Understanding Inflow and Infiltration: Causes, Impacts, and Solutions

Part 1: OCT. 21, 2025, 10 am PT/ 1 pm ET

waternow alliance

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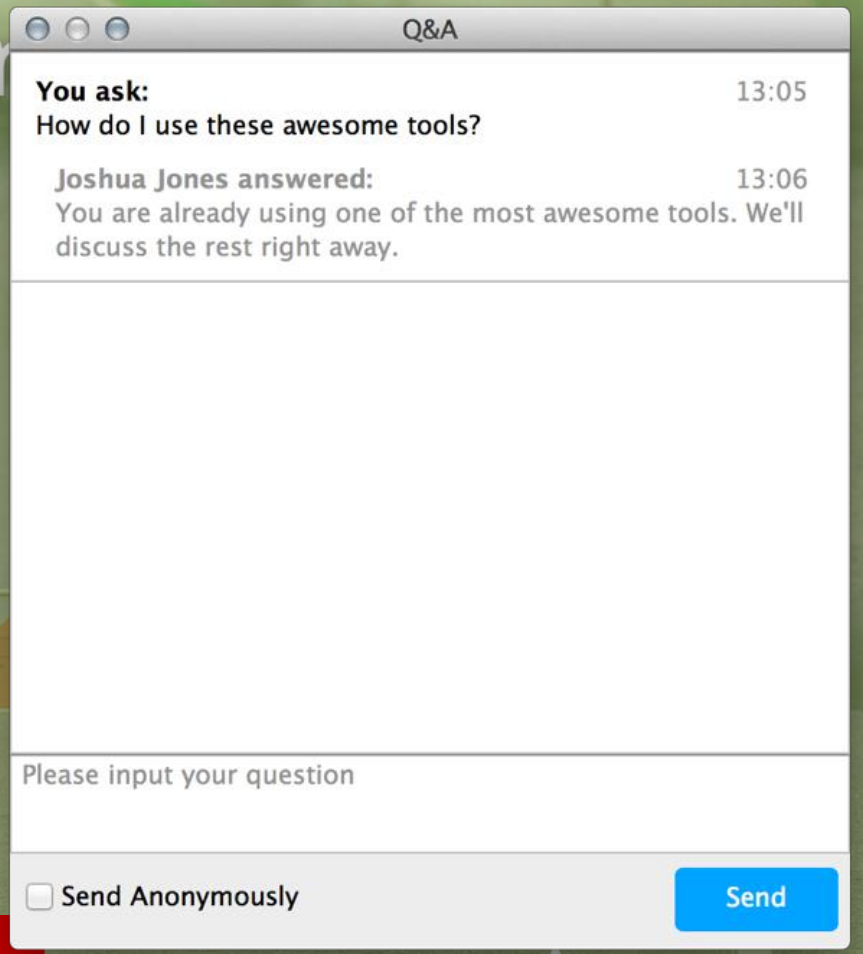

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Mute | Chat | Raise Hand | Q&A | Leave Meeting

Certificate of Completion

This session has **NOT** been submitted for pre-approval of Continuing Education Credits, but eligible attendees will receive a certificate of attendance for their personal record.

To receive a certificate:

- You must attend the entire session
- You must register and attend using your real name and unique email address - group viewing credit will not be acceptable
- You must participate in polls
- Certificates will be sent via email within 30 days

If you have questions or need assistance, please contact smallsystems@syr.edu.

About EFCN

The **Environmental Finance Center Network (EFCN)** is a university- and non-profit-based organization creating innovative solutions to the difficult how-to-pay issues of environmental protection and water infrastructure.

The EFCN works collectively and as individual centers to address these issues across the entire U.S, including the 5 territories and the Navajo Nation. The EFCN aims to assist public and private sectors through training, direct professional assistance, production of durable resources, and innovative policy ideas.

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WaterNow works to advance transformation in the urban water sector to accelerate the widespread adoption of sustainable, affordable and resilient water strategies.

We do this as a national network for local water leaders and decision makers, empowering them with the technical assistance, resources, and tools they need to implement innovative One Water drinking water, stormwater, and wastewater solutions in their communities.

waternow alliance
water leaders. resilient solutions.

Please Complete the Post-Webinar Survey!

