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Biannual Journal H2 2026



**THE PEOPLE
BEHIND THE NEW
CTAM** (Cover Story at page 10)

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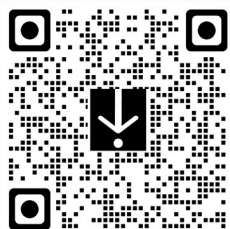
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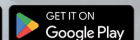
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Message from BAMI-I President

Dr. Tom Iseley

Ph.D., P.E., Dist. M. ASCE, PWAM, BAMI-I President

Indiana's water future depends on how effectively its institutions work together and how well its utilities manage the infrastructure that communities rely on every day. A proposal by Indiana Senate District 29 candidate John Ruckelshaus to establish a cabinet-level "Water Czar" has brought renewed attention to statewide coordination. I support stronger coordination and believe that it must be accompanied by practical assistance for the utilities responsible for implementing infrastructure policies.

A responsibility shared across institutions

The reported proposal identifies the Indiana Utility Regulatory Commission (IURC), Office of Utility Consumer Counselor (OUCC), Indiana Department of Environmental Management (IDEM), Indiana Finance Authority (IFA), and Department of Natural Resources (DNR) among the agencies whose water-related activities would be coordinated. Their responsibilities span different aspects of utility oversight, environmental protection, infrastructure financing, and water resources. The broader institutional network includes additional state and federal entities, as illustrated in the accompanying diagram.

The need for coordination is longstanding. The IFA's 2015 evaluation of water utility planning found uncertainty among surveyed utilities about how agencies exchanged information and which agency should lead water supply planning. The Indiana Chamber's 2024 Water Policy and Planning in Indiana report likewise emphasized the importance of aligning responsibilities across multiple agencies. These findings help explain why statewide leadership deserves attention beyond any single development project or legislative proposal.

A coordinating role could help agencies connect information, estab-

lish shared planning priorities, and clarify responsibility when decisions cross institutional boundaries. However, its effectiveness would depend on defined authority, adequate resources, and working relationships with existing institutions. The number of organizations involved does not by itself establish that their functions are unnecessary or duplicative. The practical question is whether their responsibilities and information can be connected well enough to support timely, informed decisions.

From requirements to continuing management

Indiana's asset management initiatives provide a direct connection between statewide policy and utility performance. SEA 272, enacted in 2022, addressed wastewater compliance and related infrastructure needs. HEA 1459, enacted in 2025, established periodic asset management program reporting for applicable water and wastewater utilities outside the IURC's jurisdiction for rates and charges. These developments create an opportunity to strengthen the way utilities plan for maintenance, renewal, and long-term service.

The distinction between reporting and implementation is important. Under the IURC's published guidance, the first reporting cycle runs from 2026 through 2029 and focuses on the status of each utility's program. Failure to submit a report is the only deficiency in that first cycle; an asset management plan is not required to meet first-cycle compliance. Subsequent cycles examine improvement, implementation, program maintenance, and management training. The reporting requirements described by the IURC exclude regional wastewater districts.

Our objective at BAMI-I is to help util-

ities establish a management process that remains useful between reporting deadlines. An asset inventory must be maintained as equipment and facilities change. Condition information must help identify problems and guide maintenance. Investment priorities must consider the likelihood and consequences of failure, while financial plans must account for the costs of operating, repairing, and replacing infrastructure over time.

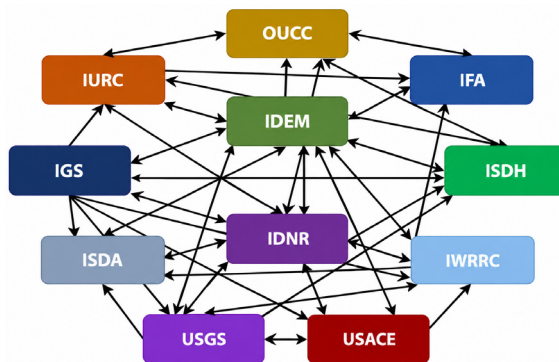
Smaller utilities may need assistance organizing existing records, selecting affordable assessment methods, preparing capital improvement programs, and explaining investment choices to their governing bodies. A reporting requirement can establish accountability, but it does not automatically provide the staff time, technical knowledge, or funding needed to carry out these activities. Support must therefore be designed around the decisions utilities actually face.

The proposed contribution of WIIC

BAMI-I, in cooperation with the World Trade Center-Indianapolis, has developed and submitted a proposal for a Water Innovation and Infrastructure Center (WIIC). The proposed center would support utilities and work with relevant state agencies on water infrastructure and asset management needs. Its potential contribution is to connect policy expectations with practical tools, training, and technical assistance.

WIIC could help utility staff and governing bodies understand asset management, organize asset and condition information, evaluate renewal priorities, and develop sustainable financial plans. It could also help translate research and inspection technologies into practices appropriate for utilities of different sizes. Documenting implementation experience would allow communities to learn from one another and help identify where further guidance or assistance is needed.

The center's services, governance, funding, and agency relationships would need to be defined through the proposal and subsequent agreements. Clear roles would allow statewide coordination and technical support to reinforce one another. Our goal is to help Indiana connect leadership with implementation so that communities can make better infrastructure decisions and sustain reliable water and wastewater service.



Interagency Complexity in Indiana Water Governance



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RIP

Stephen "Steve" Hontz

IN MEMORIAM

STEPHEN "STEVE" HONTZ

October 26, 1965 – July 21, 2026

President of Ace Pipe Cleaning, Inc. and BAMI-I board member

Stephen R. "Steve" Hontz Jr. died on July 21, 2026, at age 60. His career connected the daily work of maintaining underground infrastructure with support for the people learning to manage it.

Born in St. Joseph, Missouri, Steve served eight years in the United States Air Force. At Ace Pipe Cleaning, he began as a jet vac operator and rose to president during a 36-year career. His obituary describes a leader who built teams, developed new business and gave people opportunities to begin again.

BAMI-I's memorial statement re-

calls his service on the Board of Directors and his support for the Institute's education and research. Under his leadership, Ace Pipe Cleaning contributed technical expertise and field support to the Switz City Asset Management Project. The partnership brought industry experience into work with a small community facing practical infrastructure needs.

His support also reached Purdue University's Underground Infrastructure Team. Through Ace Pipe Cleaning, he helped sustain student leadership activities, applied research and technology development. BAMI-I's tribute recognizes the company's contributions to conferences, educational programs,

publications and student activities as part of that continuing commitment.

Those contributions gave collaboration a practical form: field assistance for a community project, opportunities for students and support for professional education. They remain central to how BAMI-I remembers his work.

"Steve's vision, leadership, generosity, and friendship have left a lasting mark on our profession."

From BAMI-I's memorial statement, signed by Tom Iseley, Chairman and President

BAMI-I extends its sympathy to Steve's family, friends and colleagues at Ace Pipe Cleaning.



Message from Journal Editor

Ms. Wei Liao

BAMI-I Journal Editor, PWAM

At first, almost everything in our industry looks like a technical problem. We need better ways to locate a utility, inspect a pipe, detect infiltration, understand deterioration, or predict failure. And the technology has advanced enormously. Today we have multi-sensor inspection, 3D mapping, increasingly connected GIS and asset management systems, and now artificial intelligence capable of processing information at a scale that was difficult to imagine even a few years ago.

After 20 more years working in underground infrastructure, I have come to believe that technology is not the hardest part of our problem.

The harder problem is turning what we see into what we know—and turning what we know into what we do.

A utility may have thousands of inspection records and still not understand its system. It may know that an asset is deteriorating and still not act. It may purchase sophisticated technology but lack the data structure, workflow, funding, or organizational responsibility

necessary to turn that technology into better decisions.

This issue returns to that gap again and again.

The people behind the new CTAM curriculum have spent decades working inside it. Their experiences range from handwritten sewer inspection records in the 1970s to modern pressure-pipe assessment, GIS, financial planning, and risk-based asset management. What makes their experience valuable is not simply that they know current best practices. They also know where earlier approaches failed, what the profession learned, and why collecting information is only the beginning.

North Texas Municipal Water District's condition assessment program shows why inspection must move beyond simply seeing defects toward quantified and repeatable evidence. The team in Xinyu shows the same movement compressed into a single workflow: a survey vehicle narrows a suspected gas leak to a stretch of ground, a trained dog walks it, an instrument confirms the location, and only then does a crew go out. The Western Virginia Water Authority's digital transformation experience reminds us that sophisticated systems cannot compensate for poor data or poorly defined processes. Our articles on utility mapping, AI, material selection, and I/I all approach different technical problems, but underneath them is the same question:

Can we create a trustworthy chain from the physical asset, to the data, to professional understanding, to a decision, and finally to action?

I believe this question will become even more important as AI enters infrastructure engineering.

AI can help us inspect faster, organize records, recognize patterns, automate repetitive work, and make decades of information more accessible. But greater computational capability does not auto-

matically produce greater understanding. If the underlying information is incomplete or unreliable, AI can process uncertainty faster without eliminating it. That is why I do not see the future of our industry as a choice between human experience and technology.

We need both.

We need the accumulated knowledge of people who have spent years learning how infrastructure actually behaves. We need young engineers willing to question inherited assumptions. We need operators who understand what happens in the field. We need researchers who can test new ideas. And we need new technologies that make this collective knowledge more visible, structured, traceable, and usable.

This is also how I increasingly think about BAMI-I. Its work is to connect people who hold different parts of the same problem—utilities, engineers, contractors, technology developers, researchers, educators, and students—and then to preserve and transfer what they learn. A conference, a training course, a journal: each is useful in proportion to how much knowledge it actually moves from the people who have it to the people who need it.

Our underground infrastructure will always be partly invisible.

Our knowledge of it does not have to be.

If we can improve how we observe, record, share, question, and act on what we know, we can move from reacting to infrastructure failure toward understanding infrastructure before it fails.

That, to me, is the direction of buried asset management—and the direction I hope this Journal continues to explore.

Thank you for reading.

Wei Liao, PWAM

Lead Research Engineer, Purdue University



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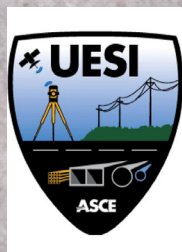
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THE PEOPLE BEHIND THE NEW CTAM

A group of industry experts have comprehensively updated BAMI-I's buried asset management curriculum, revising existing content, rewriting key sections, and adding new material. Here is what changed, and who changed it.



A buried pipe does not announce its remaining service life or tell the utility that owns it which asset needs attention first. Answering those questions takes more than an inspection. It requires reliable records, an understanding of condition and performance, and the judgment to decide what action is needed, when to take it, and how to pay for it.

Connecting those steps—look, record, assess, decide, fund, and follow through—is at the heart of buried asset management. It is also the purpose of BAMI-I's Certification of Training in Asset Management, better known as CTAM: helping utilities turn knowledge of their underground systems into practical management decisions.

That purpose has roots in the work of Dr. Tom Iseley, BAMI-I's founder and a driving force behind the creation of CTAM. BAMI-I was established in 2003 to bring greater attention to buried infrastructure, and CTAM 100 was introduced in 2010, followed by CTAM 200, 300, and 400 between 2013 and 2015. The series created a structured way to connect underground asset knowledge with planning, management, and financial decisions. Iseley continues to provide overall direction and senior advisory guidance, maintaining the program's connection to its founding purpose while supporting its continued development. His legacy is not simply the establishment of a course, but

the continuing effort to bring practitioners' knowledge into education that utilities can use.

CTAM also provides the educational foundation for BAMI-I's Associate Water Asset Manager (AWAM) and Professional Water Asset Manager (PWAM) credentials, with certification subject to the respective application and experience requirements. The updated program is expected to open by the end of 2026.

This update builds on that foundation rather than discarding it. The work includes a rewritten introduction, more developed treatment of water and wastewater systems, expanded inspection and rehabilitation content, and stronger connections between technical findings and implementation. The distinct operating conditions, assessment methods, and intervention choices of pressure and gravity systems receive more explicit attention. Financial instruction addresses not only funding sources, but revenue sufficiency, affordability, and the difficult task of presenting a defensible investment proposal to a governing body.

The delivery is evolving as well. As Jim Harris, who chairs the curriculum update committee, puts it: "COVID taught us that we can train virtually." The updated material is being organized to support virtual instruction, while live classroom training remains an option, particularly for organizations seeking group training.

Wei Liao, CTAM Course Director, has led the coordination and integration of this update, working with Iseley and the committee chaired by Harris. Her work includes organizing contributors, reviewing instructional materials, restructuring content across CTAM 100–400, reducing duplication, and addressing gaps with reference to applicable regulatory requirements, standards, and industry guidance. Building on the authors' and reviewers' contributions, her focus is to preserve CTAM's technical depth, strengthen its distinctive emphasis on buried assets, and provide utilities with a coherent, practical pathway to develop and implement asset management programs.

Adam Hershberger, of the Alliance of Indiana Rural Water, has contributed a front-line operations perspective to the review. His feedback helps assess whether the material reflects the day-to-day realities of utility work and can be applied by the people responsible for operating and maintaining the systems.

The practitioners behind the updated material bring more than knowledge of methods and standards. They bring experience of how decisions are made in the field, what happens when an approach fails, and what it takes to turn a plan into sustained action. The six principal contributors profiled in the following pages share the experiences that shaped their work—and the lessons they want the next generation of asset managers to carry forward.

THE SIX CONTRIBUTORS

In the order of the curriculum they rebuilt

Kurt Wright: The Plan That Started With a Course



Kurt Wright can tell you the exact year his asset management career began: 2012, the year he took CTAM 100. He had just won the engineering contract to develop an asset management plan for the Town of Spindale, North Carolina. It was his first asset management plan, funded entirely by a state grant, and the guidance that came with the grant amounted to a couple of pages.

To understand what Wright took on, it helps to know Spindale. The town was once a thriving textile hub, and its wastewater system was built for that economy. Then NAFTA-era policy shifts hollowed out the mills, and Spindale began the slow transition toward a tourism-based economy. The infrastructure stayed behind – aging clay pipes and brick manholes, infiltration problems, mounting maintenance headaches – serving a town that no longer had a textile industry’s tax base to pay for it.

That was the situation in 2012, when Wright went looking for grant funding for sewer replacements and recognized that an asset management plan would strengthen the applications. He secured the funding and set out to write one. “At that time, no

one in my engineering circles was talking about asset management planning,” he recalls. Nearly everything he needed to know – what an asset management plan was, how to build one – came from BAMI-I.

The result spoke for itself. When the North Carolina Division of Water Infrastructure approved the Spindale plan in 2013, the reviewer told him it was the best of all fifty asset management plans submitted that year. Wright credits BAMI-I for a share of that. The plan’s first priority was the rehabilitation of the town’s aging wastewater plant.

By then he was already giving back. The same year he took CTAM 100 as a student, he joined BAMI-I and assisted with the development of CTAM 200. He went on to complete all four CTAM modules, earn his PWAM certification, contribute to the CTAM 200 and 400 training manuals, and join the Board of Directors, where he has served through his retirement. Few people in the organization have touched as many generations of the curriculum.

Wright’s engineering roots go deeper still. A 1977 civil engineering graduate of UNC Charlotte, he founded his own firm in 2002 in Rutherford County, North Carolina – originally Kurt D. Wright & Associates, later renamed SDG Engineer-



ing – built around municipal water and wastewater work, from planning and design through grantsmanship, construction management, and startup.

And Spindale never left him. In 2024, SDG Engineering completed a comprehensive update of the plan, folding in the findings from several state-funded infrastructure projects along with new sewer assessments, smoke testing, and GIS updates, and laying out a long-term capital improvement plan for the town.

Which raises the question every asset management plan eventually runs into: who pays. Keeping the program funded meant raising rates, and it took careful financial modeling to balance those adjustments against what households could ac-

tually afford. It also took standing in front of the Spindale Board of Commissioners to make the case. Wright did not do that alone. Glenn Barnes of Water Finance Assistance had conducted the rate analysis on the original SDG team, and together they walked the commissioners through the options for putting the wastewater system's enterprise fund on sound financial footing.

Wright presented the whole arc – the mill town, the grant, the plan, the rates – at the Global Buried Asset Management Congress in Indianapolis in November 2024, with Barnes alongside. His summary of the updated plan is characteristically dry: “It provides an excellent roadmap for the town, if they choose to follow it.” Anyone who has written a plan for a governing body will recognize the weight of that last clause.

What Wright learned in Spindale did not stay in North Carolina. When BAMI-I took on the Switz City project – building an asset management plan for a town of a few hundred people in rural Indiana, intended as a replicable model for small

utilities across the state – Wright was part of the team. He conducted the comprehensive evaluation of the town's wastewater treatment plant, identifying structural risks, operational bottlenecks, and aging components, with his findings and upgrade recommendations folded directly into the plan. He also stood in front of a different kind of audience: as a guest lecturer in Purdue University's Asset Management of Underground Infrastructure course, where students worked in teams to develop asset management plans for Switz City. The engineer who once learned this discipline from a course was now teaching it through a live project.

For the CTAM update, Wright took on the module that started it all for him: CTAM 100. The original course was built on guidance nearly two decades old – a 2006 EPA cooperative agreement document. Rather than patching the old material, BAMI-I chose to write a completely new introductory text for the certification series. The rewrite closes a circle: the student of 2012 became the author of the new first course.

His diagnosis of the industry is blunt. A key reason American water and wastewater infrastructure is in such poor shape, he argues, is the absence of proper asset management. And when a utility director asks him why a team should invest time in it, his answer takes considerably less than the allotted minute: “Because you cannot afford not to.”

What has changed since 2012? “Back then, asset management was relatively new. Few engineers in my inner circles knew what it was. Now everyone does.” Spindale, for its part, has a roadmap. The town that lost its mills has something many larger utilities still lack: a purposeful accounting of every asset it owns, what condition it is in, and what comes next.

Kurt Wright, PE, BCEE, PWAM, was formerly Owner and President of SDG Engineering, Inc., founded in 2002. He retired in 2025 and continues to serve as a senior member of the BAMI-I Board of Directors. His GBAMC 2024 presentation on the Spindale AMP update is available at bami-i.com.

