

Best Practices for Integrated Water Asset Management in the Great Lakes Basin

IWAM PHASE I SUMMARY REPORT

Prepared by the Great Lakes Commission

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Background

The Great Lakes Commission's *2017 Joint Action Plan for Clean Water Infrastructure and Services in the Great Lakes Region* (Joint Action Plan) profiles regional water infrastructure challenges and proposes a suite of actions to meet them. Among those challenges is a lack of adequate information about water infrastructure assets, which can hinder effective water infrastructure management and investments. Specifically, the Joint Action Plan called for the catalyzation of asset management (AM) activities among individual water utility service providers, and for service providers to consider opportunities to improve operational efficiencies by increasing coordination across traditionally-siloed sectors and regional geographies. With funding from the Joyce Foundation, the Great Lakes Commission (GLC) embarked on a year-long effort in 2019 to better understand the barriers, opportunities, and best practices for catalyzing Integrated Water Infrastructure Asset Management (IWAM) in the Great Lakes Basin.

While states, provinces, and individual communities across the Great Lakes Basin vary in their water infrastructure AM policies and practices, there are many examples of communities advancing innovative strategies. The IWAM project was designed to gather information about these strategies and the barriers to their wider adoption through structured conversations that engaged over 150 water infrastructure practitioners and AM professionals from across the Basin. The structured conversations took two forms: first, GLC hosted four webinars, each focusing on a different aspect of IWAM: (1) *What is IWAM*, (2) *Water Infrastructure Financing*, (3) *Technology*, and (4*) Policy and Program Implementation*[1]. The webinars engaged experts from academic institutions as well as federal, state, provincial and local agencies. Second, the GLC organized a series of three focus groups in Mississauga, Ontario; Dayton, Ohio; and Erie, Pennsylvania. The focus groups garnered participation from a wide range of professionals from the private, public, and nonprofit sectors, and consisted of guided discussions centered on the same topics as the webinars. The IWAM project also aimed to use the findings to explore Great Lakes regional goals that might catalyze a more coordinated regional approach to IWAM and water infrastructure in general.

Accordingly, this report:

- summarizes information gleaned from the webinar series and focus groups regarding key barriers and recommended best practices for catalyzing IWAM in the Great Lakes Basin; and
- provides draft regional goals for protecting and improving the state of water infrastructure and services in the Great Lakes Basin.

[1] The webinar series included presentations from 17 water infrastructure and asset management experts and leaders. Hyperlinks in the Webinar and Focus Group Summary section of this document lead to recordings of these presentations, allowing for a deeper dive into the information summarized herein.

Key Barriers for the Catalyzation of IWAM & Recommended Best Practices to Overcome Them

Key Barrier 1: The traditional definition of a "water infrastructure asset" that is embraced by leading federal, state, and provincial grant and loan programs focuses on physical constructed assets (e.g. pipes, pumps, treatment plants), leaving out critical elements of water systems (e.g. plans, processes, knowledge) and natural assets (e.g. riparian areas, permeable surfaces, wetlands) that directly impact the delivery of water services.

Implementation Level		Recommended Best Practices
Federal & State/Provincial	**1a**	Expand the scope of eligible investments from federal, state, and provincial grant and loan programs beyond construction and capital improvements and lend greater support to preventative maintenance and long-term planning and management efforts for systems, processes, and natural elements that are critical for efficient and sustainable water systems.
Local	**1b**	Design an IWAM program based on a holistic definition of a water infrastructure asset. Include green infrastructure and natural assets; institutional knowledge; and the protocols and processes that store, transfer, and apply system information to set priorities and increase efficiencies.

Key Barrier 2: The division of responsibility for managing water infrastructure assets between political boundaries and siloed service sectors hinders the ability to deliver the full suite of critical water services from different sectors and neighboring communities within the same watershed.