WEBINAR OBJECTIVES

Describe the causes and impacts of I&I

Describe strategies for assessing and evaluating vulnerabilities to I&I

Share solutions for addressing I&I

Highlight funding, financing and technical assistance opportunities

AGENDA

- Meet Today's Speakers
- Audience Polls
- I&I Guidance Document
- Technical Assistance Opportunities
- Q&A

TODAY'S SPEAKERS

Andy Kricun, P.E.
Principal
Moonshot Missions

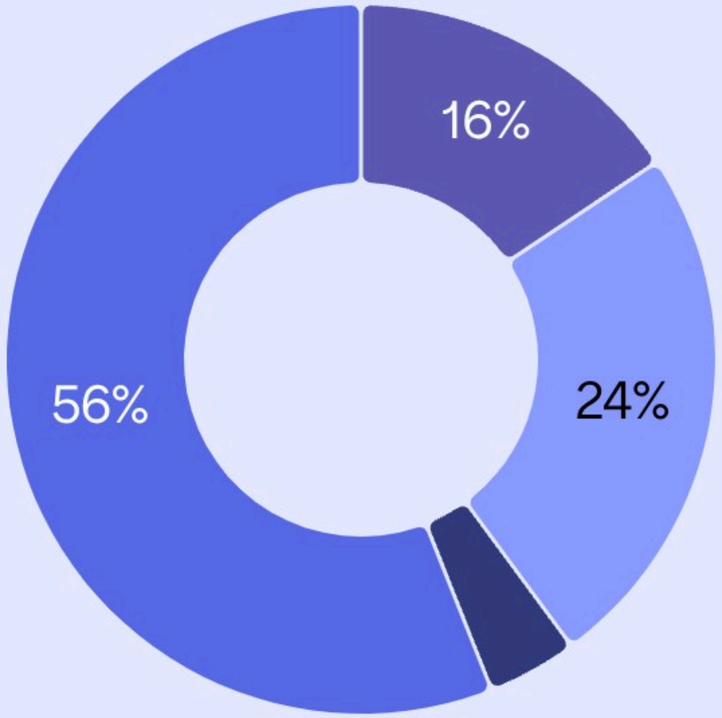
Rania Bashar, PhD, P.E.
Senior Program Manager
Moonshot Missions

Nick Meurer
Utility Advisor
Moonshot Missions

Amy Weinfurter
Director of Strategic Projects
WaterNow Alliance

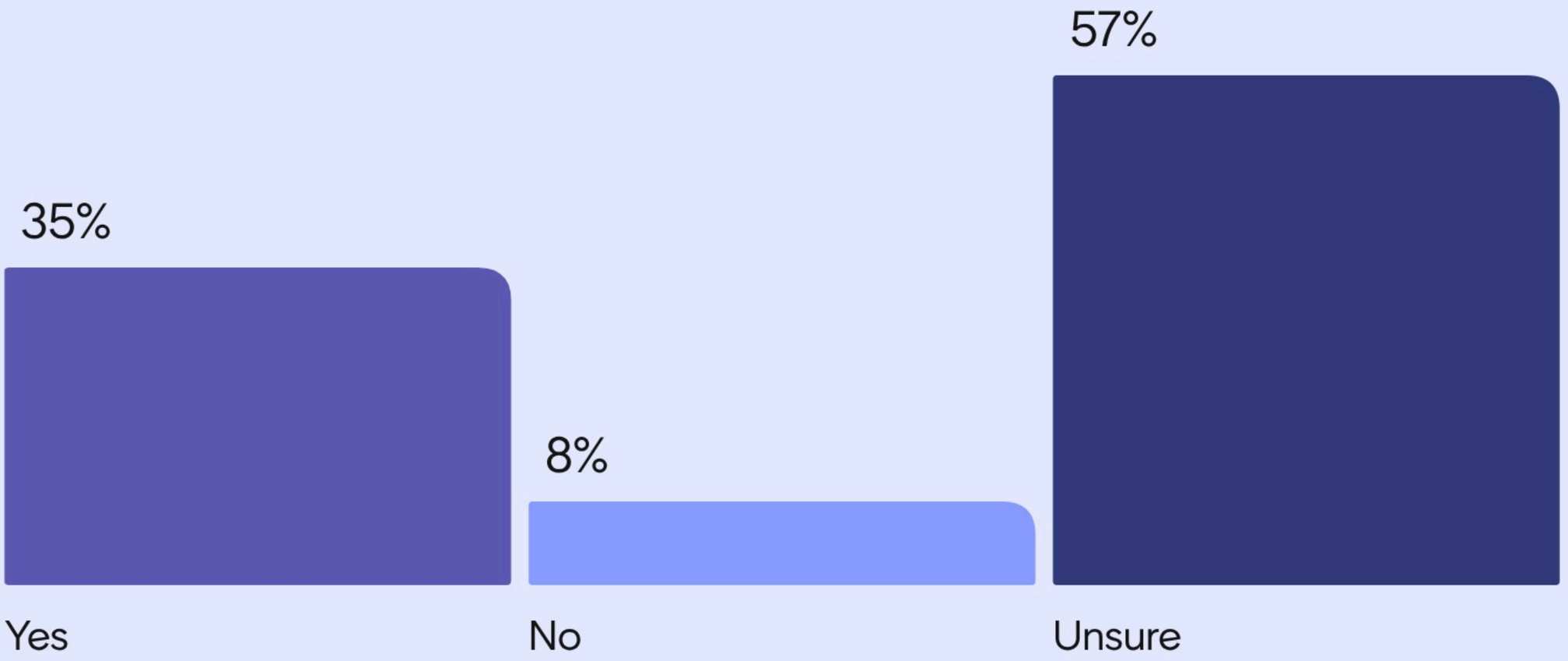
Time for audience polls!