From Clay to Infrastructure Leadership: Smith Rangel's Journey in Asset Management



Smith Rangel's connection to buried infrastructure began long before it became the focus of her professional career. Her father, Roque Rangel, managed construction projects and often coordinated sewer and water service connections. Through those early experiences, she was exposed to the physical reality of buried infrastructure and the work required to build and connect the systems beneath our communities.

At the time, she was not thinking about engineering or infrastructure. What remained with her, however, was a lasting connection to the environment in which that work took place. “My fascination was playing with the clay that came out when

they opened a trench. I could take that soft clay in my hands and mold it into anything my imagination could come up with. That was, for me, the best part of being there. That was my real gift.”

Only later did she begin to understand the broader significance of what she had been exposed to the trenches, pipes, and service connections that formed part of the infrastructure supporting communities. When her professional career eventually brought her to water and wastewater systems, the work carried a sense of familiarity. “I felt, in a way, that I was returning to something that had been part of my life all along. The difference was that now I could understand its importance, its complexity, and the responsibility involved in caring for it.”



“Looking back,” she says, “my story with buried infrastructure began long before my first professional project. It began with my father, an open trench, and probably a little clay between my hands that I could transform into anything I imagined.

Perhaps that is one of the reasons why, so many years later, I still feel such a strong and very personal connection to this field.”

A civil engineer with a Master’s degree in Engineering – Project Management from the University of Maryland in College Park, Smith has worked with consulting firms and public utilities in both the United States and Latin America, supporting the Baltimore County Bureau of Utilities on infrastructure programs under the Baltimore County’s Consent Decree, and working with EAAB, the municipal water and wastewater company of Bogotá, Colombia. She is a NASSCO®-Certified Trainer in PACP™, MACP™, and LACP™, serves on the BAMI-I Board of Directors.

That focus is reflected in her contribution to the CTAM 200 update. Her sections cover asset management planning, asset inventory and data management, condition assessment, and inspection, with particular emphasis on the process of turning field information into meaningful decisions. The update was needed, she says, partly because technology and inspection methods have evolved, but also because the industry’s understanding of asset management itself has matured. “A utility can have thousands of inspection records, but if the information is not consistent, reliable, properly managed, and connected to the asset inventory and decision-making process, its value is limited.”

For Smith, this principle is fundamental to effective asset management. The quality of a decision can never be better than the quality and understanding of the information behind it.

Over the years she has encountered utilities with years of inspection data, sometimes thousands of records, that were not consistent enough to support reliable comparisons or confident prioritization. In other cases, the technical information itself was good, but it was never properly connected to the asset inventory, the GIS, the risk framework, or the capital planning process.

Collecting data, she concluded, is only one part of the job. The information must also be understood: what it represents, how it was collected, what standards were used, how reliable and consistent it is, and perhaps most importantly, what decision the information is intended to support.

When asked about the classic situation in which the data indicates that an asset needs attention but no action follows, Smith does not reduce the issue to a single cause: It is rarely just the data, the budget, or the decision chain. Very often, the challenge is the translation: the information was never presented in a way that decision-makers could effectively use.

“A condition score by itself does not necessarily explain why an asset should be prioritized.”

Connecting condition to consequence of failure, risk, criticality, and service levels creates a stronger basis for decision making. For Smith, that is the purpose of asset management, not simply identifying assets in poor condition, but establishing a defensible process for determining what should be renewed, when, and why.

Her advice to young engineers follows the same principle: get out of the office.

Spend time in the field, talk to operators and inspectors, look at the assets yourself, and question what the information is telling you.

The most valuable lessons of her own career, she says, did not come only from textbooks or classrooms. They came from seeing how infrastructure actually behaves, listening to the people who work with it every day, and understanding the consequences of the decisions made – or not made – based on the information engineers provide. “Technical knowledge will always be important, but the engineers who make the greatest difference are those who can connect the data, the infrastructure, the people, and the decision.”

Smith’s professional journey has taken her a long way from those early construction sites. Yet the connection remains. The clay may have been one of the first material she encountered beneath the surface, but her professional work today is focused on something far more complex: understanding buried infrastructure, the information that describes its condition, and the decisions that determine its future.

Smith Rangel, M.Eng., is a civil engineer with a Master’s degree in Engineering – Project Management (MEPM) from the University of Maryland, a NASSCO-Certified Trainer (PACP™, MACP™, LACP™), and a member of the BAMI-I Board of Directors, with experience across utilities in the United States and Latin America. She is a main contributor to the wastewater module update of CTAM 200.

Dr. Diego Calderon: Shaping the Future of Underground Infrastructure Management

Diego’s introduction to buried infrastructure came in 2006, fresh out of a civil engineering degree, working as a field inspector on a vertical construction

project that needed new water and sewer connections. He remembers watching a pneumatic piercing tool install water service laterals without tearing up the road, and being amazed –he says now, “without realizing it at the time, I was looking at



two pillars of my career: buried asset management and trenchless technology.”

Two moments soon persuaded him towards the underground infrastructure management. The first was an industry trade show, in 2008, while performing research on asset management and trenchless technology at the Center for Underground Infrastructure Research and Education (CUIRE). At the show, the sheer intricacy of underground utility challenges, along with the ingenuity and variety of technical solutions, provided him with substantial reasons to stay engaged in this field. The second moment came during the financial crisis of that same year. Watching the recession hit sector after sector, he noticed that utility work held a strong position given its critical role in the nation’s economy and society. Water and wastewater systems are critical infrastructure; therefore, utilities must maintain their assets and deliver basic services regardless of any downturn. He had found a field that was both fascinating and essential.

The career that followed has encompassed a wide arrange of positions in the industry, including field engineer, project engineer, project manager, municipal engineer, researcher, university professor, and design engineer. Two of his experiences with asset management include his research work on asset management practices for culverts and storm sewers, and his role as project manager for the Office of Asset Management at the City of Baltimore Department of Public Works. It was then, about 15 years ago, when he noted

that buried asset management was transforming from short-lived programs into dedicated business units. Today, Diego works as a senior technical consultant and subject matter expert in condition assessment and trenchless technology at Jacobs, and contributes to projects worldwide. A registered professional engineer in Georgia and Maryland and a NASSCO-Certified Trainer in PACP™, MACP™, and LACP™, he has trained hundreds of professionals in the industry’s inspection standards.

For the CTAM update, Diego’s primary contribution is in the development of the CTAM 200 water module, which had identified needs and important gaps. The previous version of CTAM 200 only glanced at the asset management principles for water distribution systems, by merely mentioning scattered references through a manual whose framework and examples were mostly built around sewers. There was no dedicated attention to asset types, failure modes, and condition assessment practices specific to water distribution and transmission assets. Additionally, the previous CTAM 200 did not consider that water systems fail differently than sewers, and that they are inspected and monitored differently. The updated manual closes those gaps on condition assessment and asset management for water systems.

His one-minute pitch to an asset management director skeptical of CTAM takes the form of a question: wouldn’t you rather have your team anticipate major infrastructure failures before they happen

instead of combating them reactively? Success there, he argues, is often a combination of experience, motivation, and informed decision-making. While the first two come from practice-oriented day-to-day work, the third comes from select education opportunities and targeted training.

Ask what he is excited about now and he reaches for a project that compresses part of his career into one job: the relocation of a stone sewer installed around the mid-1800s, that crosses five railroad tracks. Designing a new sewer through a densely populated historic neighborhood makes any project uniquely challenging. These conditions require careful prioritization of decisions and design needs, that are also clearly aligned with CTAM principles. The project involves targeted condition assessments, identification of ground conditions around the crossing, and the selection of trenchless technologies.

A century and a half separate the pneumatic piercing tool that started his career from the hand-laid stone sewer he is now working to replace. The discipline connecting them is the one he helped write into the new curriculum.

Dr. Diego Calderon, PE, is a senior technical consultant and subject matter expert in condition assessment and trenchless technology, and a NASSCO-Certified Trainer (PACP™, MACP™, LACP™). He is a main contributor to the CTAM 200 course update and the primary contributor of the water module.

Jim Harris: Confessions of a Sewer Rat



Jim Harris started in 1976 at McCullough Associates, a firm dedicated to performing Sewer System Evaluation Surveys the EPA required alongside treatment plant funding. This included manhole inspection above and below ground, flow isolation, smoke testing, CCTV - All output on

paper - with calculations and recommendations on handwritten spreadsheets. “We were the first company in the US that used civil engineers to do this work,” he says.

There was a term he kept hearing in those early years: sewer rat. It described an almost immediate reaction people had to working in sanitary sewers. Some had it, many did not. “I was a sewer rat. It flowed



through my blood.”

Fifty years later, that is still the most reliable way to understand Harris’s career. It carried him from the paper-and-clipboard era of McCullough through decades of collection system work, eventually to Jacobs Engineering, where he served as a Civil Engineering Specialist until retirement. Along the way he became one of the people the industry trusts to define what competent sewer evaluation actually looks like – chairing CTAM 300 on BAMI-I’s certification board, serving on its Board of Directors and on the NASSCO Board of Directors, and now chairing the committee overseeing the CTAM curriculum update itself.

But ask him what he is proudest of knowing, and he starts with what he got wrong.

Cost Effective Analysis was the standard of his era: estimate the infiltration and inflow contribution of each defect, compute the cost to transport and treat that flow, compare it against the cost of repair, and fix only the defects that penciled out. Sound economics was the rule, defect by defect. The whole industry ran on it.

It had two blind spots, and Harris names them without flinching. First, flow contributions could not be accurately estimated – the numbers underneath the analysis were softer than anyone admitted. Second, and more damning, nobody understood migration. Water shut out of one repaired defect did not go away. It moved downstream and found its way in through the next defect – the ones that had failed the cost-effectiveness test and were left alone. Project after project, I/I removal fell far short of the projections, and for years the industry did not understand why.

“From this we learned the need to rehabilitate comprehensively by area,” Harris says. One sentence, carrying a generation of corrected practice. It is the kind of lesson that cannot be derived from first principles in a classroom. Someone

had to run the projects, watch the numbers disappoint, and figure out where the water went. Harris was one of the people who did – and that lesson now lives inside the material he teaches.

For the CTAM update, Harris carries a double load: he chairs the update committee guiding the entire revision, and he rewrote CTAM 300, the gravity pipe module – the course he has chaired on the certification board for years. Interestingly, his reason for the rewrite was not that the old material had fallen behind. “It was not so much that the old version had fallen behind but that we desired CTAM to be organized a bit differently,” he explains. CTAM 200 and 300 had grown to overlap too heavily, so the team simplified both. CTAM 200 now focuses on gathering the data to build an asset management plan. CTAM 300 focuses on using that data – recommending, prioritizing, and selecting rehabilitation and maintenance. The revision also folds in rehabilitation methods that did not exist in the original, and its most significant addition is a far more robust pressure pipe module.

The delivery changed as much as the content. “COVID taught us that we can train virtually,” Harris says. “The new material is organized to be taught virtually rather than in the live classroom.” Coming from a man whose first survey outputs were handwritten, the shift from classroom to screen registers as just one more format change in a career that has seen several.

Not that he has retreated behind a screen. Retirement, in Harris’s case, depends upon how you view retirement. He continues to teach BAMI-I and NASSCO-certified training around the country, including PACP™ – the Pipeline Assessment Certification Program that serves as the North American standard for coding the condition of wastewater pipes. There is a quiet symmetry in that assignment. In 1976, Harris was recording pipe defects on handwritten spreadsheets, in

whatever format McCullough Associates had devised for itself. Today he teaches the standardized coding language that finally gave the whole industry one way to describe what a camera sees underground – the common vocabulary that makes modern condition data comparable, and asset management possible. The sewer rat, still making his rounds.

If a student takes one thing from the new CTAM, Harris wants it to be this: a utility needs to purposely consider every asset, know its condition, and know its next step. And his one-minute pitch to a skeptical asset management director is even shorter – these practices are simply the most efficient and frugal way to manage your assets.

His advice for young engineers goes to something underneath technique. Before they learn asset management principles, before they write or implement a plan, they need to understand why it matters. “A lack of understanding the significance of asset management will contribute to a lack of passion in what they are attempting to do, which will contribute to a lack of achieving effective results.” No passion, no results. The sewer rat’s syllogism.

As for CTAM itself, the man who helped build it offers a plain endorsement: a structured curriculum, written by recognized subject matter experts, that he considers one of the most effective ways to receive training in asset management. He would know. He has spent fifty years learning these lessons the hard way so that the next generation can learn them in a course.

Jim Harris is a retired Senior Project Engineer (Jacobs Engineering) and a member of the BAMI-I Board of Directors, and has also served on the NASSCO Board of Directors. He chairs the CTAM curriculum update committee as well as CTAM 300 on the certification board, and teaches BAMI-I and NASSCO-certified training nationwide.

Ron Thompson: Forty Years of Watching the Technology Catch Up



The camera could not even turn its head. When Ron Thompson started evaluating sewer systems in the 1980s, the state of the art was black-and-white CCTV with no pan-and-tilt, supplemented by flow monitoring and dye testing. The work itself was driven by P.L. 92-500 – the Clean Water Act – which sent a generation of engineers underground to conduct infiltration/inflow studies and Sewer System Evaluation Surveys. Thompson worked through system after system, assessing condition and running cost-effective evaluations for repair or replacement.

The pull toward this work started even earlier, in a cooperative education program during his engineering degree. Alternating quarters of school and work at an environmental consulting firm, he rotated through nearly everything the firm did: air emissions control for industrial clients, groundwater sampling, surveying, drafting, water and sewer plant design. The final work quarter landed him in sewer system evaluation – flow monitoring and CCTV – and that was the one that stuck. He has spent the four decades since watching the toolkit he started with become unrecognizable.

Which makes him a fitting author for the module he rewrote in the CTAM update: pressure pipe inspection technologies, an area that has changed as much as any in the field. The technologies for seeing inside a pressurized main barely existed when Thompson was feeding monochrome cameras into gravity sewers. Today they are an industry of their own, and the new CTAM had to reflect that.

Few people have watched CTAM itself evolve from closer range. Thompson's involvement goes back to 2008, when CTAM 100 was still being developed – making him, among the current authors, the one

whose history with the program runs deepest. He continued through the development of CTAM 200 in 2012, served on the certification board, and has taught in the classroom programs that compress all four modules into an intensive week. The early courses ran online; over the years he watched the program grow into both formats. When BAMI-I decided the curriculum needed rebuilding, he was one of the few people who had seen every version of it.

His own career carries a lesson he offers freely, because he learned it late. He spent over twenty years working and living in one place, hesitant to relocate when large project opportunities came up. When he finally started taking them, every move taught him new approaches and new skills. His advice now: evaluate the opportunities that come, even the ones with risk attached. The knowledge is worth the disruption.

The biggest of those moves came in 2020, when Waggoner Engineering acquired Applied Engineering & Science, the Alabama consulting firm where Thompson served as Vice President of Technical Operations. The acquisition brought AES's water, wastewater, and asset management practice into Waggoner's utility division. "We understood the culture, people, and the client service approach based on the many years of interaction in Mississippi and Alabama," Thompson said at the time. "I look forward to creating new relationships and serving clients." He carried his title with him, and today leads continued research on new technologies for field application and data processing – still doing, at Waggoner's scale, what he started doing with a black-and-white camera.

His case for asset management is built on reliability. Ask him why a utility team should invest the time and he goes straight to outcomes: fewer catastrophic



events, fewer unplanned shutdowns, fewer unplanned costs. Then he adds the benefit most people miss – a staff that develops a detailed understanding of its own system and its own jobs. Asset management, in his telling, is workforce development wearing a technical disguise.

If a student takes one thing from the new CTAM, he wants it to be the significance of life cycle cost and the long-term budgeting process. Not the inspection technology he has spent his career advancing – the economics underneath it. It is a telling choice from the toolkit man: the tools change every decade, but the discipline of thinking in decades does not.

His advice for young engineers comes in two parts, and both point at the same future. Technology never stops changing, so continued learning is critical to providing optimal solutions. And the education never stops flowing outward either – there is an ongoing need, he says, to educate political leaders and the public about what asset management is for and what it delivers. Forty years after P.L. 92-500 sent him into the sewers, Thompson is still working both ends of that equation: mastering the next technology, and explaining to the people above ground why it matters.

Ron Thompson is Vice President of Technical Operations at Waggoner Engineering and a senior member of the BAMI-I Board of Directors. He rewrote the pressure pipe inspection module for the updated CTAM and has been involved with the program since 2008.

Glenn Barnes: The Man Who Talks About Money

Every asset management program eventually arrives at the same uncomfortable place: someone has to pay for it. Glenn Barnes has spent his career standing in that place.

He came to asset management through a side door: rate studies. Beginning with his work with the Environmental Finance Center at the University of North Carolina in 2006 and continuing with his work with Water Finance Assistance since 2019, Barnes helped utilities figure out what their service actually costs and how to price it. Along the way he noticed a pattern. The utilities with an asset management plan could anticipate their future expenses. The ones without were guessing. Back then, most were guessing – especially the small systems.

The moment that anchored him in the sector came through an EPA-funded national training and technical assistance program for small water systems, which he co-directed from 2012 to 2019. The work took him across the country, meeting the people who run water systems in nearly every state and territory. “I was so impressed with their dedication to their communities. It was an honor to give even a tiny bit of support to them, and I knew I would stay in the sector for the rest of my career.”

One of the engineers he eventually ended up working alongside was Kurt Wright. Barnes conducted the rate analysis for the Spindale, North Carolina asset management plan on the SDG Engineering team, and together the two presented the town’s Board of Commissioners with options for putting the wastewater system’s enterprise fund on sound financial footing. In November 2024 they shared a stage again, presenting the updated Spindale plan at the Global Buried Asset Management Congress in Indianapolis. Two of the people rewriting CTAM had already spent years proving its principles in the same

small town.