Implementation Level		Recommended Best Practices
Federal	**2a**	Increase coordination between DWSRF and CWSRF programs. Prioritize investments that utilize collaborative approaches such as cross-sector coordination, regional data sharing, and watershed-scale planning efforts. Create a funding agency coordination team (FACT) to help set priorities and avoid duplicative efforts and competing interests.
State/Provincial	**2b**	Provide increased technical assistance and financial incentives for utilities to consolidate voluntarily, with a focus on assisting utilities that are chronically out of compliance or unable to provide publicly-demanded levels of service; set policies that facilitate this change such as allowing municipalities to expand their water service areas to contiguous areas without annexation.
State/Provincial	**2c**	Facilitate regional peer-to-peer exchange programs to encourage communication between managers of siloed utilities whose actions have direct and collective impacts on each other's water services operations.

Local	**2d**	Increase local utilities' communication across traditionally siloed sectors and with neighboring regional utilities to explore potential benefits of increased coordination of resources and services. Set up systems that incentivize these practices, such as interdepartmental or regional memorandums of understanding (MOU).
Local	**2e**	Design an IWAM program based on desired levels of service, instead of on discrete assets. After determining levels of service, account for all assets that impact those services, including those that are outside of the utility's direct control. Use this to identify opportunities to increase efficiencies through cross-sector and geographic collaboration.

Key Barrier 3: Current levels of investment from federal, state and provincial governments are insufficient to support essential elements of IWAM and are further hampered by a limited scope of eligible activities for major grant and loan programs, particularly regarding stormwater.

Implementation Level		Recommended Best Practices
Federal	**3a**	Increase federal investments in drinking and wastewater infrastructure to match or exceed historical levels and align with current needs in the U.S. and create policies that lead to increased investments in stormwater management in the U.S. and Canada.
State/Provincial	**3b**	Expand the scope of permittable uses of SRFs and provincial funding programs to increase incentives for AM and long-term planning activities at the local level, as well as increased coordination on a regional level.
State/Provincial	**3c**	Enable the creation of local stormwater utilities and further incentivize the establishment of rate structures for new utilities that fully cover short and long-term costs of maintaining desired levels of service.

Key Barrier 4: Public undervaluing of water infrastructure assets and the services they deliver, particularly compared to more visible assets (e.g. roads and bridges), leads to insufficient investments from local sources and lack of political leadership to champion IWAM.

Implementation Level		Recommended Best Practices
Federal State/Provincial & Local	**4a**	Implement outreach and education campaigns to convey the true value of water infrastructure assets, the benefits of proactive management strategies, and the consequences of system failures to the public and elected officials.
Local	**4b**	Prioritize investments in the long-term management of local and regional water infrastructure and take advantage of existing state and provincial funding programs.

Local	**4c**	Invest in tools and models that help quantify the value of natural assets, calculate avoided costs through long-term planning and regular maintenance, and demonstrate the risk of inaction across multiple infrastructure sectors, including sectors not traditionally linked to water services such as roads and bridges.

Key Barrier 5: Most water utility rates do not create enough revenue to cover the true cost of delivering services or support investments in long-term planning or the advancement of AM and IWAM goals. Lack of understanding about tradeoffs between rates and desired levels of service, coupled with affordability challenges drive public resistance to rate increases.

Implementation Level		Recommended Best Practices
Federal & State/Provincial	**5a**	Incentivize the creation of local water rates based on full cost accounting by providing dedicated funding for communities to engage in studies to determine the full costs of sustainable water service delivery.
Federal & State/Provincial	**5b**	Create dedicated funding streams to assist customers who cannot afford to pay for water services at necessary rates.
Local	**5c**	Set rates at necessary levels to deliver desired levels of service and engage in education and outreach to build public support. Rate structure analysis, vulnerability assessments, cost-avoidance estimates, and rate setting tools can be used as a basis for public outreach initiatives.
Local	**5d**	Adopt rate structures such as tiered rates or lower base-level usage costs in order to keep water services affordable while requiring high-volume water users to cover a proportionate share of water system costs.
Local	**5e**	For water utility systems that are chronically unable to generate revenues required to achieve compliance and/or maintain desired levels of service, consider voluntary regional and cross-sector consolidation to unlock otherwise inaccessible funding streams, achieve economic efficiencies through reduced overhead costs, and increase staff and technical capacity.