How would you rate the level of I&I in your system?

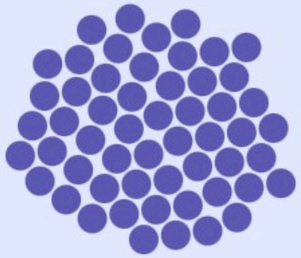


16%	Severe – major contributor to overflows and treatment burden
24%	Moderate – noticeable but manageable
4%	Minor – low impact on system performance
56%	Unknown or unmeasured

Has I&I gotten more severe lately (due to rainfall frequency and/or severity)?



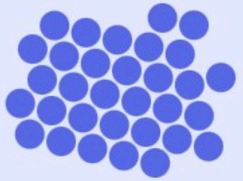
Which of the following best describes your community's wastewater and stormwater system?



47% Municipal Separate Storm Sewer System (MS4): stormwater and wastewater are separate

21% Hybrid/Partially Combined System: some areas are combined, others are separate

5% Combined Sewer System (CSO): stormwater and wastewater share the same pipes



27% Unsure

MOONSHOT MISSIONS

Understanding Inflow and Infiltration: Causes, Impacts, and Solutions

Developed by

Moonshot Missions

For

WaterNow National Trainings

10/21/2025

MOONSHOT MISSIONS

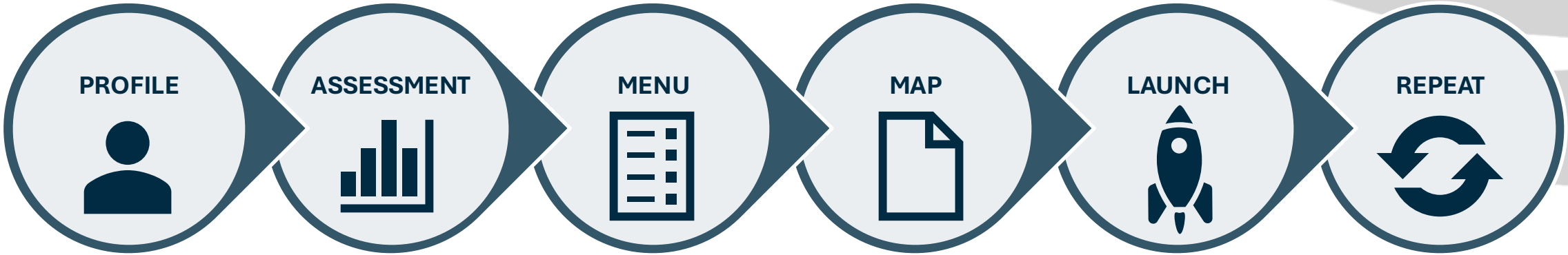
Every person deserves clean water at the tap and in local waterways, regardless of who they are or where they live.

OUR MISSION

Serve as a trusted peer advisor for communities to secure safe, accessible, and affordable drinking water and clean waterways, regardless of zip code.

OUR METHOD

Founded on building a trusted relationship with utility leaders and staff, Moonshot deploys a six-step approach, which relies on careful homework and humble listening:



We do our homework. We learn your community, operations, budget, and management systems.

We practice humble listening with staff to identify challenges and opportunities for improvement.

We deliver a menu of potential projects that improve performance and reduce costs.