By then Barnes was deeply woven into BAMI-I’s work. In October 2024 he led the organization’s webinar on using asset management to move utility leaders to action – teaching exactly the skill he considers most undervalued in the profession: translating technical findings into arguments a governing board will actually act on. And when BAMI-I launched its most ambitious small-utility effort, the Switz City asset management project in Indiana, Barnes was on the team. Water Finance Assistance conducted the water and wastewater rate study for the town – a community of a few hundred people with its own treatment plant and distribution system – assessing whether the existing rate structure made sense for its customer base, and proposing a phased financial strategy that spreads the long-term investment across annual budgets while diversifying funding sources. Readers of this journal may remember his account of that rate study from a previous issue.

For the CTAM update, Barnes rewrote CTAM 400 – the module on how to pay for everything the other modules teach you to find. Much of the old version’s utility finance material held up and was retained. What the new version stresses is a truth many boards would rather not hear: customer charges, largely through debt service, are what will pay for infrastructure projects. New sections cover affordability and, crucially, how to approach a governing body about the rate increases an asset management program requires.

That last part he learned the hard way. He has watched boards refuse to take on necessary projects unless a grant appeared. Grants are rare. Projects got delayed. Public health carried the risk. “Some governing bodies are unwilling to raise rates to pay for capital projects, even when they agree that the projects are necessary.”

Ask him where the system breaks –



why the data says fix it and nobody does – and he does not hesitate: the decision chain. Implementing an asset management program’s findings usually means debt and rate increases, and the profession is not always honest about that. Nor does it explain inaction well. “It seems like deferring a capital project will cost the utility nothing, when in fact it may lead to a catastrophic asset failure, public health impacts, and increased future costs.”

If a student remembers one sentence from CTAM 400, he wants it to be this one: it is very likely you will need to raise rates to fund the capital projects your asset management program identifies.

His own firm, Water Finance Assistance, works on what he calls money and people problems. A recent project shows the money side in practice. His team ran a rate study for a wastewater utility in a low-income community with a shrinking population. The data analysis surfaced something nobody had put into words: for decades, those struggling households had been quietly subsidizing the utility’s three industrial customers, who paid no monthly base rate and the lowest volumetric rate of any customer class. When rates had to rise, the board had the evidence in front of it – and fixed the discrepancy. It is the kind of finding that stays buried until someone actually looks, and it is a fair summary of what Barnes believes data is for.

The people side is newer, and he is

animated about it. The sector obsesses over retirements, Barnes argues, while overlooking the employees who are not retiring but might still walk out the door. Salary is part of why someone stays, but so are a career path and the relationship between an employee, their supervisor, and their colleagues. He and his partner Elora Arnette are building ways to measure all of it – a fuller picture of why utility staff stay or leave, for a sector that cannot afford to lose them.

His advice to young engineers has nothing to do with pipes, and everything to do with the rooms he has spent his career in. Learn to translate technical findings into something that inspires a board to act using plain language, aimed at what boards actually worry about: money, affordability, customer impact.

And his closing thought goes past the engineering entirely. Water and wastewater utilities allow communities to be healthy and prosperous, and the deci-

sions made today determine whether that service continues. “Our children and our grandchildren are counting on us to get it right.”

Glenn Barnes is the Director of Water Finance Assistance, focusing on rates, affordability, employee development, and retention. He rewrote CTAM 400 for the updated curriculum and served on the rate study team for BAMI-I’s Switz City asset management project.

THE CTAM PROGRAM

Expected to Open By The End of 2026

The updated CTAM program is expected to open for enrollment by the end of 2026. The new curriculum is designed for flexible delivery, with virtual instruction as well as live classroom options for organizations seeking group training. Completing the CTAM series provides a pathway to the PWAM credential.

The curriculum will continue to evolve. BAMI-I’s working group will review and update the material regularly to keep pace with industry practice, emerging technologies, and lessons learned in the field.

More details on the program, schedule, pricing, and registration will be announced soon.

Stay tuned at bami-i.com.

ACKNOWLEDGMENT

BAMI-I gratefully acknowledges all members of the CTAM Curriculum Update Committee for their time, expertise, and contributions to the development of the updated CTAM curriculum. BAMI-I also recognizes the authors and contributors who developed earlier generations of the CTAM curriculum, whose work established the foundation on which this update was built.

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FROM PIXELS TO PRECISION:

Multi-Sensor Inspection and a Decade of Asset Management at North Texas Municipal Water District

By Amin Tehrani, Ph.D., P.E. and Scott Hoelzle, P.E. - Wastewater Conveyance Group.



“The program required quantified, repeatable measurements rather than descriptive observations.”

In January 2026, the pipeline Condition Assessment Program (CAP) at North Texas Municipal Water District (NTMWD) was named Asset Management Project of the Year at the Underground Infrastructure Conference. The recognition marks the near-completion of a ten-year commitment the District made in 2016, when NTMWD began a program to inspect all 147 miles of its large-diameter gravity mains, as part of its obligations under the Texas Commission on Environmental Quality's (TCEQ) Sanitary Sewer Overflow Initiative. A foundational decision made at the outset of the program has shaped nearly every finding and recommendation produced since: rather than relying on closed-circuit television (CCTV) alone, as has historically been standard practice across much of the industry, NTMWD structured the program around multi-sensor inspection (MSI).

This article presents a practitioner-level discussion of that decision, nine years on. It addresses the specific limitations of CCTV as a stand-alone assessment tool, the condition data that sonar makes available and CCTV cannot, the framework used to translate that data into repair, rehabilitation, or

replacement decisions, and the operational requirements of sustaining a program of this scale over a decade. It also addresses a limitation identified within the current MSI platform itself, and the equipment change planned for the program's second ten-year cycle.

Limitations of CCTV as a Stand-Alone Assessment Tool

CCTV inspection has long been the industry standard for gravity pipeline condition assessment, and for good reasons. A qualified operator can reliably identify cracks, root intrusion, joint separation, and blockages, and the resulting footage is straightforward for reviewers and stakeholders outside the inspection discipline to interpret.

However, CCTV is fundamentally a visual, qualitative assessment method. It documents the appearance of a defect but does not quantify its magnitude, its rate of progression, or conditions below the flow line. A CCTV inspection cannot measure remaining wall thickness in a concrete pipe or quantify ovality in a plastic pipe to any meaningful precision. More significantly, CCTV cannot assess conditions obscured by flow: sediment accumulation, debris loading, or defor-

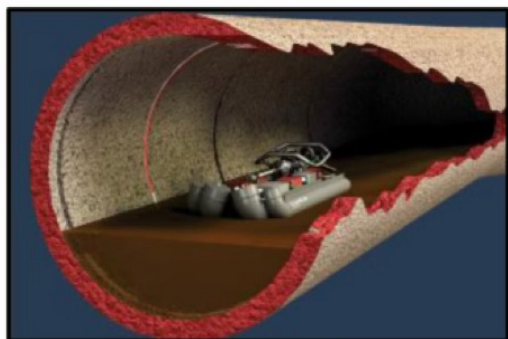
mation occurring at or below the waterline is effectively unobservable by camera, regardless of image quality.

For a program intended to establish a defensible, decade-long baseline condition dataset to support capital planning, this qualitative limitation was not acceptable. The program required quantified, repeatable measurements rather than descriptive observations.

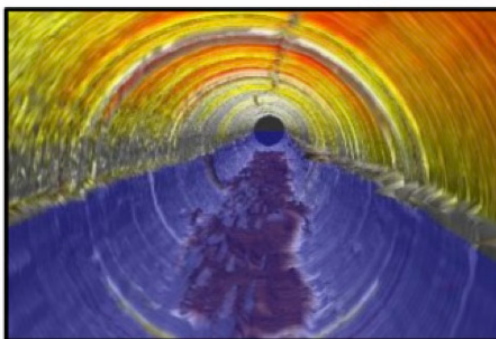
Multi-Sensor Inspection Technology

NTMWD's inspections are performed using the RedZone Robotics HDProfiler platform, which integrates three sensing technologies in a single inspection pass: laser profiling, high-definition CCTV, and sonar.

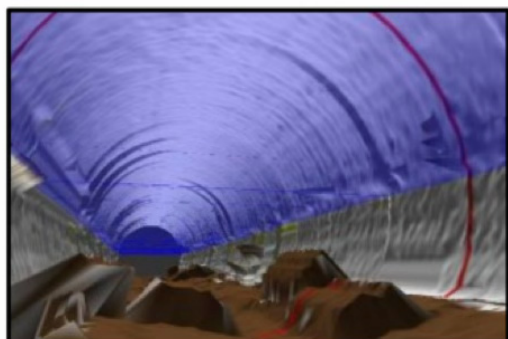
Laser profiling scans the unobmerged pipe wall and measures the inspected wall location against the original as-built geometry, to a stated margin of 0.1 percent. In concrete pipe, this differential quantifies wall loss due to corrosion in measurable units, rather than a qualitative descriptor such as “moderate corrosion observed.” In plastic pipe, the same geometric data is used to quantify ovality, which is correlated to estimated remaining useful life (RUL) using deflection thresholds developed in consultation with manufacturer guidance. HD



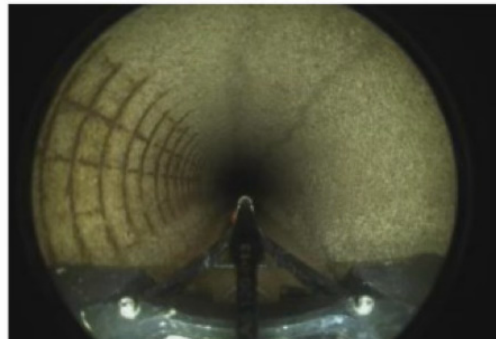
Multi Sensor Inspection (MSI)



3D Laser Inspection



Sonar Inspection



HD Video

CCTV is recorded concurrently and provides visual correlation to the laser and sonar data, allowing observed defects to be tied to a specific quantified location along the pipe.

Sonar addresses the portion of the pipe that CCTV cannot reach: the submerged pipe surface, including the invert. Sonar measures depth of flow and quantifies the height and volume of debris accumulated on the invert, and it can detect deformation in the submerged pipe wall to a stated margin of 0.4 percent. This capability – quantifying submerged debris volume and deformation – represents the most significant practical advantage MSI provides over CCTV-only inspection, and is discussed in greater detail below.

A Known Limitation of the Current CCTV Component

It is worth noting, in the interest of a complete and technically accurate account, that the CCTV component of the platform used throughout the program's first ten-year cycle employs a fixed fish-eye lens. This configuration provides a wide field of view but does not allow the operator to redirect or zoom the camera to a specific point of interest during review. As a result, minor surface defects – hairline cracks in particular – are, on occasion, more difficult to positively

identify than they would be with a steerable camera. This limitation is inherent to the fixed fisheye configuration rather than to the laser or sonar components of the platform, and it does not affect the quantitative wall-loss, ovality, or debris-volume measurements described above.

Having identified this limitation through nine years of field experience, NTMWD is planning to procure an upgraded MSI platform for its second ten-year inspection cycle that incorporates a 360-degree camera system. A 360-degree camera allows the operator to pan and reorient the field of view after the inspection pass has been recorded, rather than being limited to the single fixed perspective captured in the field. This is expected to materially improve the detection rate of minor structural defects, including hairline cracking, that are more easily missed under the current fixed fisheye configuration.

The Value of Quantified Submerged Data

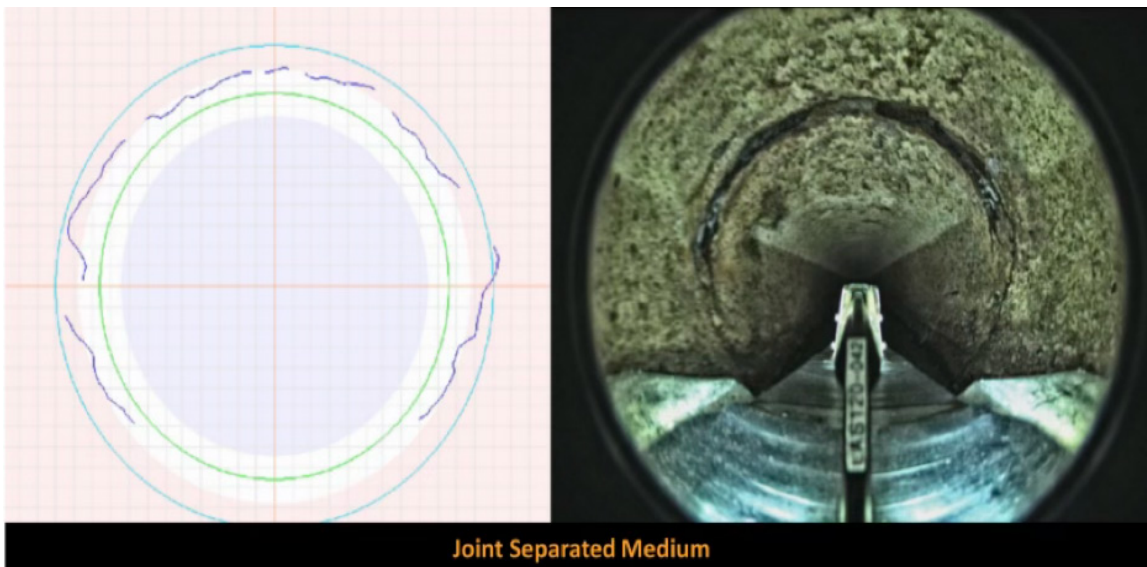
The practical significance of sonar-derived debris volume and submerged deformation data is best understood in the context of a typical field scenario. A gravity segment may appear entirely sound above the flow line – intact concrete, no

visible cracking, an unremarkable CCTV record – while carrying a substantial sediment load on the invert. CCTV alone provides no means of distinguishing a thin sediment film from a significant accumulation; sonar provides an actual measured volume.

This distinction directly changes the recommended course of action. Where a segment exhibits surcharging or reduced hydraulic capacity and sonar indicates a high sediment volume, the appropriate response is a cleaning contract followed by re-inspection, not a capital rehabilitation project. Under a CCTV-only assessment, the same segment could reasonably be flagged as a capacity or structural concern and advanced toward a rehabilitation recommendation it did not require. Conversely, sonar can identify invert deformation or a bellied section concealed beneath accumulated debris that a camera would not detect at all,

since the debris itself obstructs the view. This represents a genuine structural finding that a CCTV-only inspection would miss entirely, and one that, left unaddressed, is more likely to progress to an emergency failure than to be captured as a planned point repair.

Under a CCTV-only protocol, a segment that cannot be fully observed below the flow line is typically documented as “unable to assess below flow line,” and is then either assigned a conservative condition score it may not warrant, or advanced without further evaluation. Neither outcome is desirable: an unwarranted conservative score can direct capital toward a segment that requires only cleaning, while advancing an unassessed segment risks allowing a genuine structural defect to progress undetected. Sonar resolves this by converting “unable to assess” into a quantified value – a debris volume, a flow depth, a deformation measurement – that is incorporated into the same scoring framework applied to every other segment in the system. Across nearly 600,000 linear feet of inspected pipe, the cumulative value of this capability lies not in any single finding but in the program's consistent ability to distinguish an operations and maintenance issue from a capital one, and a genuine structural defect from a debris accumulation that would otherwise be indistinguishable from one another.



From Data to Decision: The Scoring Framework

Every inspected pipe segment is assigned a condition score from 1 to 5, based on estimated RUL. For concrete pipe, a deterioration rate per year is calculated from observed wall loss and pipe age, then extrapolated to a projected failure point, defined as less than 0.75 inches of remaining wall thickness based on the District's field experience. For plastic pipe, the score is derived from measured ovality against thresholds developed with manufacturer input. Additional structural defects – fractures, holes, or cracks – can escalate a segment's score independent of the calculated deterioration rate, since such defects indicate the pipeline has already failed structurally.

Segments inspected using sonar only – typically re-inspections performed following a cleaning recommendation – are not assigned an RUL score, since the pipe wall has not been directly observed in those instances. This distinction is a deliberate feature of the program's methodology: condition scores are assigned only where the underlying sensor data directly supports them.

Condition scores feed a risk-based prioritization model. NTMWD developed a hydraulic and asset model of its conveyance system using Innovyze InfoAsset Planner, scoring each asset on likelihood of failure (LOF) and consequence of failure (COF), each on a scale of 1 to 10, and multiplying the two to produce a total risk score out of 100. LOF incorporates the RUL score where available, along with material, age, maintenance history, and surcharge status. COF is assessed large-

ly independent of condition, based on accessibility, depth, traffic impact, environmental sensitivity, inflow and infiltration exposure, and redundancy. Criticality changes infrequently for a given asset, while condition changes continuously, which is the basis for repeating the inspection cycle at regular intervals.

Program Results

Through FY2025 approximately 702,607 linear feet of gravity pipeline – roughly 98 percent of the District's gravity system – and 1638 manholes had been inspected under the program. Approximately 5 percent of inspected footage, or roughly 36,420 linear feet, received critical RUL scores of 4 or 5 and was advanced directly to repair action. Of the manholes inspected, approximately 62 percent received a rehabilitation recommendation, the majority related to coating failure or frame-and-cover integrity, both of which represent direct sources of inflow and infiltration. Under the risk-based assessment, over 93 percent of gravity mains scored Low or Very Low risk, with approximately 1 percent scoring High or Very High. These results indicate a system that is, in aggregate, in sound condition, while providing a quantified and defensible basis for identifying and prioritizing the small proportion of assets that require near-term intervention.

Operational Requirements

The technical capability of the MSI platform is only part of the program's success; sustaining it operationally over

a decade presents its own requirements. Each inspection window requires coordination of flow control or temporary bypass pumping with District operations staff, scheduling of access with external inspection crews, and management of traffic control and confined-space entry procedures, particularly at manholes located within active roadways. Scheduling is routinely subject to revision based on weather, flow conditions, and

contractor availability.