Key Barrier 6: Lack of standardized methods for data collection and processing hinders interdepartmental and regional collaboration and data sharing.

Implementation Level		Recommended Best Practices
Federal	**6a**	Establish minimum national data collection standards along with guidelines for standardized data collection methods that can be used to establish appropriate protocols at the state, provincial, and local level.
Federal & State/Provincial	**6b**	Provide funding for technological upgrades and staff training to expand technical capacity of water service providers.

State/Provincial	**6c**	Create standardized data collection methods for drinking, waste, and stormwater systems that enable efficient O&M, assessment of asset conditions, and capital improvement needs.
Local	**6d**	Absent federal, state, or provincial guidelines, work with other utility sectors within the same local jurisdiction and across a region to standardize data collection and processing methods and invest in data sharing efforts.

Key Barrier 7: Limitations in staff and technical capacity for (1) engagement in long-term planning efforts, (2) increasing interdepartmental and regional coordination, and (3) training workers to use new methods and implement available technologies hinders the catalyzation of IWAM initiatives.

Implementation Level		Recommended Best Practices
Federal State/Provincial & Local	**7a**	Provide dedicated funding for technical capacity expansion, training, and adoption of new technology.

Key Barrier 8: Cultural resistance within water utilities to changes such as increased coordination, data sharing, and adoption of new technology hinders the success of IWAM initiatives.

Implementation Level		Recommended Best Practices
Federal & State/Provincial	**8a**	Support local communities in their IWAM efforts but maintain local control and flexibility in design to accommodate local needs.
Local	**8b**	Design an IWAM program using a transparent process that incorporates input from all levels of staff including upper and mid-management, office support staff, field technicians, and any other workers whose jobs will be impacted by the implementation of the program.
Local	**8c**	Create an IWAM strategy with a service-centric approach and then seek technology that directly increases efficiencies, measured through Key Performance Indicators (KPIs). Invest in training and education on the benefits of implementing new technology.
Local	**8d**	Identify peer communities/utilities that can serve as “champions” and act as trusted sources of information to communicate the benefits of IWAM. Find or create opportunities for peer-to-peer interactions such as at conferences and during webinars to share success stories and lessons learned on overcoming barriers.

Key Barrier 9: Many communities have not developed Key Performance Indicators (KPIs), key goals, or metrics to guide AM efforts and evaluate outcomes of various strategies and investments in AM and/or IWAM activities.

Implementation Level		Recommended Best Practices
Federal	**9a**	Use a collaborative process across multiple federal agencies to set national and binational goals for sustainable water services. Select key metrics to track progress toward achieving these goals, and design programs to incentivize and track state and provincial actions that advance these goals. Ensure that metric tracking is not used punitively, but as a tool for gauging improvements.
State/Provincial	**9b**	Where available, use federal goals as a starting point for a collaborative process across multiple state and provincial agencies and local political boundaries to set regional goals for sustainable water services. Select key metrics to track progress toward achieving these goals, and design programs to incentivize and track local actions that advance these goals. Ensure that metric tracking is not used punitively, but as a tool for gauging improvements.
Local	**9c**	Where available, use federal, state, and provincial-level goals as a starting point for a collaborative process across multiple local utilities sectors, including those managing assets that are not traditionally linked to water services, to set local goals for sustainable water services. Select key metrics to track progress toward achieving these goals and use them as a basis for investments in public outreach and education.

Draft Regional Goals for Water Infrastructure Services and IWAM

Based on the barriers identified above, and the feedback and input from webinars and focus groups described below, GLC staff developed five draft regional goals related to water infrastructure services and the catalyzation of IWAM in the Great Lakes Basin.