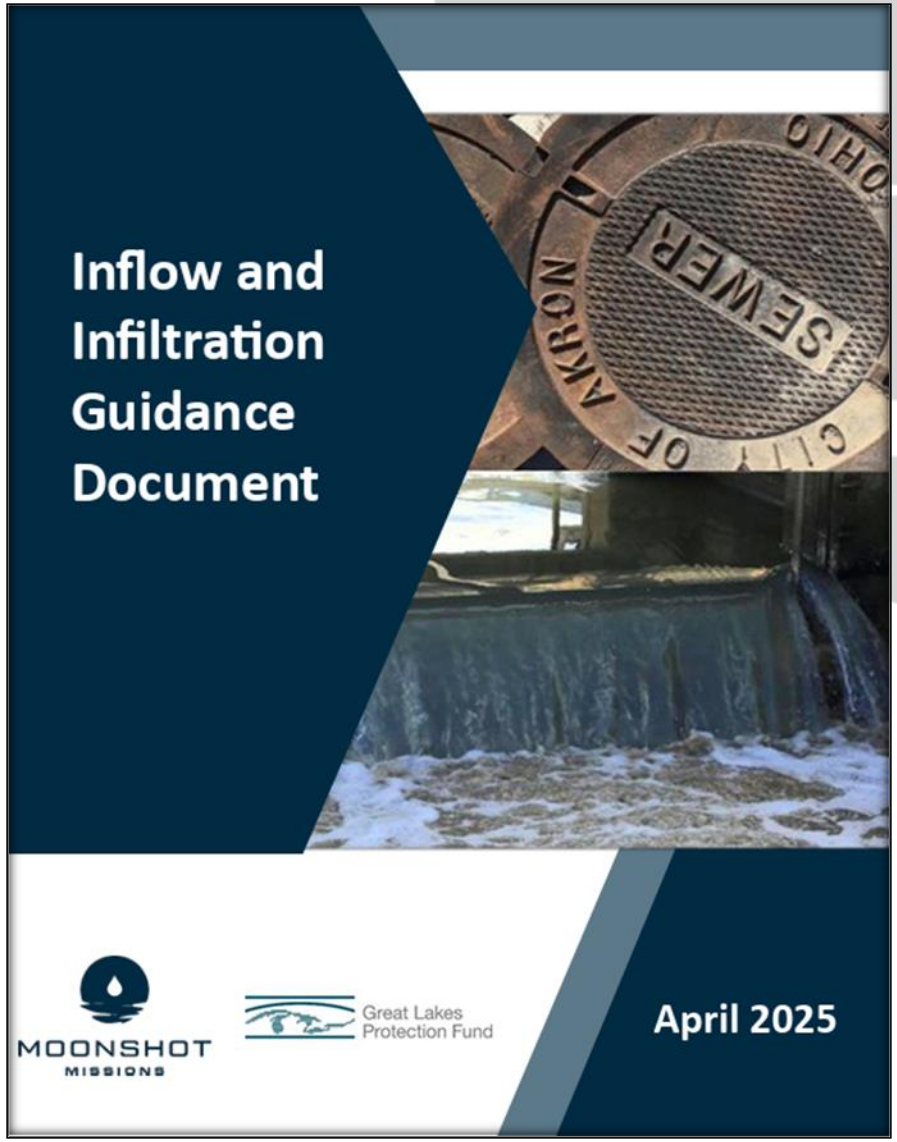
We consult with leadership to pick a manageable set of projects and develop a roadmap to implementation.

We help you through implementation by providing change management approaches and financing mechanisms.

We model what we learn to develop replicable modules to speed the evaluation of common challenges.

DOCUMENT STRUCTURE

- **Chapters 1 & 2**: Provide a comprehensive overview of inflow and infiltration.
- **Chapters 3**: Focus inflow and infiltration assessment and evaluation.
- **Chapter 4**: Includes I&I solutions and implementations for utilities to address their I&I challenges.
- **Chapters 5**: Includes case studies from utilities that have addressed I&I challenges using the solutions and implementations outlined in chapter 4.