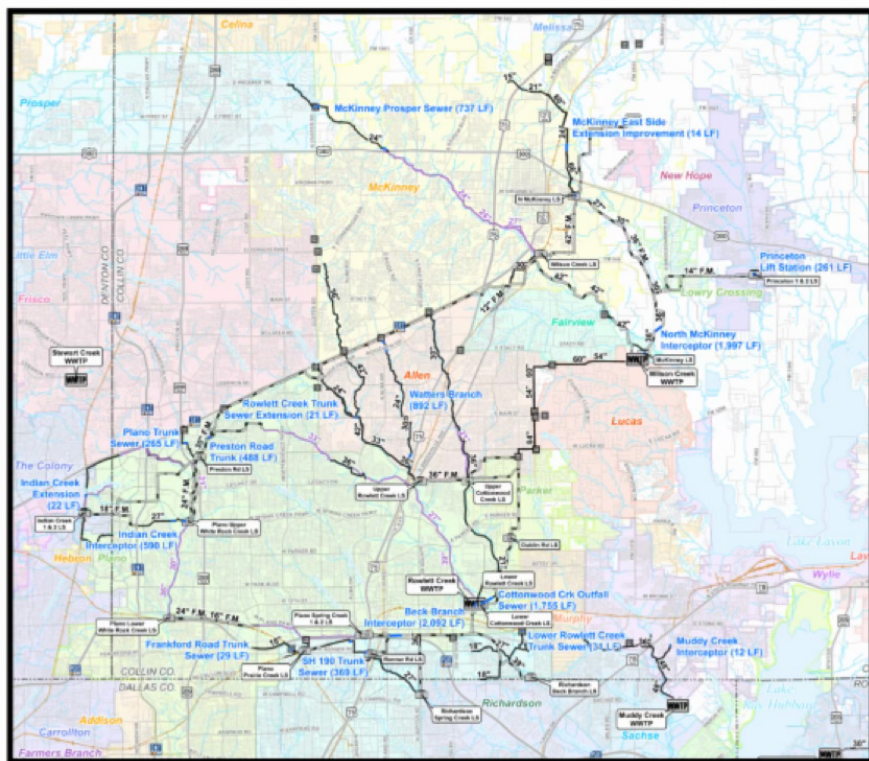
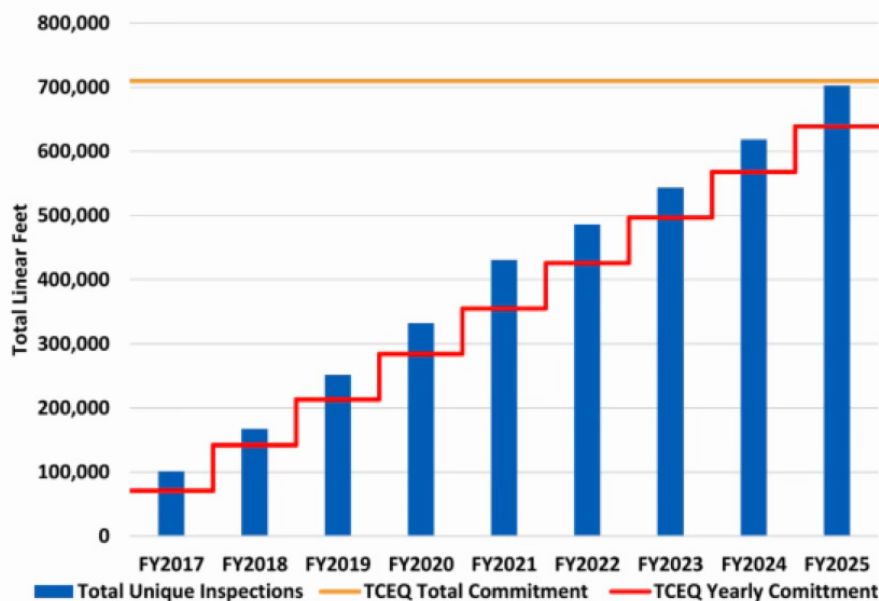
Manhole inspections follow a comparable logistical process only at a smaller scale. Manholes are inspected using a 3D optical scanner lowered into and drawn back up through the structure in a single pass, generating a point cloud that an operator can subsequently review to measure defects, corrosion, and frame or cover condition without requiring a repeat site visit.

Data management represents a further significant operational requirement. Each inspection generates laser, CCTV, and sonar data that must be processed, scored, and loaded into the District's asset management system, ITpipes, in a format consistent with Pipeline Assessment Certification Program (PACP) and Manhole Assessment Certification Program (MACP) standards, so that it remains usable to reviewers who were not present for the original inspection. NTMWD also engages an independent third-party vendor to perform quality assurance and quality control review of inspection data prior to its use as the basis for repair recommendations; this independent review has identified discrepancies that would otherwise have gone unaddressed and is considered a necessary component of a program of this scale.

Internal communication and cross-departmental coordination represent the most significant lesson learned over the program's first nine years. A program of this scope requires sustained engagement across operations, engineering, information technology, and finance, in addition to continuous coordination with

FY2025 Pipeline Inspection Plan

Gravity Main Inspections



subconsultants to maintain schedule and scope alignment. The information technology component in particular warrants specific attention: the data volumes and the number of distinct software platforms involved are readily underestimated,

and the District continues to work toward making inspection data accessible across user groups rather than remaining siloed within the system that originally captured it.

Looking Ahead

As the first ten-year CAP cycle concludes, NTMWD is initiating a second cycle. The District's full pipeline inventory will be reassessed at a minimum of 10 percent of the system annually, maintaining a current condition picture. As noted above, the second cycle will also incorporate an upgraded MSI platform featuring a 360-degree camera system, addressing the minor-defect detection limitation identified with the current fixed fisheye CCTV configuration.

The recognition received this year marks the completion of the program's first cycle. The observed outcome of nine years of multi-sensor inspection data is a quantified, defensible understanding of where risk actually resides within the system, including conditions below the flow line, ovality, and wall loss that a camera alone could never quantify. Those capabilities are the practical foundation of the District's asset management program going forward.

About Authors

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Amin Darabnough Tehrani, PhD, PE, is a recipient of the ISTT Academy Award and ASCE UESI's Younger Member Award and specializes in pipeline engineering. He is a member of multiple AWWA and ASCE committees and is actively involved in advancing the practice of pipeline engineering and infrastructure management. He currently serves as the Wastewater Conveyance Program Manager at the North Texas Municipal Water District.

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Scott Hoelzle has served the water and wastewater sector for over 25 years as both a consulting engineer and an operations manager for a public utility. He is currently employed by the North Texas Municipal Water District where he serves as the Manager of the Wastewater Conveyance System. The System provides service to approximately 1.6 Million people located north and east of Dallas and includes 25 lift stations, over 245 miles of large diameter pipelines, odor control facilities, and remote meter stations.

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Asset Management Through Material Optimization:

A Hybrid FRP–Steel Pipeline Solution for the Columbia Improvement District Irrigation System



Effective asset management begins long before a pipeline is placed into service. Although asset management is commonly associated with inspection, maintenance, and rehabilitation, many of the factors that determine long-term system performance are established during planning and design. Material selection, constructability, hydraulic efficiency, corrosion resistance, maintenance requirements, and life-cycle cost all influence the value an infrastructure

asset provides throughout its service life.

The Columbia Improvement District (CID) Pipeline Project in Oregon illustrates how an asset management philosophy can guide engineering decisions during design. Rather than selecting a single pipe material throughout the alignment, the project team evaluated the strengths and limitations of multiple materials and developed a hybrid system utilizing fiberglass reinforced polymer (FRP) pipe for the majority of the alignment and strategically located steel fit-

tings where restrained joints were required. This approach optimized constructability, reduced installation time, minimized long-term maintenance, and lowered life-cycle costs while satisfying structural and hydraulic requirements.

This paper demonstrates that selecting the appropriate material for each portion of an infrastructure system can significantly improve long-term asset performance and should be considered an integral component of asset management.

Water infrastructure owners are under increasing pressure to maximize the return on infrastructure investments while controlling construction costs, reducing maintenance, and extending service life. Traditionally, pipeline material selection has often been driven by familiarity, initial construction cost, or specification preferences. Asset management, however, encourages a broader perspective in which engineering decisions are evaluated over the entire life cycle of the asset.

The goal is no longer simply to build a pipeline that meets today's design requirements, but to develop an infrastructure system that minimizes risk, reduces operational costs, improves reliability, and provides sustainable performance for decades.

This philosophy aligns closely with modern asset management principles. Decisions made during design directly influence future inspection requirements, maintenance costs, rehabilitation frequency, hydraulic efficiency, energy consumption, operational reliability, and ultimately the total cost of ownership.

The Columbia Improvement District Pipeline Project provides an excellent example of this approach.

Project Background

Declining groundwater availability within Oregon's Umatilla Basin created an urgent need for a reliable irrigation water supply. To address this challenge, the Columbia Improvement District initiated construction of approximately 39,000 linear feet of large-diameter transmission pipeline to convey Columbia River water to agricultural users throughout the district. The system con-



sisted of approximately 39,000 feet of 72-inch pipeline operating at 180 psi plus surge pressure. The project was delivered through a public procurement process in which the material supply contract was separate from construction, requiring close coordination among the owner, engineer, supplier, and contractor.

Beyond the hydraulic demands, the project presented several engineering challenges, including a complex alignment with numerous horizontal and vertical curves, winter construction conditions, restrained joint requirements, and pressure demands exceeding the availability of standard restrained FRP coupling systems at this diameter. These constraints required the project team to evaluate alternatives beyond conventional single-material solutions.

Asset Management Begins During Design

Asset management is frequently associated with inspection programs, condition assessment, and rehabilitation planning. While these activities are essential, they occur only after the asset has been constructed. Many of the most significant opportunities to reduce future costs occur much earlier.

The selection of pipeline materials directly affects:

- service life,
- corrosion resistance,
- hydraulic performance,
- constructability,
- maintenance frequency,
- energy consumption,
- operational reliability, and
- future rehabilitation requirements.

Consequently, selecting the appropriate material should be viewed as an asset management decision rather than simply a design choice.

For the CID project, engineers evaluated multiple alternatives while considering both initial construction and long-term operational performance.

Evaluation of Alternative Material Systems

All-Steel Pipeline

Steel has long been used for high-pressure transmission systems because of its strength and ability to accommodate fully restrained welded joints. However, when evaluated from a life-cycle asset management perspective, several disadvantages became apparent for this project.

Construction during winter conditions would have significantly reduced welding





rapid installation provided maximum benefit. Steel fittings were incorporated only at locations where restrained joints were required to resist thrust forces generated at bends and major alignment changes. Custom-designed FRP-to-steel adapters allowed seamless integration between the two materials while maintaining compatibility with standard FRP couplings.

This solution demonstrates a fundamental principle of asset management: infrastructure systems should be optimized according to functional requirements rather than constrained by a single material selection philosophy.

Constructability as an Asset Management Strategy

Constructability is frequently viewed as a contractor concern; however, it also represents an important asset management consideration because construction complexity directly affects project cost, schedule, and risk.

The hybrid system reduced field welding, minimized heavy lifting requirements, and allowed most alignment changes to be accommodated using standard FRP couplings capable of angular deflection. Steel fittings were required only at critical locations, while FRP pipe lengths were optimized for transportation, handling, and rapid assembly.

Installation productivity exceeded approximately 1,500 feet per day compared with approximately 700 feet per day for a fully welded steel system under similar conditions, despite construction occurring during winter.

From an asset management perspective, reduced construction duration lowers project risk, minimizes labor exposure, and accelerates delivery of infrastructure into service.

Life-Cycle Value Engineering

The project team continued applying asset management principles during detailed design through value engineering.

Approximately 1,000 feet of steel pipe was replaced with FRP where structural demands permitted. In addition, approximately half of the pipeline was increased to a 75-inch diameter, allowing efficient nesting of 72-inch pipe during transportation while also improving hydraulic performance. The optimized design reduced shipping costs, simplified logistics, lowered pumping energy requirements, and achieved an estimated

productivity and extended installation schedules. Steel pipe sections also require heavier lifting equipment, extensive field welding, and additional field operations associated with welded pipeline construction, increasing labor demands and installation complexity. Depending on the project-specific service environment and design approach, steel pipelines may also require corrosion protection measures, such as protective coatings, cathodic protection systems, sacrificial anodes, or additional corrosion allowance. Over the long term, corrosion and internal roughness can reduce hydraulic efficiency, potentially increasing pumping costs and maintenance requirements.

Although structurally suitable, the all-steel option represented a less favorable solution from a constructability and life-cycle asset management perspective.

All-FRP Pipeline

FRP provided numerous advantages aligned with long-term asset management objectives.

Its corrosion resistance eliminates the need for cathodic protection while maintaining a smooth internal surface that minimizes head loss throughout the pipeline's service life. Lightweight construction simplifies transportation, handling, and installation while reducing equipment requirements. Standard double-bell couplings also enable rapid installation without welding, electrici-

ty, or specialized welding crews.

However, the project also exposed practical constructability limitations for an all-FRP solution under the specific project conditions. While restrained joints using flanges and field laminations are well-established methods for FRP pressure pipelines, implementing these systems efficiently for a 72-inch-diameter, high-pressure pipeline during winter construction presented significant constructability and schedule challenges. Extensive field laminations would have required considerable field labor and curing time under cold weather conditions, increasing installation complexity and reducing productivity. So, relying on field laminations throughout the project was not considered the most efficient solution. Concrete thrust blocks were also evaluated but were not preferred by the owner because of constructability considerations. Consequently, neither a conventional all-steel nor an all-FRP solution provided the optimum balance of constructability, schedule, and long-term asset management objectives.

Hybrid Material Optimization

Rather than selecting one material throughout the entire alignment, the project team adopted a hybrid approach.

FRP pipe was utilized throughout the majority of the alignment, where its corrosion resistance, hydraulic efficiency, and



30 percent cost savings compared with all-steel or all-FRP alternatives.

These decisions illustrate that value engineering should not focus solely on reducing initial construction costs. Instead, it should seek to maximize the total value delivered throughout the asset's service life.

Manufacturer Collaboration as Part of Asset Management

Modern asset management extends beyond utility owners and designers. Material manufacturers increasingly contribute engineering expertise during project development, helping optimize constructability, cost, logistics, and long-term performance.

On the CID project, Thompson Pipe Group (TPG)'s ability to manufacture both FRP and steel pipeline systems proved particularly valuable. Unlike suppliers limited to a single material, TPG evaluated the project as an integrated system rather than attempting to maximize the use of one product. This flexibility enabled the development of a project-specific hybrid solution that combined the corrosion resistance and hydraulic efficiency of FRP with the structural advantages of fabricated steel fittings only where required.

TPG also designed and manufactured

the custom FRP-to-steel transition adapters, coordinated fabrication of both material systems, optimized pipe lengths for transportation and installation, and supplied the complete hybrid pipeline under a single procurement package. Single-source responsibility reduced coordination risks between suppliers, improved compatibility among components, simplified logistics, and accelerated responses during construction.

Lessons for Asset Management

The CID project demonstrates several important asset management principles.

First, selecting the appropriate material for each application often produces better long-term performance than requiring a single material throughout an entire system.

Second, constructability should be recognized as a component of asset management because safer, simpler, and faster construction reduces project risk and overall cost.

Third, hybrid infrastructure systems can capitalize on the strengths of multiple materials while minimizing their individual limitations.

Finally, life-cycle thinking should guide engineering decisions. Corrosion resistance, hydraulic efficiency, maintenance requirements, transportation logistics, installation

productivity, and future operational costs are all interconnected and should be evaluated together rather than independently.

Conclusions

The Columbia Improvement District Pipeline Project demonstrates that asset management begins during infrastructure planning and design. By evaluating both initial construction and long-term operational performance, the project team developed a hybrid FRP-steel pipeline system that balanced structural requirements, constructability, hydraulic efficiency, corrosion resistance, and maintenance considerations.

Instead of viewing pipeline materials as competing alternatives, the project illustrates the value of integrating complementary materials into a unified engineering solution. The resulting hybrid system improved installation productivity, reduced construction costs, minimized future maintenance requirements, and enhanced long-term asset performance.

As utilities continue to face aging infrastructure, increasing financial constraints, and growing expectations for sustainable investment, projects such as the CID Pipeline demonstrate that material optimization can become a powerful asset management strategy. Rather than asking which material is best, engineers should ask which material is best suited for each portion of the system. That shift in perspective represents one of the most important opportunities to improve the performance and value of future buried infrastructure assets.

About Authors Sanaz Ghalambor



Sanaz Ghalambor, PhD, is a Technical Resource Engineer at Thompson Pipe Group with over 20 years of experience in pipeline

solutions, with a strong emphasis on polymer-based pipeline protection, corrosion control, and rehabilitation. She actively contributes to ASTM, AWWA, and ASCE committees, advancing standards and best practices in pipe design, trenchless technologies, and infrastructure renewal.

Carl Pitzer



Carl Pitzer, PE directs Thompson Pipe Group's trenchless division. A graduate of Oregon State University, he began his career with Kiewit Construction building bridges before transitioning to underground infrastructure in 2015.

A licensed Washington Civil Engineer, Carl actively presents and contributes to industry organizations, advancing trenchless technology education nationwide



CHAPLAIN'S CORNER

Dr. Lee Iseley, Naperville, IL

It has been an honor for me to have been appointed as BAMI-I's Chaplain. This appointment was made in conjunction with BAMI-I 1st GBAMC (Global Buried Asset Management Conference) in Chicago. I opened the event with a prayer of dedication. I have monitored the progress of BAMI-I during these years that followed through the Journals. It seems God is answering that prayer and continue to bless BAMI-I. The Scriptures have much to say about stewardship. That includes God's creation which includes water. Asset management of our underground infrastructure is all about being good stewards of how we handle water assets.

A term I hear often is the word "influencer." Various internet entities offer opportunities for people to influence others. The result is that little-known personalities are finding themselves being followed by thousands of people!

There have been many people who have influenced my life, but one that stands out in my family is my father, E. T. Iseley. He was a bi-vocational underground construction worker and minister. The combination of these two jobs kept him busy seven days a week. My dad had two sons and his vocational interest has been carried on in our family for years. My brother, Dr. Tom Iseley is a Civil Engineer teaching at Purdue University, and I am a semi-retired minister serving in churches in Illinois and beyond. After working with my father and brother building brick manholes, laying water and sewer pipe, operating heavy construction equipment, etc., following after my father's commitment to the ministry seemed like the best route. Tom chose following his water and sewer vocation. It is wonderful to have this opportunity to work with him and be of service to this unique organization.