1. Communities, including elected officials and the public, are educated about the value of water and understand the tradeoffs between desired levels of service and rates.
2. Safe and clean water is universally accessible to communities, regardless of a person's ability to pay.
3. All water utilities have adequate financial resources to meet short- and long-term needs, including through appropriate rate-setting, full-cost accounting, and provincial, state, and federal investment.
4. All utilities develop and implement asset management using a transparent process that meets the unique needs of their system and communities.
5. Coordination and/or integration of water services occurs across system types (e.g. drinking water, wastewater, stormwater) and across communities.

KEY IDEAS FROM WEBINARS & FOCUS GROUPS

What is Integrated Water Asset Management?

IWAM is a proactive management strategy for increasing operational efficiencies by leveraging cross-sector and geographic coordination and acknowledging the interrelated nature of administratively siloed water systems. Siloed utility sectors and competition among neighboring communities for limited resources instead of coordinating to maximize their benefits is a pervasive challenge for water service providers. Deficiencies in financial, technical, and staff capacity frequently force water utilities to "live in firefighting mode" in order to maintain the delivery of basic and critical services. When properly implemented, an IWAM program can prevent the need for costly reactive maintenance and free up capital for long-term planning and investments. This can only be realized as an ongoing institutionalized effort, as opposed to a one-off project with a discrete finish.

What is a "water infrastructure asset"?

A basic (traditional) paradigm for water infrastructure assets generally includes a community's built physical assets (pipes, pumps, treatment plants, levees). An expanded definition may also include natural features impacting flood control and water quality (vegetated riparian zones, trees, wetlands), as well as green infrastructure installations (bioswales, rain gardens, permeable pavers). However, this still leaves out other elements that are key to the sustainable delivery of critical water services (knowledge and the ability to transfer and apply it over time and space, human resources, standardized procedures, and administrative protocols). A holistic definition of water infrastructure asset is key to creating an IWAM strategy for sustainable and resilient communities.

What does it mean to "manage" an asset?

Many investments and activities that are closely associated with AM (e.g., the acquisition and use of technology, data and data collection methods, monitoring the performance of physical assets, seeking sustainable funding for infrastructure, or even publishing written AM plans and protocols) are not necessarily synonymous with effective AM. Rather, these are examples of some of the tools that communities can use to achieve AM goals. AM is the design and implementation of a system that connects these tools to people and processes in a way that allows them to be properly applied to achieve desired outcomes.

How should AM be "integrated" to optimize investment outcomes?

There is no ideal geographic scale for the implementation of IWAM; the decision to consolidate services regionally or across sectors must be made based on local culture and goals, financial considerations, environmental factors, and governance structures. The geographic jurisdictions of water service providers and management strategies encountered across IWAM Phase I were defined by everything from single municipalities, to county-wide programs, to regional service footprints, to watershed-based units, to state or provincial-level initiatives. An equal degree of variation exists in the administrative boundaries of traditionally siloed service sectors (e.g. stormwater, wastewater, and drinking water). Smaller communities are more likely to house multiple service sectors within a single department, while systems with larger service areas tend to have independently operating waste, storm, and drinking water systems.

VARIED APPROACHES TO GEOGRAPHIC & CROSS-SECTOR INTEGRATION

- The Lycoming County Water and Sewer Authority (Pennsylvania) provides services to small municipal utilities upon request, usually when they are facing major system failures, cashflow shortfalls, and compliance issues. Consolidation of management responsibilities and the offering of regulatory support on an as-needed basis has garnered significant efficiencies in water usage, increased compliance, and financial savings.
- The Great Lakes Water Authority is a regional utility that that delivers drinking water and wastewater services to millions of customers in southeast Michigan and must coordinate the delivery of drinking water and the reception and treatment of wastewater across a large network of independent utilities.
- Dayton, Ohio, acts as drinking water wholesaler to surrounding utilities, and houses drinking, waste, and stormwater services within a single department. Their AM program has both regulatory and business model drivers and is seen as a tool for increasing efficiencies and optimizing rate structures.
- Stormwater in Ontario is managed by watershed-based Conservation Authorities whose jurisdictions overlap with multiple municipal water and wastewater service providers. While stormwater directly impacts drinking and wastewater assets, there is no formal coordination at the provincial level of financing mechanisms or management efforts across these siloed service sectors.