INFLOW AND INFILTRATION SOURCES AND IMPACTS

Inflow

- Roof Drains
- Manhole Covers
- Improper Connections
- Sewer Lateral Cleanouts
- Combined Sewer Systems

Infiltration

- Aging Pipeline
- Private Connections
- Manhole Structure

Image Source: Express Drainage Surveys

Image Source: Fluence

IMPACTS OF INFLOW AND INFILTRATION

Hydraulic Impacts:

- Increased SSOs and CSOs
- Reduced treatment efficiency
- Basement backups

Financial Impacts:

- Increased treatment costs
- More wear and tear on equipment
- Fines associated with overflows

Environmental Impacts:

- Permit violations
- Loss of habitat
- Public safety

Increasingly frequent and severe weather events have amplified the effects of I&I on the wastewater system

INFLOW AND INFILTRATION ASSESSMNT AND EVALUATION

Key Indicators

- Increased flow to the treatment plant during and after wet weather events.
- Longer pump running times for lift stations in the collection system.
- Increased blocks or clogs in pipes throughout the system.
- Sanitary bypassing or overflows during wet weather events.
- Sewage backups into homes during or after wet weather events.

DETERMINING SOURCES OF INFLOW AND INFILTRATION

- Lift Station Pump Monitoring
- Manhole Inspections
- Sewer System Cleaning
- Sewer System CCTV
- Smoke Testing
- Dye Testing
- On-site Inspections
- Monitoring and Modeling

DETERMINING THE AMOUNT OF INFLOW AND INFILTRATION

- Sanitary flow: Direct sewage from users or dry weather flow.
- Infiltration: Averaging nighttime flows during a study period and subtracting any known significant industrial or commercial nighttime flows.
- Inflow: Subtracting the average sanitary flow and infiltration calculated from the total volume of inflow at the treatment plant.
- Peak Inflow: The largest flow difference between rainfall events and dry weather flow, based on a one-hour period.

- Direct Inflow: Time difference between the start of rainfall and the start of increased flow to the treatment plant.
- Delayed Inflow: Time difference between the start of increased flow to the treatment plant and the return to base flow and conditions.
- Total Inflow: Total time of increased flow to the treatment plant.

INFLOW AND INFILTRATION SOLUTIONS AND IMPLEMENTATION

- Sewer Rehabilitation
  - Open-Cut Pipe Replacement
  - Sewer Lining
  - Slip Lining
  - Pipe Bursting
  - Point Repair
  - Manhole Rehabilitation
- Private Lateral Rehabilitation
- Green Infrastructure