I mention this subject because each person influences others. What does it take to be successful in this endeavor. Three characteristics immediately come to mind – commitment, perseverance, and integrity. The tasks of life are not easy and often are met with failure before success is realized. Actually, commitment and perseverance go hand-in-hand. It is hard to think of any job that requires only one of these two qualities. Of course, integrity is paramount to ultimate success, both individually and corporately. May each of us lead with unquestioned integrity.

Let's keep our eyes on the goal. The struggles and successes are influencers for those who come behind us!

As your BAMI-I Chaplain, I am always available to be of service. Please do not hesitate to contact me at lkiseley@att.net should you have question or just need to discuss issues.

PURDUE'S WRF 5365 PROJECT

Gets Underway with Strong Industry Support

By Wei Liao



Figure 1. The project's four-theme research framework. Governance supports detection and quantification, assessment, and mitigation.

The Water Research Foundation (WRF) has awarded Project 5365 to Purdue University to develop the “State-of-Practice Manual for Inflow and Infiltration Detection and Mitigation at Street and Private Lateral Levels.” The project is underway, bringing together research, utility experience, and industry expertise to develop a practical Manual of Practice (MOP) for utilities and municipalities.

The Purdue research team is led by Principal Investigator Dr. Dulcy Abraham and Co-Principal Investigator Dr. Tom Isley. The team also includes graduate research assistant Sihan Zhou and research engineer Wei Liao. BAMI-I's technical network and buried asset management expertise also support the project.

As of September 9, 2026, the project has received support letters from 32 partners which include utilities, technology providers, consultants and an International Advisory Council. The kick off meeting with WRF and its Project Advisory Committee (PAC) took place on August 17, 2026 followed by discus-

sions with partners on August 20 and 21, 2026. A preliminary literature synthesis and draft survey and interview questions provide a foundation for the next stage of research.

Building the foundation for a practical manual

Project preparation has included internal planning, a Quality Assurance Project Plan, communication procedures, and partner coordination. The work plan is organized into four connected phases: Investigation, Communication/Knowledge Exchange, Evaluation, and Validation. Surveys, interviews, workshops, and technical review will allow practitioner experience to inform the research throughout the project.

A key deliverable of the Investigation Phase is a literature synthesis based on published technical guidance, research literature, utility and municipal documents, and practitioner resources relevant to I/I detection and quantification, assessment, mitigation, and governance.

Initial comparison tables address the

spatial and temporal resolution of detection methods, corrective actions matched to confirmed I/I sources, and lateral responsibility boundaries. Together, these comparisons connect source identification with implementation and evaluation. As shown in Figure 1, the research framework links detection and quantification, assessment, and mitigation, with governance supporting all three. This structure provides a common basis for organizing the literature review, partner input, and subsequent evaluation tasks.

Early project work highlights issues that need to be considered alongside technology selection: ownership, definitions of success, homeowner participation, and maintenance. The following insights are preliminary. Their purpose is to invite industry input and guide further investigation.

EARLY INSIGHTS FROM INDUSTRY COLLABORATION

Assessment: define the problem before choosing measures of success

PAC and partner discussions have en-

couraged the team to examine why each utility undertakes an I/I program. ParThey have also highlighted that short-duration peak-flow problems associated with overflows and building backups may require different evaluation time scales from longer-duration treatment-plant impacts. As illustrated by the technical discussion shown in Figure 2, Andy Lukas is contributing practical monitoring experience to help connect program objectives, investigation methods, and measures of success. These perspectives are helping connect I/I control program objectives, investigation methods, and measures of success.

The literature synthesis distinguishes implementation, source-correction, hydraulic, service, economic, and long-term outcomes. Inspection counts, changes in peak flow, fewer backups, and avoided costs measure different things. Keeping these outcomes distinct will support case comparisons without treating every reported benefit as measured I/I reduction.

Mitigation and verification: repair completion does not demonstrate I/I reduction

Partner and PAC discussions have emphasized an important distinction between identifying a visible defect, a confirmed active I/I source, a completed repair, and a demonstrated hydraulic benefit. Completion a project does not necessarily establish actual I/I reduction. This distinction is central to the planned evaluation of technologies and practices.

The Purdue team will examine how corrective actions are matched to verified sources and followed by quality assurance, construction acceptance, and performance verification. The evaluation will also consider rainfall and groundwater conditions, monitoring quality, and before-and-after comparison methods so that reported project completion can be distinguished from demonstrated performance.

The review also distinguishes infiltration through a defective lateral or connection from inflow entering through building or site drainage connections, such as roof leaders, sump pumps, or foundation drains connected to the sanitary sewer. These sources require different corrective actions. Identifying the pathway first helps define the work, the parties who need to participate, and the evidence needed to evaluate the result.

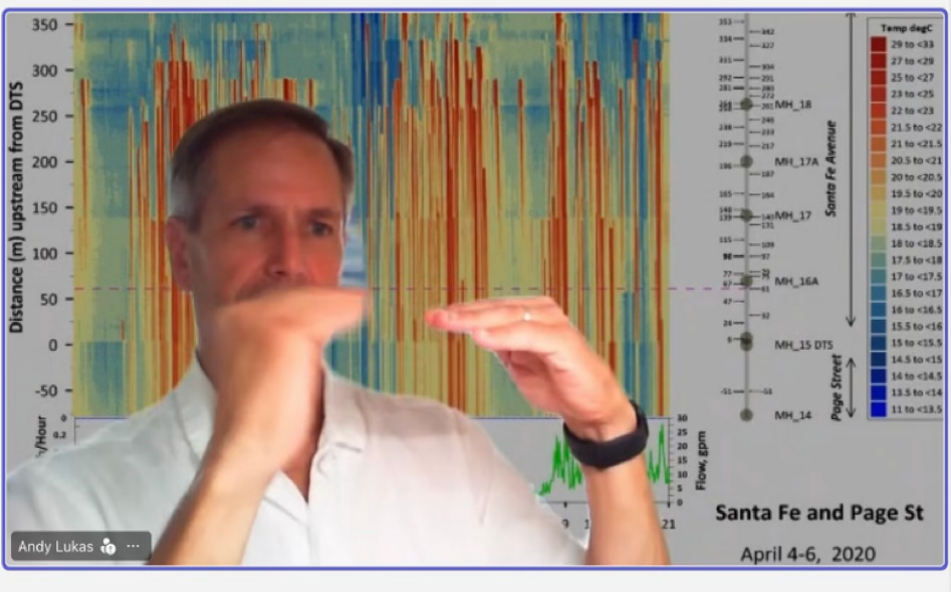


Figure 2. Andy Lukas of Brown and Caldwell shares technical insights during the WRF 5365 hybrid partner meeting on August 21, 2026.

Implementation: Homeowner participation and long-term maintenance matter

Partner discussions have also drawn attention to homeowner communication and the practical limits of requiring cor-

rective action. The literatue synthesis distinguishes owner response, access authorization, inspection, repair decisions, and completion of the required corrective work. Examining these steps separately can show where a private-property program encounters delays or loses participants.

Partner and PAC input has extended the research focus beyond construction

Ace Pipe Cleaning, Inc.	Loudoun Water, Ashburn, VA
Atakapa Services, Inc.	MWS of Nashville and Davidson County, TN
Blue Heron	National Plant Services
Brown and Caldwell	Perma-Liner Industries (Singapore) Pte Ltd
CDM Smith	Pinellas County Utilities, Largo, FL
China Hong Kong Society for Trenchless Technology, Hong Kong	Pitts Fowler Enterprises, Inc.
City of Pompano Beach, FL	Sacramento Area Sewer District
City of Revere, MA	SANIPOR
Columbia Water, SC	South Carolina State University
Confluence Trenchless Solutions, LLC	Stamford WPCA, CT
County of Fairfax, VA – Department of Public Works and Environmental Services	Trenchless Groundwater Movers
Fort Wayne City Utilities Engineering, IN	TriCo Regional Sewer Utility
George E. Kurz, P.E. (TN), DEE (individual consultant)	Underground City Oy, Finland
Halifax Water	University of Birmingham, U.K.
HNTB	Waggoner Engineering
Hanouf Alhumaidi,Kuwait University, Kuwait	Waugh Infrastructure Management Ltd., New Zealand

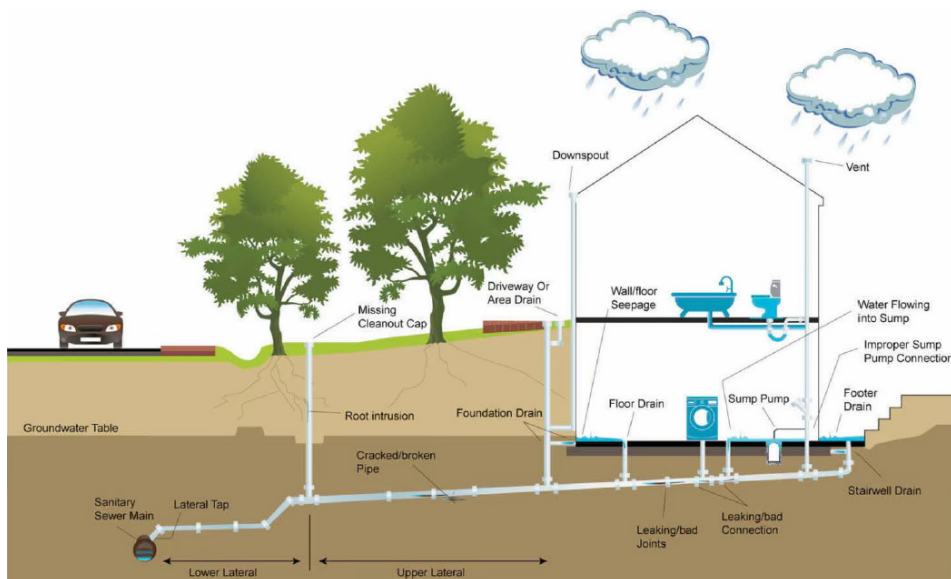


Figure 3. Common sources and pathways of infiltration and inflow associated with private property and sewer laterals.
Source: Water Environment Federation (2016), *Private Property Infiltration and Inflow Control*.

to protecting completed repairs, continued monitoring, and long-term maintenance responsibility. Case studies and interviews will be used to help examine how rehabilitated assets can be identified, protected, and maintained over time.

Governance: Lateral ownership shapes program design and delivery

One issue receiving particular attention is how lateral ownership and responsibility boundaries shape an I/I program, well beyond who pays for repairs. These boundaries affect who can arrange inspections, coordinate corrective work, and maintain the asset afterward. The draft survey asks about ownership, access authority, payment, restoration, and long-term maintenance separately, so the team can see not only where a boundary is drawn but how utilities organize work across it.

Partner and PAC discussions have reinforced that lateral ownership and responsibility vary substantially among utilities. The Purdue team is examining how these differences affect inspection and testing requirements, right-of-entry arrangements, homeowner communication, incentives, enforcement, restoration, and long-term maintenance.

PAC discussions have added practical perspectives on responsibility for the work itself, including cases in which a municipality performs work on a privately owned lateral while the homeowner later bears the consequences of poor

restoration. . Utility experience has underscored the additional budget, staffing, and operational demands that can arise when responsibility extends toward the building. These perspectives reinforce the need to define restoration duties, work quality, resources, and ongoing obligations—not simply ownership.

Partner discussions have also highlighted cases in which work on mainlines and manholes alone could not address system-wide I/I, requiring utilities to consider private laterals as part of the solution. These examples will inform case-study review of the authority, access, funding, and implementation conditions needed to address sources on private assets.

The literature synthesis groups program/I control approaches into incentive-based, enforcement-based, and utility-led models. It also distinguishes the reason for adopting an approach—such as capacity needs or regulatory compliance—from the mechanism used to carry it out. The aim is to understand the implementation conditions, not to assume that one ownership model or policy mechanism suits every community. Figure 3 illustrates common private-property I/I pathways, including defects in laterals and connections as well as building and site drainage sources. The figure helps show why ownership, access, and responsibility must be considered together with source identification when designing an I/I control program.

Industry support is shaping the next stage

Project partners are contributing technical advice and have offered documents, case studies, and professional time. Committed in-kind support substantially far exceeds the project's minimum requirement, with commitments covering technical review, interviews, data sharing where possible, and workshops.

Partners have offered case-study leads, technical resources, utility experience, and potential data-sharing opportunities. Examples include distributed temperature sensing resources and cases involving infiltration control, private laterals, rehabilitation, and asset-record integration. These contributions will be reviewed as potential inputs to the project's case studies and technology and practice evaluation.

The project's International Advisory Council includes partners from Finland, New Zealand, Hong Kong, Kuwait, the United Kingdom, and Singapore. WRF's PAC provides a separate channel of technical guidance, with project coordination supported by Research Manager Jessica Metcalf and Project Administrator Corina Santos.

In the next stage, partner feedback, surveys, interviews, and case studies will deepen the evidence for evaluation and validation. Utilities and practitioners are invited to contribute relevant program documents, monitoring records, case examples, and lessons from both successful and less successful approaches. Case information may be anonymized where needed.

The Purdue team and BAMI-I thank all project partners, contributors, WRF staff, and PAC members for their time and continued support.

Additional Organizations — Support Letters Pending

Insituform Technologies; NASSCO; P3i-Tech Pte Ltd.

The team also acknowledges Kirkkonummi Water Utility and Great Lakes Water Authority for participating in the early technical exchanges.

Project information inquiries: Dr. Dulcy Abraham, dulcy@purdue.edu; Dr. Tom Iseley, diseley@purdue.edu.



Figure 1. The GM8000 stepped-frequency MCGPR array, shown towed behind a survey vehicle. The same modular array also runs in a push-cart configuration for footpaths and constrained sites.

MAP MORE, TRENCH LESS

Latest generation multichannel GPR (MCGPR) as a new baseline for large-scale utility mapping leveraging on real-time 3D imaging, uninterrupted positioning in GNSS-challenged environments, and a cloud workflow built for distributed SUE teams.

By Dan Broekhove and Alex Novo

Beneath every street sits a dense, layered network of water, gas, sewer, power and telecom lines. Before anyone excavates, that network has to be found, because striking a live utility means safety incidents, service outages and blown schedules. The catch is that records for assets installed decades ago are often missing, outdated or simply wrong, so a desk study is only ever a starting point. Field investigation is where certainty is earned. Ground penetrating radar (GPR) has become a mainstay of that field work: it is non-destructive, it detects metallic and non-metallic targets alike, it images trenches, voids and changes in backfill, and, unlike point tools, it returns continuous subsurface coverage. Its limits are real (clay-rich, highly conductive soils attenuate the signal), but for most surveys it remains the workhorse. For large jobs

“For large jobs the question has never been whether to use GPR, but how to cover more ground, faster, without trading away confidence.”

the question has never been whether to use GPR, but how to cover more ground, faster, without trading away confidence.

From a single line to a rolling 3D picture

That is exactly what multichannel GPR (MCGPR) changes. The GM8000 is a modular, stepped-frequency continuous-wave (SFCW) array. In its utility configuration it captures 23 channels across a 1.67 m swath in a single pass, at road speed rather than walking pace. In prac-

tice, a large intersection or a multi-lane corridor is covered in a handful of passes instead of dozens of hand-pushed lines. Densely spaced channels mean better target continuity between lines and far less interpolation. The guesswork that erodes confidence when parallel single-channel profiles are stitched together. Fewer passes also means less time exposed in live traffic, which is its own safety dividend.

The platform is deliberately modular: the array towed behind a vehicle for open corridors and intersections or deployed in a push-cart configuration for constrained sites. One data model, one workflow, whatever the site demands.

Seeing the answer while you are still on site

The bigger shift is that the operator no longer drives blind and hopes. The GM8000 renders a georeferenced 3D

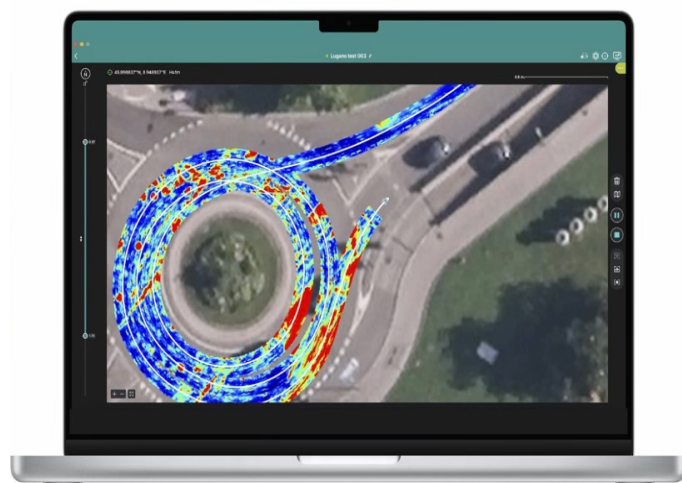


Figure 2. Georeferenced MCGPR data rendered live over aerial imagery during an urban survey. A white trajectory indicates a fixed RTK position; operators verify coverage against satellite and CAD / GIS as-built layers while still on site.

view of the subsurface live, laid directly over satellite imagery and, critically, over the client's own CAD / GIS as-built layers. Linear features line up (or do not) against the record drawing in real time. Coverage gaps, missed lines and obvious mismatches with the as-built are caught on the spot, not three weeks later at a desk. That in-field verification loop is where revisits and re-mobilizations quietly disappear from a project's cost.

Positioning where GNSS gives up

Dense urban mapping is where positioning usually breaks down: tree canopy, tall buildings and underpasses drop the satellite fix exactly where utilities are densest. The GM8000's Visual Inertial Positioning System (VIPS) is built for that. It fuses dual-antenna RTK GNSS with an IMU, wheel odometry and camera-based visual odometry "deep fusion" to hold a centimetre-grade trajectory through outages. Where a GNSS-degraded section is anchored by a fixed RTK position before and after it, the cloud automatically bundle-adjusts that segment back into place on upload. Positioning errors during limited-signal outages are held to roughly 0.1% of distance travelled (about 0.3m worst case).