IWAM Financing

In the United States, federal funding for water infrastructure has declined steeply since the 1970s, and states and local communities have been unable to replace it with other sources. As water infrastructure falls into greater disrepair the investment gap continues to grow. Similarly, the Canadian provinces have substantial unmet needs for water infrastructure. Forced to focus on reactive maintenance to maintain basic services, water utilities often find themselves without the capacity to invest in long-term planning or efforts to increase efficiencies through coordination across sectors and geographies.

Barriers to sustainable AM financing

Major state-level programs for funding water infrastructure such as State Revolving Funds (SRFs) are focused on capital investments, and largely preclude the use of loans and grants for preventative maintenance and planning activities, including AM, that would decrease the need for major capital investments. Moreover, in both the United States and Canada, stormwater management is largely unregulated and underfunded compared to drinking and wastewater, despite the direct impacts that stormwater can have on these other service sectors. The need to ensure that water services remain affordable compounds IWAM financing challenges, as rate structures are often set at levels that can sustain basic operations but are unable to support major capital renewal and long-term management planning. The cost avoidance benefits of engaging in proactive management are a strong argument for investing in IWAM but is difficult to prove and requires additional technical and financial capacity that many utilities lack.

Lack of understanding about the physical condition of water infrastructure assets and the value of maintaining them presents an additional significant barrier. Unlike some other major infrastructure assets such as roads and bridges, the majority of water infrastructure is buried underground or located within treatment plants where it goes unseen by the public. If basic levels of service are maintained, an erroneous assumption can persist that preventative maintenance is not necessary. As a result, water infrastructure maintenance is often a low priority, despite its value for communities. When maintenance is deferred until the problem becomes visible in the wake of a catastrophic failure, the costs of restoring and maintaining services increase significantly.

Rate structures that do not fully convey the value of water infrastructure or cover the true cost of maintaining desired levels of service can lead to costly and reactive scenarios. Insufficient rates lead to insufficient funding for system operations, including asset management. However, setting rates that cover the true cost of delivering critical services will likely exceed what some households can afford if rates are applied evenly across all customers. Convincing stakeholders to make up-front investments in IWAM remains difficult and faces the paradoxical challenge of convincing the public that spending money is the key to garnering long-term savings.

Federal, state, & provincial opportunities to bolster IWAM financing

Increasing federal funding to reduce the water infrastructure investment gap would help boost the capacity of local utility providers to engage in long-term planning and coordination efforts. Making water infrastructure financing a higher priority for state funding with increased allocations for SRFs would also help communities in the United States improve their drinking and wastewater infrastructure systems. However, the infusion of capital alone will not lead to a sustainable solution for current deficiencies in the water infrastructure assets and the services they deliver. If funding focuses only on capital improvements and is not matched with an

increased focus on long-term planning and other IWAM activities, water utilities will end up with persistent capacity shortfalls akin to those they currently face. Increasing efforts to help key decision-makers, utility managers, and the public understand the true cost and value of water services, as well as the higher costs of emergency repairs relative to preventative maintenance is critical to garnering sustainable public support for infrastructure financing. Current federal, state, and provincial funding programs should expand their scopes to further incentivize investments in IWAM by including significant allocations dedicated to planning and other activities that build efficiencies and reduce costs over the long term.

Local-level opportunities to bolster IWAM financing

Collaborative approaches like IWAM can enable utilities to better operate and maintain water infrastructure assets. Integrating AM practices can unlock new financing and funding opportunities, particularly for identifying options to integrate stormwater management with other forms of infrastructure. This could include social/environmental impact investing, traditional municipal bonds, SRFs that support green infrastructure, and leveraging private investment.