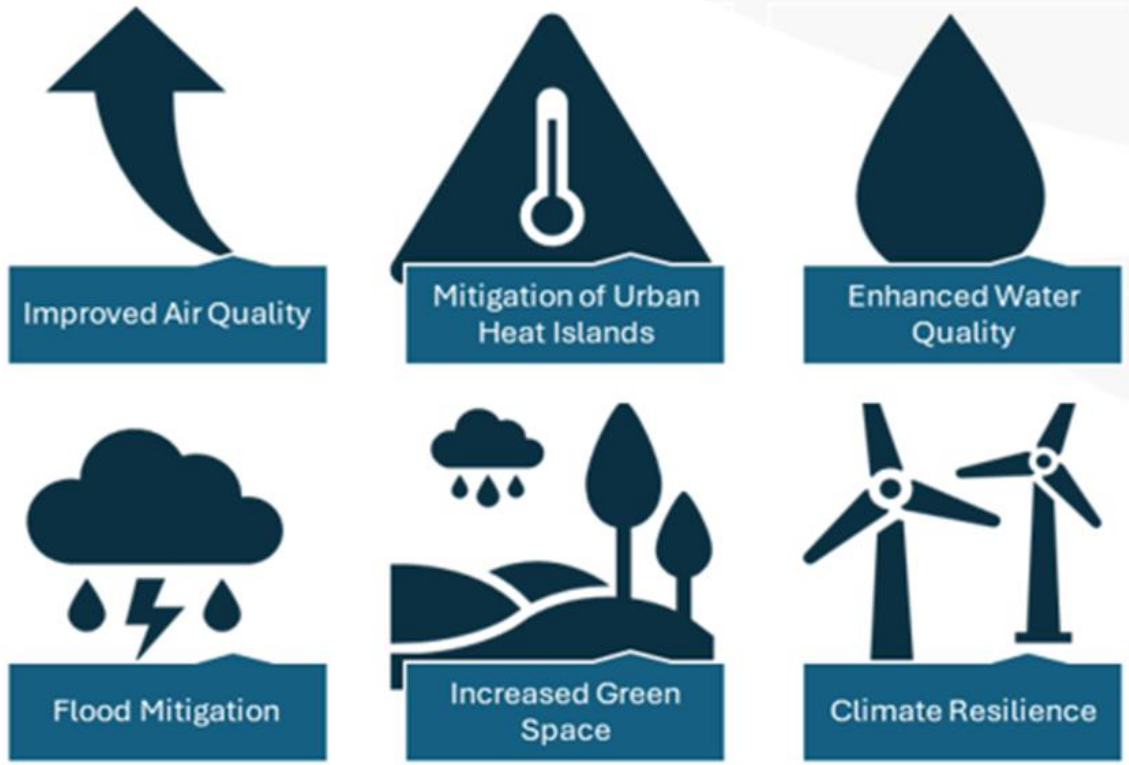


Figure 1. Environmental Justice Benefits of GI

MAINTENANCE BEST PRACTICES

- Asset Management
- GIS
- Monitoring (Smart Sewers)
- General Maintenance
  - Sewer Cleaning
  - CCTV Inspection
  - Catch Basin Cleaning
  - Manhole Inspection

Figure 2. Asset Management Plan Components

CAMDEN COUNTY, NJ – CASE STUDY

- Population: ~500,000
- 80 MGD in size
- Treats 135 Miles of Regional Sanitary Sewer Collection from Camden County and The City of Camden's Combined Sewer System
- Pure Oxygen Activated Sludge Process
- Utilizes CHP and Solar to Enhance Green Energy Production
- Discharges to Delaware River

COMBINED SEWER OVERFLOW (CSO) MITIGATION

- Green infrastructure programs to reduce combined sewage generation
- Optimized sewer cleaning to maximize storage capacity
- Selective sewer separation to strategically reduce overflows
- Construction of relief sewers to eliminate overflow points
- Netting and screening at remaining overflow outfalls
- Wastewater treatment plant expansion to increase wet-weather capacity

INFILTRATION & INFLOW (I/I) MITIGATION

- Track I/I through wet vs. dry weather flow analysis
- Prioritize removal opportunities based on cost-effectiveness
- Seal manhole leaks and rehabilitate structures
- Line or replace sewers in critical zones
- Upgrade pumping stations for hydraulic efficiency
- Expand treatment capacity only as a last resort
- Integrate green infrastructure to reduce stormwater inflow
- Eliminate illegal interconnections contributing to excess flow

MOONSHOT MISSIONS

QUESTIONS?

Contact

Rania Bashar, PhD, PE
Senior Program Manager
rania@moonshotmissions.org

Accessing Technical Assistance for Small, Rural & Tribal Systems

WATERNOW ALLIANCE

What support is available?

WaterNow can provide technical assistance for rural, small and tribal systems in a variety of ways:

- Support for **planning and assessing system needs**
- Building **planning technical, financial, and managerial capacity**
- Support for engaging the community to **map challenges and assets**
- Identifying **funding and financing opportunities**
- Navigating **grant and loan application processes**

Specialized Technical Assistance: Rural, Small, & Tribal Systems

Pro bono support for **wastewater and stormwater systems** across the U.S., serving communities of **10,000 people or fewer**.

What to expect?

- Dedicated team of **subject matter experts** to help answer your questions
- **Step-by-step assistance** to help rural, small, and tribal water systems address storm and wastewater challenges
- **Resources & guidance** to ensure compliance with all applicable federal, state, and local regulations
- The **technical assistance process** includes:

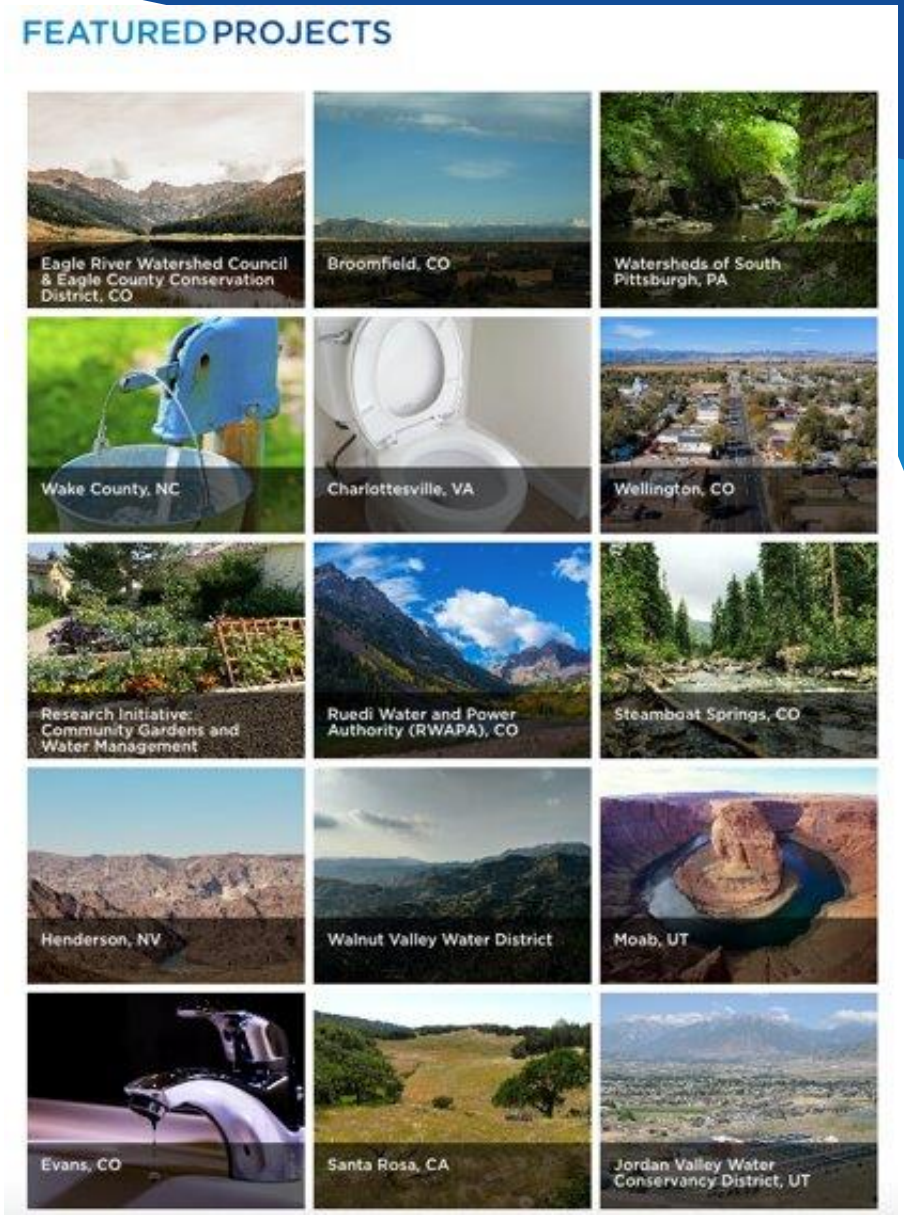
Additional technical assistance programs and resources can be found at the WaterTA website

Getting Started: Determine Project Readiness

- What is the **primary purpose** of your project and what outcomes are expected?
- Where are you in the **planning and design** process?
- Have you selected an **architectural or engineering** firm?
- What is your **project schedule**?
- If planning to utilize a loan, what the project's **sources of repayment**?
- What is the total **estimated project cost**?

Project Accelerator Support

- 250 hours of **pro bono technical assistance**
- Over a **6-12 month** period
- City/Agency identified project, driven by **local priorities**
- **Jump start** innovative water management initiatives



TiR Pilot Communities: Accelerating Investments in Sustainable Projects

Become a TiR Pilot Community

Ready to bring your localized water infrastructure strategies to scale? Become a TiR Pilot Community!

WaterNow and our TiR Experts are available to provide up to **300 hours of hands-on technical support** to cities and utilities interested in activating and scaling-up innovative water strategies in their communities to address water security challenges. TiR communities have access to legal, policy, finance, and accounting expertise over a **6-12 month period, free of charge**, to help them strategize the full scale financing of their particular localized infrastructure project.