One dataset, many desks

Field data syncs automatically to the cloud (Screening Eagle Workspace), where it is stored and processed, making it available to whoever needs it, wherever they are. A crew in the field, an interpreter in another city and a QA / QC reviewer can all work on the same dataset instead

of emailing project files, or mailing hard disks, back and forth. For firms running distributed teams, that turns interpreta-

tion and independent review into a parallel, auditable process rather than a serial bottleneck.

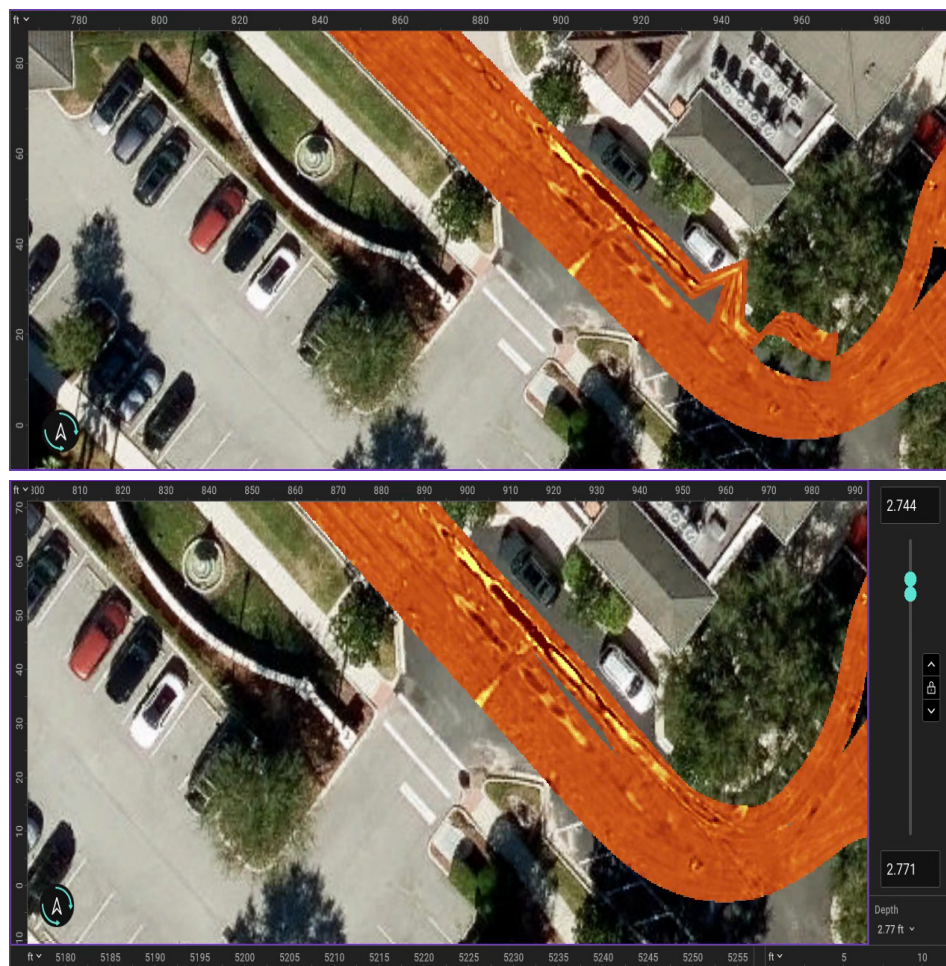


Figure 3. Positioning through GNSS degradation. Top to bottom: a GNSS-only trajectory drifts; real-time deep fusion (VIPS) holds the line; cloud bundle-adjustment refines the final trajectory after upload. Example of trajectory correction, (top image without and bottom image with).

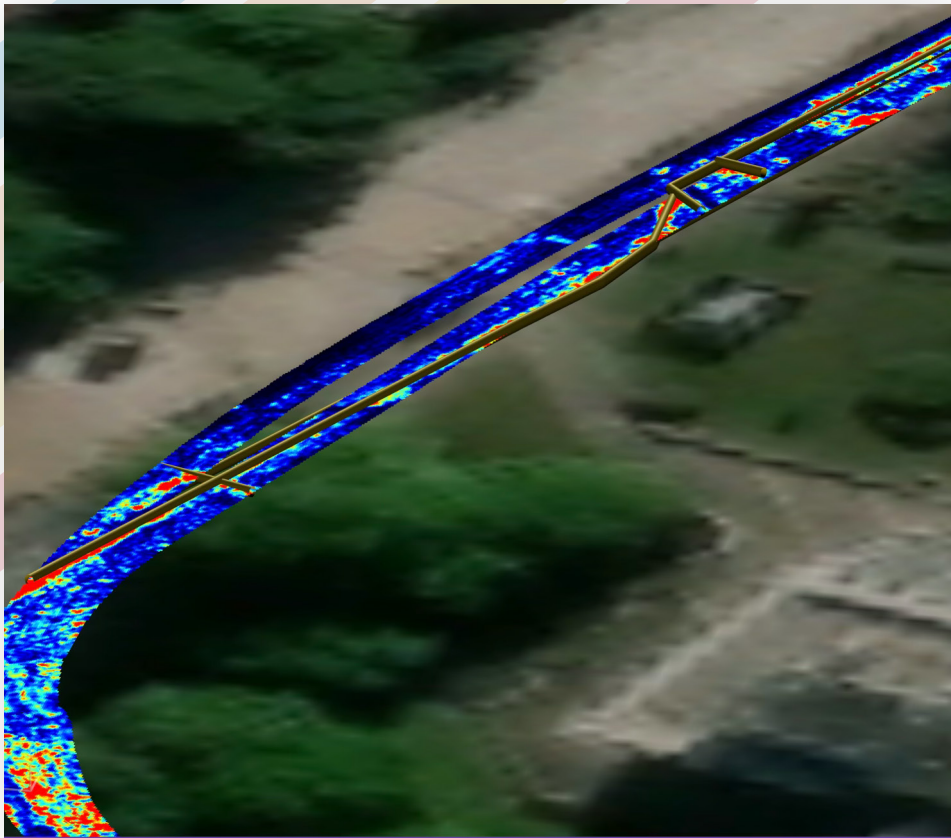


Figure 5. Multichannel data with utilities drawn in 3D for clear analysis

Where it lands in ASCE 38-22

For SUE practitioners the relevant question is always: which quality level, and can you defend it? Under ASCE / UESI / CI 38-22, the current Standard Guideline for Investigating and Documenting Existing Utilities, surface geophysical designating sits at QL-B, the minimum grade for design decisions and the tier that GPR and electromagnetic locating are built to serve. Dense, continuous MCGPR coverage strengthens the QL-B layer and, just as importantly, documents

the basis for every depicted line including the raw radargram, the trajectory, and the processing so the achieved quality level is traceable, not merely asserted. Better QL-B coverage also sharpens where scarce, expensive QL-A test holes actually need to go, concentrating vacuum excavation on genuine conflicts rather than scattering it on guesses.

What it means for SUE

The economics of SUE have never really been in dispute. Independent studies going back to the landmark 1999 FHWA-funded work have put returns on

the order of several dollars saved for every dollar invested, driven by avoided damage, fewer relocations and shorter schedules. What MCGPR adds is throughput and confidence at the same time. More coverage per shift, denser data, real-time verification and defensible positioning, all feeding a cloud record the whole team can stand behind. For an industry whose core promise is “know before you dig,” that is a meaningful move of the baseline.

About Authors

Dr. Alexandre Novo



Dr. Alexandre Novo is a SVP Head BU Subsurface Insights GPR with 20+ years of international experience leading innova-

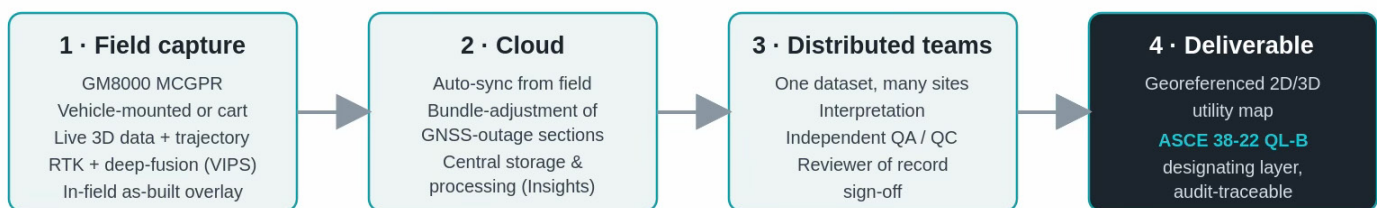
tion, strategy, and commercialization of advanced sensing and geospatial technologies. Expert in Ground Penetrating Radar (GPR), digital products, AI-enabled workflows, and subsurface infrastructure solutions, with a strong track record of translating research into commercially successful products.

Dan Broekhove



Dan Broekhove is the GPR Business Development Manager for the Americas at Screening Eagle Technologies, specializing in Ground Penetrating

Radar (GPR), subsurface utility mapping, and advanced non-destructive testing technologies. With more than a decade of experience in the geophysical and infrastructure industries, Dan works closely with engineering firms, utility locating companies, contractors, and municipalities to implement GPR solutions for locating and mapping underground utilities and infrastructure.



Where it sits in the ASCE 38-22 quality-level ladder



Dense, continuous QL-B coverage narrows where costly QL-A test holes are actually needed — and documents the basis of every line.

Figure 4. One field dataset flows to the cloud, where distributed teams interpret and independently QA / QC it, producing a traceable QL-B designating layer under ASCE 38-22.

FROM SIGNAL TO SITE

How Xinyu turned a vehicle-canine concept into a practical utility workflow

By Yaqin Xiang, Jia Zhou, Bin Ruan, and Haosheng Xiong

Hong Kong and China Investment Limited, Shenzhen, China.



Field photographs 1. Canine searches along a planted verge (left) and a paved street edge (right).

In leak detection, finding a signal and finding a repairable asset are not the same job. A mobile platform can screen long street corridors and show a crew where the air deserves a closer look. A trained dog and handler can enter the spaces a vehicle cannot and track the characteristic scent used to odorize distribution gas. Neither, by itself, produces a repair decision. The utility still needs field verification, asset knowledge, safety judgment and a documented handoff.

That gap between a field signal and action defined the project in Xinyu City, China. The project brought together the local gas utility, Southeast University and U-Tech Engineering Company Limited around a simple operating question: how can a utility move from network-level screening to a location its field team can

investigate and manage?

The project connected mobile screening, canine search, instrument verification and utility follow-up. The project received the UESI 2026 Best Project Award at the Pipelines Conference in Detroit.

THE LAST MILE OF LEAK DETECTION

Urban distribution systems are not laid out for the convenience of an inspection crew. Pipes run beneath roads, courtyards and landscaped areas. Service connections emerge beside buildings. Walls, parked vehicles, traffic and changes in surface cover all shape what a crew observes in the field. A road-based reading can narrow the search, but it does not automatically identify the asset that requires attention.

That is the practical “last mile” of leak detection. The mobile team asks, Where should we investigate? The dog-handler team asks, Where is the odor trail strongest and repeatable? The verification technician asks, Can an instrument confirm that this location requires utility attention? The owner then asks, What asset is involved, what is the immediate safety response and

what happens next?

Treating those questions as one undifferentiated task creates confusion. Treating them as a planned sequence creates a manageable field operation.

A RELAY, NOT A RACE

The Xinyu project worked because each participant had a distinct job.

The mobile survey team created reach and context. Its role was to screen accessible corridors and turn atmospheric observations into a focused field assignment. It did not declare a repair location.

The canine and handler team supplied access and search judgment. The dog tracked the odorized-gas scent rather than measuring methane, while the handler interpreted behavior in light of wind, surfaces, traffic, distractions and the animal’s condition. A canine response was a search cue, not a final diagnosis.

The verification technician performed a separate instrument check. Handheld measurements gave the utility information it could evaluate alongside the search record. If the result was unclear, the correct response was not forced certainty; it was

“The innovation was not a dog added to a vehicle. It was a disciplined handoff between signals, people and decisions.”



Field photographs 2. Canine search in ground vegetation (left) and the associated handheld instrument check (right).

another check or a return under more suitable conditions.

The utility team supplied asset knowledge and decision authority. Its staff understood the network, controlled access, evaluated immediate safety needs and owned the follow-up. Without that role, even a well-localized search cue could remain disconnected from maintenance.

This division of responsibility prevented the project from becoming a contest over which tool was “best.” Coverage, access, confirmation and action are different functions. The operating value comes from connecting them.

THE FIELD DAY STARTS BEFORE THE VEHICLE MOVES

A successful survey day begins with a shared plan, not a sensor. Before deployment, the teams need agreement on the target area, safe access, communication channels, stopping rules and who has authority to escalate an observation.

The same discipline applies to the working dog. Heat, cold, traffic, noise, surface conditions, hydration, rest and the dog’s behavior are operational variables, not side notes. The handler must be able to pause or end a search without pressure to produce an alert. Protecting the animal also protects the quality of the work.

The Xinyu campaign ran through winter, making contingency planning especially important. In any urban deployment, changing conditions can make a planned route inaccessible or place a search area beyond immediate public access. Field teams therefore need the authority to adapt the sequence while keeping the verification standard unchanged.

THE ALERT IS NOT THE ANSWER

Canines are compelling to watch, and that creates a communications risk. A photograph of a dog indicating near a pipe can easily be interpreted as proof that a leak has been found at that exact asset. The field process is more careful.

A surface search cue can guide follow-

up without, by itself, establishing the exact asset that requires attention. That is why the Xinyu workflow kept a deliberate boundary between canine search and utility confirmation.

This boundary is important for safety and credibility. It avoids two opposite errors: treating every response as a confirmed leak, or dismissing canine work because it does not replace an instrument. The dog is neither a laboratory analyzer nor a novelty. It is a specialized search partner within a controlled field-verification process.

For utilities considering a similar approach, the confirmation rule should be settled before the first deployment. Everyone should know what evidence advances a field alert, what triggers a repeat check, what requires immediate action and what remains unresolved. A consistent rule is more valuable than a dramatic field anecdote.

BUILD ONE CHAIN OF CUSTODY FOR EVERY FIELD ALERT

The project record should tell the story of a decision without exposing sensitive infrastructure information. Internally, that record needs enough detail to connect the screening assignment, the canine search, the verification result, the relevant asset context and the utility’s disposition. Externally, the same record must be stripped of precise locations, route maps, customer information and instrument screens before it is used in a presentation or article.

This is where project management and publication discipline meet. The most useful field photographs are often the most sensitive: they may show a building number, a vehicle plate, a GIS screen or an identifying asset. Permissions and redaction cannot be an afterthought. The project team should decide at the start which images are operational records, which may be shared and who can approve their release.

The same principle applies to performance claims. A trade article should not convert operational records into broad claims that the project was not designed to

support. Detection, confirmation and repair are different endpoints. Clear language protects the owner, the project team and the reader.

SIX PRACTICES OTHER UTILITIES CAN BORROW

The Xinyu experience points to six practices that travel better than any equipment list.

1. Define the decision before selecting the tool. Decide whether the program is screening, localizing, confirming, prioritizing or closing repairs. One field activity should not be described as all five.

2. Design the handoffs. Name the person who receives each output, the evidence required to advance it and the person who can stop or escalate the work.

3. Separate a field alert from confirmation. Make the instrument-confirmation step visible in the workflow and in the language used with managers, residents and the media.

4. Treat the handler-dog team as a professional unit. Procurement alone does not create capability. Training, certification, welfare, trust and the handler’s authority are part of the operating system.

5. Keep the asset owner in the loop. The utility’s records, safety procedures and maintenance priorities give field observations their meaning.

6. Plan data governance and communications together. Decide what will be retained, what will remain confidential and what can be published before images and maps begin circulating.

These practices are deliberately technology-neutral. The transferable part is not Xinyu’s equipment list but its governance: accountable roles, explicit handoffs and decision gates.

FROM PILOT TO PROGRAM

Scaling the workflow requires standardizing field records, training new personnel, auditing confirmation rules, protecting canine welfare and linking validated observations to maintenance outcomes.

That is also where other utilities should begin. Do not ask first whether a dog can find what a vehicle cannot. Ask whether your organization can manage the handoff from a network signal to a field search, from a field search to instrument confirmation and from confirmation to an accountable asset decision.

If that operating sequence is clear, very different forms of intelligence can work together. If it is not, adding another sensor - biological or electronic - will only add another disconnected stream of information.

BEYOND TECHNOLOGY

Demystifying Digital Transformation for Small and Medium-Sized Utilities

By Joyce Zhu, Tesha Okioga, Erika Hoffman, Meagan Cupka, Scot Sutherland, Mike McEvoy

Over the past few years, digital transformation has become a hot topic in the water and wastewater industry. It comes with big promises to address some of the most complex challenges facing the water industry, including aging infrastructure, non-revenue water loss, and resilience planning (Grigg, 2025). However, the term, when not defined with the right context and shared understanding, could lead to very different interpretations of what it means and how to create a digital transformation plan to realize its promised values. In this article, we share the Western Virginia Water Authority's (the Authority's) experiences, as a mid-sized water and wastewater utility navigating the digital transformation journey, and the lessons learned along the way. Since its creation 22 years ago, the Authority has expanded to serve over 69,000 customer accounts in six localities, with over 1,200 miles of water-distribution mains and 1,100 miles of wastewater collection pipes.

First, let's break down this seemingly sophisticated concept, Digital Transformation, to something we are all familiar with, like cooking in the kitchen, as illustrated in Figure 1. In fact, these two unrelated processes are not that different if you consider all the components that are needed to create successful outcomes. In the digital transformation "kitchen", the digital systems are the tools and equipment that provide the capabilities, like the stove and oven in our kitchens. Data are the ingredients we process and cook with the systems. Business processes and governance are the recipes that document the workflows and provide specifications for how work should be performed. Ultimately, people are chefs who apply the knowledge and judgment to combine systems, data and processes to realize the utility value - the finished meal. Just like cooking,



Figure 1 An illustration of comparing the digital transformation journey to cooking in the kitchen, highlighting the five core components of a successful digital transformation program – systems, data, processes, people and utility value.. Graphic is rendered with ChatGPT.

we get better by learning from the outcome and incorporating feedback to improve the other four components.