AM can make operations more efficient which can free up funds and increase available capital (including rate revenues) to invest back into water infrastructure. As demonstrated in the breakout box above, several state and provincial programs incentivize AM at the local level. Water systems with available resources should prioritize taking advantage of these programs and choose to invest in IWAM activities. In the absence of higher-level financial support, communities should set rates at levels that accommodate both short-term system needs and long-term planning considerations. Rolling out more frequent, smaller rate adjustments instead of one-time significant hikes will likely yield smoother transitions with the public. If rates become unaffordable when set at necessary levels, system managers should explore opportunities to establish customer assistance programs to ensure equity.

STATE & PROVINCIAL STRATEGIES FOR INCENTIVIZING ASSET MANAGEMENT

- In Pennsylvania, SRF funds are managed through the PENNVEST program that incentivizes AM activities through: (1) increased ranking points for grant applications that include AM, particularly if AM planning can demonstrate that rates generate insufficient revenue for desired levels of services; (2) offering up to $25,000 for AM plan development; and (3) requiring fiscal sustainability plans for all new wastewater treatment infrastructure investments.
- The Ohio EPA formerly offered up to $10,000 in principal loan forgiveness, and currently offers 0% interest planning loans through their SRF program for communities who voluntarily undertake AM planning activities.
- Provincial regulations in Ontario require water utilities to undertake certain AM activities. Achieving compliance with these regulations unlocks dedicated funding for utilities that is sourced via tax revenues.
- The Illinois Department of Natural Resources supports the creation of stormwater utilities that create a dedicated funding stream for stormwater management. Creating a new utility is a prime opportunity to account for IWAM activities when setting rate structures.
- Michigan's Stormwater, Asset Management, and Wastewater (SAW) program provides loans to municipalities that can be used for wastewater asset management projects that don't include construction, as long as the applicant

Allocating resources toward increased education and transparency about how water services are paid for can be a key step toward catalyzing IWAM. Focusing on helping communities understand the full costs of managing their water systems can ensure sustainability of the levels of service that they demand. This can also help make the case for gradual rate hikes as a method of avoiding large increases. Ironically, a well-executed AM plan is an ideal tool to communicate the true cost of maintaining expected levels of water services and the high value of those services to decision-makers and the public.

IWAM and Technology

The acquisition or use of technology alone is not AM, but technology is a tool that can help communities achieve their AM and IWAM goals. The type of technologies employed by Great Lakes Basin water systems range from very advanced (e.g. integrated GIS mapping, digital tracking software, and remote cameras), to very simple (basic spreadsheets, hand-drawn system maps, and non-digitized maintenance and repair logs). In nearly all cases, the digitization of information about water infrastructure assets will yield multiple benefits for systems with an interest in advancing AM or IWAM goals. However, considering the vast differences in communities across the Great Lakes Basin and the rapid evolution of technology, there is no single technology or software that will be best suited to catalyze IWAM across all water systems.

Barriers to using technology to advance IWAM goals

Traditional water infrastructure investment programs such as SRFs cannot be used to purchase software or technological applications, creating an expense that many service providers cannot afford. Even if ideal technology and applications are available, limited staff capacity and lack of training can hinder its implementation. Simply using technology to collect and/or digitize data also falls short of achieving IWAM goals, as many systems find themselves “data rich but information poor” when data is not being properly analyzed or applied to its full potential. Furthermore, the lack of standardized methods for data collection and processing means that even if technology is fully used to achieve localized AM goals, instances of data sharing between service sectors and across geographies required to support an IWAM program are limited.

Cultural barriers and lack of education about how and why technology is being employed may also lead to resistance among utility workers and impede adoption. Some primary examples from IWAM focus groups included instances where workers: (1) fear that technology will replace their jobs, (2) view tracking technology designed to increase efficiencies as infringing on their personal privacy or as a threat to other job performance/security concerns, and (3) general resistance to changing habits that have been formed over decades.