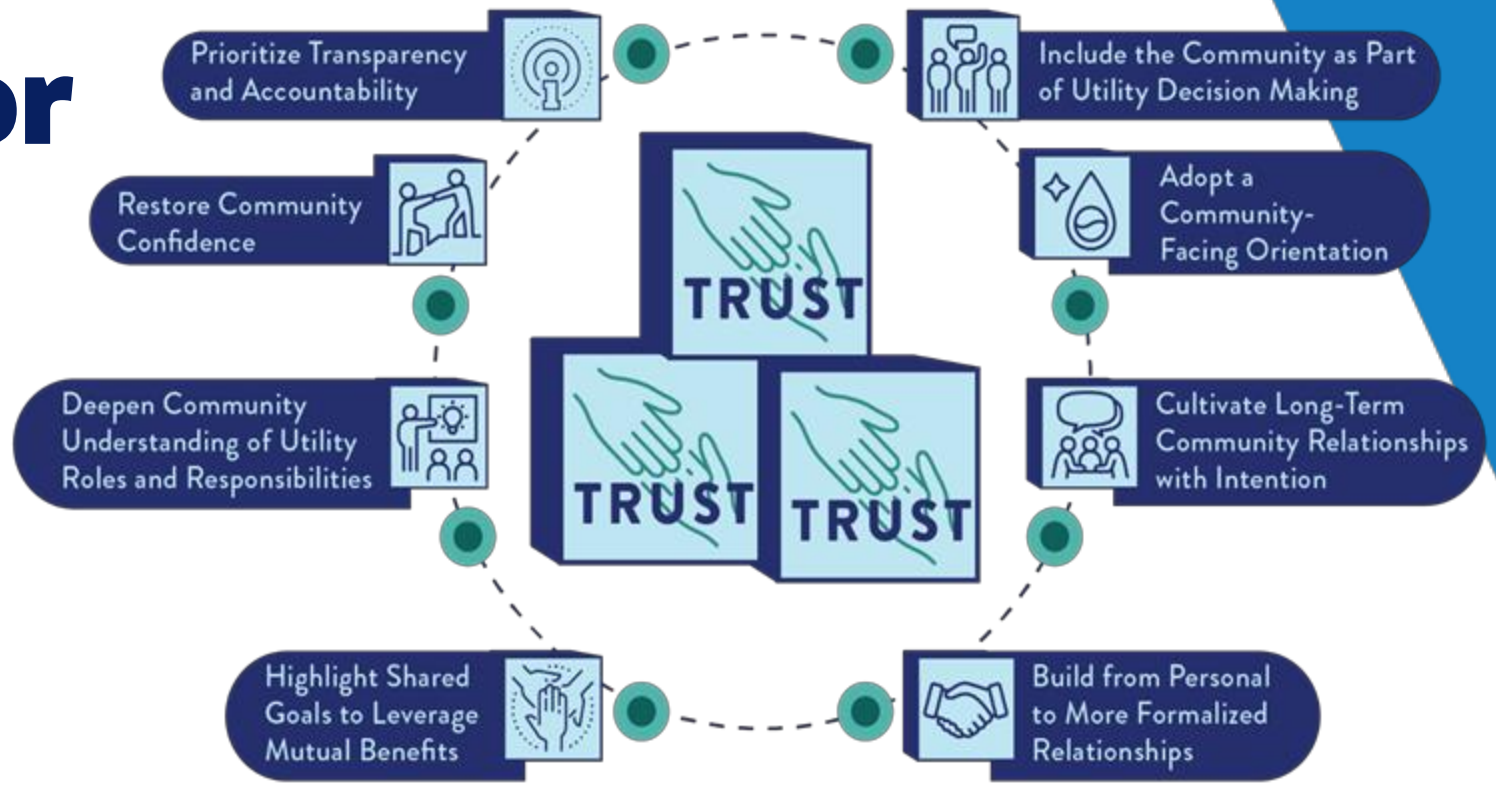
Benefits include:

- Access to a team of financing, bond, tax, and accounting experts to identify and execute on financing options.
- Tailored research and analysis on using debt financing mechanisms to pay for localized infrastructure.
- Facilitation of stakeholder meetings to build consensus on localized infrastructure financing options.
- Support on developing bond packets, capital improvement plans, city council resolutions, ordinances, or other materials to advance full scale localized infrastructure financing.
- Guidance on best practices for communicating with customers about localized infrastructure.
- Become a national leader on sustainable water management.

To find out more about becoming a TiR Pilot Community fill out this short form, and WaterNow staff will be in touch.

https://tapin.waternow.org/start-implementing/#pilot

Building Blocks of Trust: Best Practices for Authentic Partnerships & Community Engagement



Building Blocks of Trust Training Series

Based on the Building Blocks of Trust report, this online, self-paced training series covers the 8 “Foundations of Trust.” Created to support community groups and water utilities in building strong relationships for clean and safe water, this training aims to uplift long-term partnerships with mutual benefits.

Sign Up Now

bit.ly/BBoTTraining

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river NETWORK
connecting people · saving rivers


Q&A

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Join us for Part 2 in November!

Register: bit.ly/470zyze

Part 2: NOV. 18, 2025, 10 am PT/ 1 pm ET

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JOIN THE ALLIANCE

LEARN MORE AND SIGN UP

www.waternow.org/join-the-leaders

PLEASE COMPLETE OUR SURVEY!

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THANK YOU!

For more information email:

Amy Weinfurter, aw@waternow.org
Emerson O'Donnell, eo@waternow.org

Resources:

https://efcnetwork.org/