In this article, we therefore share some of our experiences in this system-data-processes-people-outcome framework, specifically looking at how enabling systems, leveraging actionable data, streamlining processes, empowering people and validating outcomes translated our digital investments into sustainable results and value.

I. Enabling Systems

Identifying the system backbone

From its inception, the Authority knew that its Geographic Information Systems (GIS) would play a vital role in its future. The Authority was formed in 2004 with the merging of water and sewer utilities serving the City of Roanoke and Roanoke County. At

the time of merger, one of the first steps was to unite the mapping records from the two systems into a fully digitized Local Government Model (LGM) Geodatabase. The LGM allowed the Authority to standardize various datasets and created a common spatial data structure for the newly consolidated utility. The first five years of GIS development went beyond data standardization as illustrated in Figure 3. The Authority not only maintained that data in a GIS environment but also made the data accessible to all internal staff as well as the public through a web-based GIS. The web-based GIS quickly became the source of mapping beyond jurisdictional boundaries for Authority staff and local government employees, such as emergency operation staff. In 2007, the Authority took the next leap and initiated an ArcMap-based horizontal asset management system and horizontal work order system. In 2012, the Authority utilized geospatial and asset

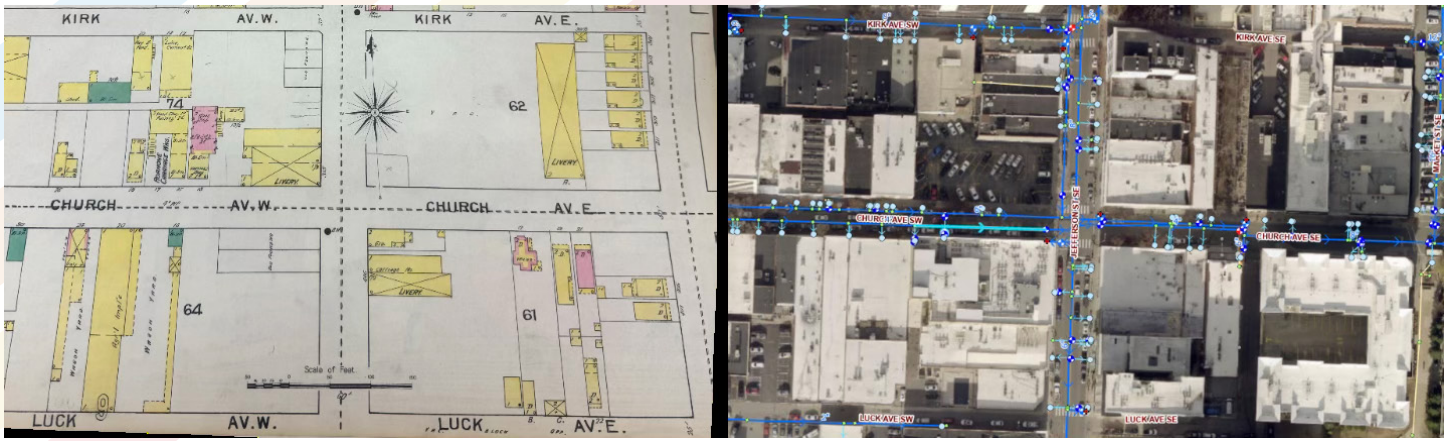


Figure 2 A comparison of the old paper map before GIS and the current GIS view of the same area.

information and developed hydraulic models for both its distribution and collection system, to better understand system behavior and plan for capacity driven system improvement projects.

Integration to build the digital ecosystem

As GIS adoption has matured within the Authority, its role has expanded well beyond documenting the location and physical characteristics of utility assets. GIS now provides a spatial framework through which employees can locate assets, access associated records, visualize system relationships, and identify geographic patterns. Assets, easements, plats, drawings, plans, and other records can be connected through their shared location and asset identifiers, making GIS an increasingly important point of access to the Authority's information.

This does not mean that GIS must store or govern every type of utility data. Specialized enterprise systems remain authoritative sources for the business information they are designed to manage. Our utility's recent transition from separate work order systems to a consolidated enterprise work order system illustrates this relationship. Historically, GIS integration was largely limited to work associated with horizontal water and wastewater infrastructure. During the transition, GIS asset definitions, locations, identifiers, and network structures provided a foundation for organizing assets within the new enterprise system, which supports work order management across a broader range of asset classes. The integration is bidirectional. GIS supplies consistent asset and spatial information to the new work order system, while relevant updates generated through work order activities like inspections, repairs, and maintenance activities flow back from the work order system to GIS. This exchange reduces conflicting records and helps ensure that employees using either system are working from consistent information.

The institutional familiarity employees have developed with GIS is equally important for adopting GIS. Because a map pro-

vides an intuitive way to find infrastructure, GIS has become a natural starting point for locating an asset of interest, viewing its characteristics, accessing related records, examining nearby work activities, and performing system or spatial analysis. Rather than requiring users to know which database contains each piece of information, the asset and its location provide the common thread connecting information across systems. GIS therefore provides the spatial backbone that allows asset information to be understood in the context of the physical utility system.

Consider the example of an operator responding to a water main break at 2:00 a.m. There is a lot to do and an urgency to repair the pipe fast and safely. The operator may need to identify the affected main, review its material and diameter, locate nearby valves and customers, examine recent repairs in the area, look up available easements, and determine the likely extent of a shutdown. When GIS connects these records and presents them in their geographic context, it can shorten diagnosis, support a more informed response, and help restore service more efficiently. The value comes not from the map

alone, but from the integration of systems and information around the asset.

Our experience suggests that interoperability should be treated as a core requirement when selecting and configuring future digital systems. For small and mid-sized utilities, the objective does not need to be a single system that performs every function. A more practical model is a connected digital ecosystem in which each system performs its specialized role, while GIS provides the shared spatial context that makes information easier to find, understand, and apply.

II. Actionable Data

Technology itself does not produce meaningful results. In our kitchen analogy, data is the ingredients. Sophisticated equipment can expand the cooking, but it cannot compensate for missing, poor-quality or unsuitable ingredients. Similarly, a utility can invest in powerful enterprise systems without realizing the intended value if the underlying data is incomplete, inconsistent, inaccessible or disconnected.

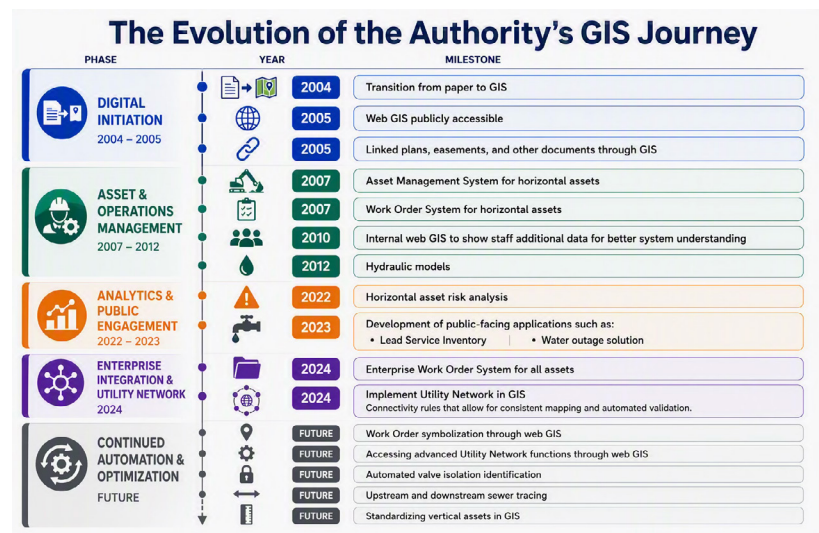


Figure 3 The Evolution of the Authority's GIS journey from initiation to future roadmap, rendered in Microsoft Copilot.

Data that is usable and useful

Ideally, data needs to be usable and useful. Usable data is needed to ensure quality results and support defensible analyses. Useful data, on the other hand, is needed to answer relevant questions, inform decisions or expose underlying risks or trends. Understanding the two dimensions of data will help shift the data collection effort from collecting as much information as possible to collecting and maintaining the information needed to improve utility outcomes. For small and mid-sized utilities, the implication of data management could be even more critical due to limited staff, resources, and capabilities. The availability of data does not guarantee its value. Collecting information without defined purposes can increase data storage and maintenance burdens with little benefits to improve outcomes. Therefore, it is even more crucial for utilities with limited resources to start with the problem and work backwards to define the level of data requirement needed to support the decision making.

For example, the recent upgrade of our hydraulic water model illustrates how technical data is leveraged for actionable insights. The existing hydraulic model was expanded to estimate how long water travels through and remains in the distribution system. Further field tracer study using fluoride was conducted to compare observed travel times with modeled scenarios and to help delineate the mixing zones between two water systems. Seven tracer sampling sites were selected with predicted water age ranging from less than 1 day to 15 days. Observed travel times at six of the seven monitoring locations were generally consistent with the model predictions. Results at the site with the highest predicted water age were inconclusive because persistent background fluoride prevented a clear interpretation. Overall, the field tracer study was particularly useful to validate model output and instill confidence in using the model for disinfection byproduct sampling site identification and flushing location optimization.

Another example was the Authority's pipe risk analysis, where information from multiple sources was combined to support capital planning. Building on decades of high-quality asset and operational data including pipe attributes, service connections, historical repairs, maintenance activities and condition assessment records, we were able to pull data from various sources to develop a model that estimates the likelihood and consequences of failure of our pipe assets and establish risk rankings. The modeling results were validated against recent failure records and institutional knowledge from experienced personnel. The risk model was able to build on institutional knowledge and to highlight specific pipe or system attributes that contribute to higher failure records, enabling more targeted proactive system assessment



Figure 4 The Authority GIS staff, Meagan Cupka (left) and Erika Hoffman (right) attending the ESRI User Conference in San Diego in 2024 to stay abreast of the rapid developments in GIS.

and capital planning. For example, while there is a general understanding that older and cast-iron pipes are more prone to failure, our system specific risk analysis showed that 1930s cast iron pipes had much lower break records than the 1950s cast iron pipes. Risk factors identified in the analysis are incorporated into asset management, system analysis and replacement and rehabilitation planning.

In both the modeling and risk analysis examples, a risk score or a water age map will remain unused unless there are intentional efforts to use them to guide decisions. Digital transformation occurs when reliable data, appropriate analytical tools, and professional judgment come together to produce better decisions.

III. Streamlining Processes

Clearly defined processes are another necessary component for how to operate digital systems for consistent utility outcomes. In our kitchen analogy, processes and documentations are the recipes that allow reliable creation of a desirable outcome. The equipment may be capable, the ingredients may be available, and the people may be skilled, but a consistent outcome still requires an understood sequence of actions. Streamlined and well documented processes are like a family recipe book that provide direction on how work should be sequenced and performed.

Enabling automation through processes

This structure becomes especially important when multiple systems must operate as a connected digital ecosystem. Reliable integration depends not only on enabling efficient data exchanges between platforms, but also on shared data specifications and workflows that define how information is created, entered, reviewed, transferred, and updated. Automation is key to support efficient data exchange, but it cannot compensate

for poorly defined workflows or inconsistent use. For example, information from a completed repair can update an asset's record in GIS only when the work order is associated with the correct asset and the relevant fields are completed consistently. Without these standards, automation may move incomplete or inconsistent information between systems more quickly without improving its quality or usefulness.

Saving the recipes with documentation

While training transfers operational knowledge, Standard Operating Procedures (SOPs) transform the operational knowledge into documented repeatable procedures, essentially defining the step-by-step processes, responsibilities, and actions needed for system processes. SOPs also preserve technical and institutional knowledge so that future teams can follow the established processes effectively, consistently replicate what works, and avoid reinventing processes from scratch. SOPs should explain the reasoning behind key process decisions, in a context that helps staff understand, not only what steps to follow, but why those steps matter and should ideally incorporate lessons learned. They should also be living documents that are kept current. This supports cross-training, strengthens replicability of responsibilities, and reduces dependence on any single person, therefore lowering operational risk. After all, one chef should not be the only person who knows the recipe.

The Authority's Engineering Services Division owns and is responsible for several technologies and applications utilized by the organization, including the GIS, hydraulic modeling systems, and the Authority's Project Management Information System. To ensure that these applications and processes are consistently, correctly, and securely used and executed, respectively, as part of its divisional-level cascaded goals, all Engineering

staff are expected to conduct “Cross-Training for Replicability”. To advance this goal, each staff member is expected to conduct at least one peer training session each year, focused on a core task or process within their area of responsibility. Examples of SOP created and adopted recently include Capital Improvement Project Communication Plan that documents the appropriate communication mechanisms based on project scale and public impact and a guidance document that details the procedure to gather and process data across multiple enterprise level systems for monthly boarding reporting.

IV. Empowering People

FOMO: Cook the Meal, Not the Trend

Digital transformation in water utilities is ultimately about value creation, enabled by technology, that is, starting with the outcome you want to deliver, then choosing the tools (systems) and ingredients (data) that best achieve it. While innovation can create opportunities for improvement and sometimes a sense of urgency to keep pace with industry trends, perhaps even a fear of missing out (FOMO), successful digital transformation requires a clear vision that emphasizes the value and outcomes of transformation rather than technological innovation alone. To realize clear value realization and organizational wide adoption, leadership often plays a critical role in supporting and communicating the value and purpose of the transformation. In addition, it is helpful to identify digital transformation “champions” across the organization and in designated initiatives to motivate change by demonstrating successes and reiterating values and objectives in ways that resonate within their internal teams, which helps to build ownership, alignment and commitment in the long run.

Trying New Recipes - Fear of the Unknown: Workforce Development

Training plays a critical role in this workforce development by building the knowledge, skills, and confidence needed to overcome the fear of the unknown, adopt new technologies, and realize their intended value. The training approach, delivery format, and support mechanisms should be tailored to the complexity of the technology and the varying levels of user familiarity, capability, and learning needs across organizations. Continuous evaluation and refinement of training efforts can further improve learning effectiveness, user adoption, and overall transformation outcomes.

Ultimately, successful digital transformation is sustained not by technology alone, but by empowered people who understand the purpose of the change, have the skills and support to adopt it, and can share and

preserve knowledge for others.

IV. Validating and Sustaining Outcomes

The final component of the digital transformation framework is evaluating whether new capabilities produced their intended outcomes and using the results to guide continued improvement. A successful go-live confirms that a system has been implemented but it does not demonstrate that the intended benefits have been realized. The Authority evaluates value at two levels: the experience of the employees who interact with the expanded digital capabilities and ultimately the improved level of service provided to the customers and communities. In the water main repair example, integrated GIS information can help employees diagnose the problem and coordinate the response more efficiently. Those operational improvements may also support shorter service interruptions, more accurate identification of affected customers, and more timely communication.

A feedback loop is particularly important for small and mid-sized utilities seeking to develop fit-for-purpose digital capabilities. A household kitchen is not designed to reproduce the operations of a Michelin-starred restaurant, nor does it need to be. Each kitchen is configured around the people it serves, the meals it prepares, the resources available, and the results it needs to produce. Similarly, utilities do not need to replicate the digital architecture of larger organizations. They can develop solutions around their own priorities, infrastructure, resources, staff capacity, organizational readiness, and appetite for change.

Digital transformation does not need to remain the mysterious or intimidating concept it is sometimes perceived to be. It can begin with something as fundamental as digitizing asset records, making information more accessible, or improving employees’ confidence in interpreting and using data. These incremental improvements can become the foundation for more integrated and advanced capabilities, as organizational needs and readiness evolve.

Ultimately, the most valuable digital solution is not necessarily the most sophisticated one. It is the one that can be adopted, sustained, evaluated, and continually improved to help employees work more effectively and provide meaningful, measurable value to the customers and communities we serve.

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About Authors

Joyce Zhu is the Program Manager of Planning and Asset Management at Western Vir-

ginia Water Authority. With a PhD in Civil and Environmental Engineering from Virginia Tech, an MEng from MIT, and a PMP, she combines technical expertise with program leadership to turn data, technology, and cross-functional collaboration into practical solutions for complex infrastructure challenges. She is passionate about advancing sustainable, resilient water systems and helping utilities translate innovation into measurable operational and customer value.

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Erika Hoffman is the Geographic Information Systems (GIS) Manager for the Western Virginia Water Authority, where she leads the development and management of geospatial data, mapping systems, and GIS technologies that support utility operations, planning, and asset management. With more than 20 years of service at the Water Authority, Erika brings extensive expertise in GIS applications and spatial data management for water and wastewater infrastructure.

Meagan Cupka is a GIS Technician III in Asset Management and Engineering at the Western Virginia Water Authority, where she supports utility planning, asset management, and infrastructure decision-making using advanced geographic information systems technologies. She brings a strong background in environmental stewardship, project management, mapping, and community engagement, with previous leadership experience at the Blue Ridge Land Conservancy.

Scot Sutherland is the Planning Engineer at Western Virginia Water Authority. Scot holds a bachelor’s degree in environmental science and engineering from Virginia Tech. Scot is a proud veteran serving as an US Army Engineer for eight years. For the past twelve years with the Water Authority, Scot has developed extensive expertise in asset management, condition assessment, system design and utility coordination.

Michael McEvoy is the Executive Director of the Western Virginia Water Authority. A graduate of the University of Florida with a degree in Environmental Engineering, he has extensive experience in utility management, having worked for electric and water utilities in Florida, Georgia, and Virginia. Mike is an active leader in the water industry and regional community, serving on several professional and public boards while championing sustainable infrastructure, environmental stewardship, and operational excellence.

UIS COMMUNITY NEWS

New Chapters for Yuxi Zhang and Joseph Porter



Yuxi Zhang presenting “AI for GPR: Utility Mapping vs. Strike Prevention” during the 28th Utility Investigation School (UIS) at the GroundBreakers facility in Indianapolis.



Yuxi Zhang meets with Screening Eagle in Shanghai



Joseph Porter teaching at the Utility Investigation School (UIS) in Indianapolis.