Best practices for using technology to advance IWAM goals

Acquiring specific software, applications, or other types of technologies should not be the focus for systems looking to develop AM and IWAM programs. Rather, the focus should be to first develop holistic processes for AM, and then identify technology that can help facilitate and simplify these processes. One way to accomplish this is to describe system needs in an RFP and evaluate different proposals for technological solutions. These processes should utilize interdepartmental collaboration to the greatest extent possible, including departments that are not traditionally part of water infrastructure AM functions (e.g. engineering, finance, public affairs, organizational development, etc.), to participate in the decisions about what technologies to invest in. System operators should seek opportunities to formalize these collaborations through interdepartmental memorandums of understanding (MOU) that can serve as a guide for standardizing data collection methods and data-sharing agreements.

When asked about best practices for overcoming cultural barriers to investment in new technologies, focus group participants stressed the need for education and inclusivity. Multiple people from all levels of responsibility within a water system, from top administrators to field-level technicians, should be included in program design and decision-making processes with respect to acquiring and implementing new technology. This will help to ensure that the purpose and benefits of new tools are understood by the people who will be using them and increase the chances that they become integrated into daily operations and maintenance activities. Focus group participants also reported that despite initial hesitancies, field technicians tended to embrace new technology once they had a chance to test it and see the benefits firsthand. In addition, following implementation, attitudes about tracking technology tended to flip from concerns about privacy, to being seen as a motivational tool capable of producing metrics that utility professionals at all levels could take pride in.

USING TECHNOLOGY TO CATALYZE ASSET MANAGEMENT

- Macomb County's Department of Public Works used funding from Michigan's Stormwater, Asset Management, and Wastewater (SAW) program to digitize information on their wastewater infrastructure assets for the first time. Baseline data will continuously be updated and used to implement an AM program that includes inventory, life cycle analysis, replacement costs, O&M manuals, maintenance tasks and schedules, and GIS mapping applications.
- The Great Lakes Water Authority's Next Generation Enterprise Asset Management System is currently being developed to control, maintain, and operate regional water and wastewater infrastructure that includes over 800 miles of water distribution lines serving 127 different local water utilities and wastewater trunk sewers and interceptors that funnel into the largest single-site water resources recovery facility in the United States.
- Both Dayton's (Ohio) Risk Assessment Tool for Source Water Protection and Credit Valley Conservation's (Ontario) Cost Avoidance Tool (focused on quantifying the impacts of flooding from unmitigated stormwater runoff) are prime examples of how technology can be used to prioritize investments based on financial risks, as well as generate data that can help communicate the value of water infrastructure AM to decision-makers and the public.

IWAM Policy and Program Implementation

Intrinsic differences among Great Lakes communities and the water systems that serve them mean that the there is no one size fits all AM or IWAM program design that can be applied across the Basin. Differences in regional governance structures also create different drivers and incentives. While some systems' AM efforts are voluntary and framed as commonsense business practices that optimize resource management outcomes, some state and provincial-level policies compel water utilities to undertake specific AM activities. Proponents of the business practice approach point out that exclusively viewing AM through a compliance paradigm runs the risk of creating a "box-checking exercise" where capacity-constrained utilities do the bare minimum to comply, but are unable to fully realize the benefits of AM. However, without a mandate, most communities in the Great Lakes Basin have not voluntarily invested in IWAM or long-term planning activities. These two drivers are not mutually exclusive, and when applied synergistically may lead to optimal outcomes.

Barriers to IWAM program implementation

The top barrier identified during Phase I of this project was insufficient technical and staff capacity at the local level, particularly for smaller and rural water systems. Most communities do not have resources available to design long-term planning and coordination strategies, let alone the capacity to implement and sustain them. That would require resources for training staff on new protocols and technologies and securing the support of political leadership, the public, and other key stakeholders. For this reason, creating federal, state, or provincial mandates for IWAM activities without the accompaniment of financial assistance can create a burden for resource-limited systems that are already struggling to maintain required levels of service.

