/pdfs/energy-camp-presentations/West%20Lafayette%20Waste%20Water%20Treatment%20Plant.pdf (last accessed March 1, 2019)

About us

The Mayors Innovation Project is a learning network among American mayors committed to "high road" policy and governance: shared prosperity, environmental sustainability, and efficient democratic government. We are a project of COWS. We can be contacted at:

7122 Sewell Building
University of Wisconsin–Madison
Madison, WI 53706
info@mayorsinnovation.org • www.mayorsinnovation.org • @mayorinnovation

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