In both the United States and Canada, support for stormwater management lags behind drinking and wastewater from all levels of government. This is partly explained by the fact that stormwater management relies heavily on "natural assets" that are not included within the traditional paradigm of water infrastructure assets. The value of these types of assets is hard to quantify, and their direct connection to the delivery of water services can be difficult to convey to the public. In the United States, SRFs exist for drinking and wastewater infrastructure, and although a small portion of CWSRF is dedicated to stormwater, there is no equivalent dedicated funding stream for these types of infrastructure assets. While stormwater utilities could provide an alternate (outside of SRF) source of sustainable funding for stormwater management, many communities don't have dedicated stormwater utilities. In Ontario, AM for drinking and wastewater, but not stormwater, is driven by provincial regulation and policies that link compliance with dedicated funding streams.

Even if financial, technical, and staff capacity is readily available, cultural resistance among utility staff and the public were identified as significant barriers to IWAM program implementation. For example, if an IWAM mandate is viewed as a top-down approach that does not meet the unique needs of an individual system, it may be poorly received by utility managers and field technicians who are responsible for implementing AM. If utility workers are only told what to do, and no effort is made to explain how it benefits them and/or the system, the program is unlikely to succeed. Without significant investments in outreach and education, resistance can also be expected from the public. As discussed previously, many communities are not aware of the status and true value of water infrastructure assets that they cannot see. As a result, they are likely to advocate for resources to be allocated toward more immediately visible issues, but the squeaky wheel is not necessarily the one that most badly needs the grease. When the public is not properly educated or supportive of investing in a holistic IWAM program, political leadership to champion the issue is also slow to emerge.

Best practices for the design and implementation of IWAM Programs and Policies

A successful AM or IWAM program will be one that is created internally within the system it is designed to serve. It must address the unique needs of its community and have the support of the public, key decision-makers, and the water service professionals responsible for implementing it. In order to be sustainable in the long term, the design process should consider the expected lifespan of existing physical assets; include efforts to quantify the value of natural assets; incorporate vulnerability assessments; and plan for future conditions related to climate change, development, and demographic shifts. The program should have clearly defined key performance indicators (KPI) or goals and metrics based not on individual assets, but on desired levels of service. The tracking of KPIs can provide a foundation for outreach and communication. Continually conveying the success of investments and direct benefits to communities is critical for sustaining public support.

To combat cultural resistance within utilities all levels of staff should be involved in the IWAM program design process. This will help foster a sense of ownership among the people responsible for implementation. While private sector consultants can provide technical assistance to help communities achieve their goals, it is essential that outside actors are limited to a supporting role, and do not lead the effort. The same applies to federal, state, and provincial policies designed to catalyze IWAM. While financial and technical assistance from government agencies is critical, policies mandating AM activities at the local level should remain flexible and allow for program design and implementation to be controlled locally. Finding opportunities to increase peer exchanges and share stories of success and lessons learned between communities who are champions of AM and IWAM programming and similar communities who are less advanced in their programming can also be a tool for overcoming cultural barriers.

LEADING THE WAY FOR IWAM POLICY DESIGN & PROGRAM IMPLEMENTATION

- The Michigan 21st Century Infrastructure Commission established the Michigan Infrastructure Council (MIC) and the Water Asset Management Council (WAMC) to design and implement long-term management strategies for water and other infrastructure sectors across the state. Since 2016 it has partnered with regional groups like the Southeast Michigan Council of Governments (SEMCOG) to pilot infrastructure AM programs at several local water utilities.

- The Canadian Network of Asset Managers (CNAM) provides resources to assist water systems in advancing their AM goals. This includes opportunities for regional neighboring communities to connect with each other and share information on best practices. The city of Windsor is an active participant and has used CNAM resources to incorporate lessons learned from other municipalities into the design of their AM program.

- Ohio's Senate Bill 2 requires drinking water systems to engage in AM activities, including documenting plans for long-term capital improvements and full-cost accounting. Ohio's SRF requires that system capabilities are verified to receive funding and incentivizes AM training by using principal forgiveness or no-interest loans.