The BAMI-I Utility Investigation School (UIS) is about more than technical training. By bringing together instructors, students, researchers, technology providers, and utility professionals, UIS creates a professional community where knowledge is shared, relationships develop, and new opportunities emerge. This issue celebrates two members of that community as they begin new professional chapters.

Yuxi Zhang Joins Screening Eagle’s Singapore Headquarters

Following the completion of her Ph.D. at Purdue University, Yuxi Zhang has joined Screening Eagle Technologies as a Product Owner at the company’s Singapore headquarters.

Yuxi has shared her expertise in ground penetrating radar (GPR) with UIS participants twice – at the 10th school at Purdue campus, and again at the 28th Utility Investigation School (UIS) at the GroundBreakers facility in Indianapolis. – and the connections she built through the BAMI-I and UIS community helped open the door to this opportunity. “I have high expectations for her

future contributions to our company,” said Dr. Alexandre Novo, Senior Director of Product Management, GPR Products and Applications, at Screening Eagle. Screening Eagle Technologies has itself been a longtime sponsor and supporter of the BAMI-I Utility Investigation School, providing equipment demonstrations and industry expertise that give participants direct exposure to current GPR technology.

As Product Owner, Yuxi will work with customers and software developers to translate GPR research and customer needs into software requirements and development priorities for GPR data-processing software. She will also provide GPR expertise to guide the development and validation of new algorithms and AI-assisted workflows.

Joseph Porter Joins T2 Utility Engineers

Longtime UIS instructor Joseph Porter, PMP, M.ASCE, has joined T2 Utility Engineers as Practice Development Manager, based in Golden, Colorado.

Joe brings more than 16 years of experience in subsurface utility engineering, spanning field data collection, CADD, project management, training, quality management,

and discipline leadership. That breadth of practical experience has made him one of UIS’s most frequent instructors – he has taught at numerous schools over the years, helping participants connect technical concepts with real-world SUE practice.

His move to T2 further strengthens a long-standing relationship within the UIS community. T2 Utility Engineers has been a longtime supporter of the BAMI-I Utility Investigation School, providing sponsorship, equipment demonstrations, and industry expertise that give participants direct exposure to current technologies and professional practice. We look forward to continuing to work with Joe and T2 team as UIS approaches its 30th school.

A Community That Extends Beyond the Classroom

Yuxi and Joe took different paths – one from research into product development, the other from field practice into practice leadership. Both remain part of the UIS community, where researchers, students, instructors, and technology providers work side by side – and where those connections keep turning into collaborations, new ideas, and opportunities.

INNOVATION UNDERGROUND:

How Tire-Derived Aggregate is Reshaping Infrastructure Asset Management Across Wet Utilities and Highways

Jibanananda Das

Prior to transitioning into the Infrastructure Asset Management domain, I spent a significant number of years working as a Geotechnical Engineer. Because of that background, a recent news highlight detailing how Maine engineers convert nearly 1 million scrap tires annually into lightweight highway fill immediately caught my attention [1].

When civil engineers discuss major capital works, public attention usually gravitates toward surface-level assets: newly paved expressways, sleek bridge decks, or modernized water treatment plants. Yet, as any geotechnical practitioner knows, the long-term reliability and lifecycle costs of these multimillion-dollar assets depend entirely on what sits beneath them.

Subgrade instabilities, high pore-water pressures, expansive or compressible clays, and overburden stresses on buried utilities are constant threats to structural integrity. Unaddressed, these underground challenges trigger premature pavement rutting, pipeline shear failures, and costly emergency interventions.

One of the most versatile solutions bridging modern geotechnical engineering and strategic asset management is Tire-Derived Aggregate (TDA). Produced by shredding waste tires into engineered chips, TDA possesses a unique combination of lightweight density, high permeability, thermal insulation, and energy absorption.

Initially developed to stabilize highway embankments over soft soils, TDA's strategic



Figure 1: Tire-Derived Aggregate (TDA), Image Credit: Official website of CalRecycle

value has expanded into water, wastewater, and stormwater infrastructure.

2. Part 1: The Wet Utilities Paradigm: Water, Wastewater, And Stormwater Infrastructure

2.1 Buried-Pipe Infrastructure — Bedding, Backfill, and Asset Protection

Buried water mains, trunk sewers, and stormwater conduits are highly vulnerable to differential settlement and surface-induced stresses. When rigid concrete, ductile iron, or flexible HDPE pipes traverse soft soils (such as marine clays or organic peats), unequal

subgrade settlement induces differential deflection. This structural imbalance leads to cracked pipe walls, sheared joints, and sudden main breaks.

Using TDA as pipe bedding and trench backfill creates a lightweight, flexible cushion that directly mitigates these forces:

- **Overburden Stress Reduction:** TDA weighs approximately 500 to 650 kg/m³ (30–40 lbs/ft³) roughly one-third the weight of traditional soil or crushed stone (1,800 to 2,000 kg/m³ / 110–125 lbs/ft³). Substituting virgin aggregate with TDA slashes the net downward surcharge on buried conduits, suppressing

post-construction consolidation.

- **Vibration Damping:** The elastomeric properties of shredded rubber absorb dynamic surface impact loads and traffic vibrations, preventing stress concentration on pipe crowns and joints.
- **Trench Load Arching:** TDA's high compressibility relative to adjacent native soil allows favorable soil-structure interaction, helping arch surface loads away from the pipe barrel.

Project Example- St. Paul Underground Utility Corridor (St. Paul, Minnesota): To construct deep stormwater trunk lines through compressible organic peat and weak subgrades, engineers specified TDA trench backfill above culverts to minimize settlement and protect joint integrity (Minnesota Pollution Control Agency / City of St. Paul, 2004). [2]

2.2 Infiltration and Stormwater Retention Galleries

In urban stormwater management, land constraints make traditional retention basins cost-prohibitive. Standard crushed stone backfill yields a void space (porosity) of 30% to 35%. In contrast, loosely compacted TDA provides a void space exceeding 50%.

Because TDA holds significantly more runoff per unit volume than natural gravel, underground infiltration vaults backfilled with TDA require smaller excavation footprints to store equivalent storm volumes.

Project Example - California Subsurface Infiltration Basin Pilots (City of Riverside & Los Angeles County, California): CalRecycle-sponsored pilot programs placed TDA in urban stormwater infiltration galleries. Taking advantage of TDA's >50% void ratio, the cities captured peak storm runoff within compact footprints without requiring additional land acquisition (CalRecycle Municipal Utility Reports, 2012–2018). [3]

2.3 Decentralized Wastewater Drain Fields

In decentralized wastewater management, septic tank effluent percolates through drain fields composed of coarse aggregate. TDA acts as a high-performance substitute for crushed drain-rock in leach trenches. Its high void volume maintains aerobic conditions that cultivate beneficial microbial biofilms to break down organic waste. Furthermore, environmental testing indicates that rubber aggregate can absorb certain heavy metals, hydrocarbons, and nutrients (e.g., phospho-

rus) from effluent stream applications under specific operating parameters.

Project Example – Rural On-Site Wastewater Programs (South Carolina & Texas): State environmental agencies approved TDA for residential and commercial septic leach fields. Contractors reported that TDA was far easier to transport and install manually than heavy rock, cutting installation labor costs by up to 30%. [4]

3. Part 2: Highway and Landfill Infrastructure Applications

3.1 Transport Embankments over Soft Soils

Building linear transport infrastructure over weak subgrades induces massive consolidation settlement and slope instability. Historically, mitigating soft subgrades required soil mixing, driven piles, concrete load-transfer platforms, or extended preloading periods—adding millions to CapEx. TDA lightweight embankment fill reduces surcharge loads on soft subgrades, mitigating shear failure while clearing legacy waste tire stockpiles.

Project Example- Portland Jetport Interchange (Portland, Maine): Constructed over 12.2 meters of low-shear-strength Presumpscot marine clay, approach ramps faced extreme settlement risks. Engineers utilized 1.2 million recycled passenger tires as lightweight TDA embankment fill. This reduced the dead load on the sensitive subgrade and delivered \$250,000 in direct material savings compared to commercial expanded shale lightweight fill. [5]

3.2 Landfill Leachate Collection Systems

Modern sanitary landfills require Leachate Collection and Removal Systems (LCRS) to capture liquid runoff before it threatens surrounding aquifers. TDA functions as a high-capacity drainage layer and gas collection pipe backfill. Its high hydraulic conductivity maintains rapid flow rates without clogging, while its elasticity shields synthetic geomembrane liners against puncture from waste placement operations

Project Example- Iowa & Wisconsin Landfill Drainage Projects (Des Moines County Landfill, IA & Dane County Landfill, WI): Facility managers replaced virgin stone with 3-foot TDA layers for primary leachate drainage blankets, saving millions in aggregate sourcing and transport fees

across multi-acre cells (US EPA / State DNR Reports, 2008–2015). [6]

4. Part 3: Engineering Limitations and Design Constraints

While TDA provides clear structural and financial advantages, geotechnical and utility asset managers must design around three core operational boundaries:

- **ASTM D6270 Layer-Thickness Limits (Self-Heating / Exothermic Prevention):** Scrap tire fill can undergo exothermic (self-heating) reactions if exposed to excessive air and organic matter in thick, unconstrained lifts. ASTM D6270 limits individual TDA layer thickness to 3.0 meters (10 feet) for Class I applications (chips under 75 mm) and 3.0 meters max per lift with soil covers for Class II applications (chips up to 300 mm). Designs exceeding these depth thresholds require specific thermal monitoring and strict compaction controls. [7]
- **Leaching Potential of Heavy Metals and Organics:** In unsaturated zones, TDA leaching of metals (such as zinc, manganese, and iron) or trace organic compounds (like polycyclic aromatic hydrocarbons) remains extremely low. However, when submerged continuously in acidic or low-pH groundwater, metals can leach out. Consequently, TDA is not recommended for unlined installations below the permanent water table, within unbuffered aquatic ecosystems, or in direct contact with potable water aquifers without barrier membranes or environmental testing.
- **Conditions Unsuitable for TDA Placement:** TDA is unsuitable for applications requiring high structural stiffness, minimal initial elastic compression, or direct unpaved wheel loading without a rigid overburden cap. TDA deflects under load; therefore, it must be overlain by a structured soil cap, crushed aggregate base, or concrete/asphalt pavement structure to distribute traffic loads.

5. Part 4: The Management and Capital Works Perspective

From an Infrastructure Asset Management standpoint, the case for TDA extends well beyond project-level cost savings. Evaluated across the full asset lifecycle, TDA aligns with four strategic pillars that underpin mod-

ern buried asset management.

5.1 Whole-of-Life Cost Optimization

The financial case for TDA is strongest when viewed across the full asset lifecycle rather than at the point of construction. By mitigating settlement-induced distress upfront, TDA prevents early-stage pavement cracking, road rutting, and buried pipe shear failure. In documented Maine Turnpike Authority projects alone, TDA delivered USD \$493,000 to \$250,000 in CapEx savings per project compared to expanded shale alternatives [2, 8]. These are construction-phase savings only; the lifecycle savings – through avoided emergency pipe repairs, reduced carriageway resurfacing, and elimination of reactive maintenance – compound over the asset's service life.

For buried utility assets specifically, preventing a single major water main break event (emergency excavation, service disruption, road reinstatement, regulatory reporting) can cost a utility authority hundreds of thousands of dollars. A TDA bedding specification that reduces the probability of joint failure by even a small margin represents exceptional lifecycle value.

5.2 Capital Risk Mitigation

Subsurface soil failures are a leading cause of infrastructure project cost overruns. Substituting heavy soil with lightweight TDA reduces structural uncertainty and can eliminate the need for expensive ground-anchoring, piling systems, or multi-year preloading programs – each of which carries its own schedule risk and cost-estimate uncertainty. For buried assets, unplanned differential settlement is a leading driver of unscheduled capital renewal expenditure (CapEx replacement before the end of planned service life).

5.3 Accelerated Project Schedules

Eliminating multi-month soil consolidation waiting periods – which conventional heavy fills impose on soft subgrade projects – directly reduces traffic disruption, community impact, and contract preliminaries costs. For water and wastewater authorities managing live networks, a shorter construction program reduces the duration of service isolations, pressure zone manipulations, and bypass pumping, all of which carry both operational cost and customer service risk.

5.4 Circular Economy and ESG Alignment

Incorporating approximately 100 scrap tires per cubic meter of TDA directly aligns municipal capital works programs with corporate Environmental, Social, and Governance (ESG) mandates, sustainability reporting obligations, and the global circular economy imperative. BAMI-I's own mission to advance buried asset management globally aligns precisely with the kind of material innovation that TDA represents technically rigorous, economically justified, and environmentally accountable.

6. Conclusion

Tire-Derived Aggregate has matured from a niche experimental fill material into a technically well-characterized and regulatory-approved geotechnical solution with documented applications across highway embankments, pipeline bedding systems, stormwater infrastructure, on-site wastewater systems, and landfill drainage. The discipline of buried asset management stands to benefit considerably from its mainstream adoption.

The case for TDA is strongest when evaluated through an asset management lens: its Capex savings are real and documented; its lifecycle cost advantages – through reduced settlement-induced maintenance – are even larger; and its contribution to circular economy objectives is both measurable and increasingly mandated. At the same time, responsible specification demands awareness of its limitations: the ASTM D6270 layer-thickness cap, metal leaching sensitivity near groundwater resources, and unsuitability beneath rigid pavements and in permanently saturated fills.

As buried asset management continues to professionalize globally – through frameworks championed by organizations such as BAMI-I – it is precisely this kind of geotechnical-meets-strategic-management thinking that will define the next generation of underground infrastructure stewardship. Looking beneath the surface, and embracing rigorously evaluated circular materials, is not merely good engineering practice: it is the asset manager's obligation to the communities and environments they serve.

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About Authors

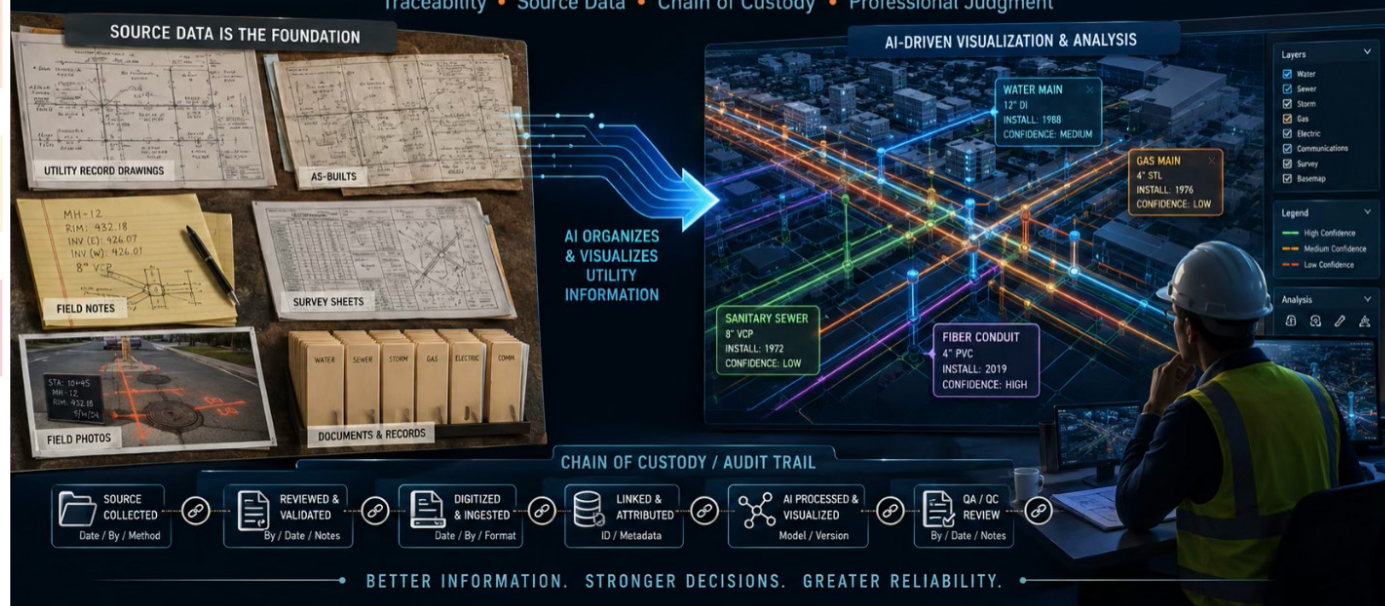
Jibananda Das

Jibananda Das is a Chartered Professional Engineer (FIEAust, PE, CPEng, NER, APEC Engineer, IntPE (Aus)) with expertise spanning geotechnical and infrastructure asset management. A 2024 IAM McKeown Award finalist and BAMI-International Ambassador for Australia, he brings deep experience bridging geotechnical practice with strategic asset lifecycle management. Currently he is working as Project Manager- Transit Asset Management for LA Metro.

AI Cannot Manufacture a Higher Level of Confidence

Presentation Quality $\neq$ Data Quality

Traceability • Source Data • Chain of Custody • Professional Judgment



AI in Utility Engineering

INNOVATION REQUIRES TRACEABILITY

By Gregory Jeffries, CUC, M.ASCE

Artificial intelligence is rapidly changing how information is collected, searched, interpreted, organized, and presented. Utility engineering will be no exception. AI offers enormous potential. It can review large volumes of utility records, recognize patterns across multiple documents, extract attributes from drawings, compare conflicting datasets, digitize historical information, identify potential utility features, and help professionals focus their investigative efforts. But there is an important distinction we cannot afford to overlook:

AI can assist in evaluating utility information. It cannot become an untraceable substitute for the evidence upon which that information is based.

That distinction is being considered as part of the forthcoming update to ASCE 38 and in the Utility Engineering Manual of Practice currently being developed through ASCE/UESI.

The objective is not to prohibit AI-derived information, quite the opposite, we must develop a framework that allows the profession to consider and take advantage of these technologies while preserving the principles that have always been fundamental to professional utility engineering: Evidence. Traceability. Professional judgment. Accountability.

AI-Derived Data Must Be Vetted

The first principle is straightforward: AI-generated, AI-interpreted, or AI-modified utility information should never simply

be accepted at face value.

AI is capable of processing extraordinary amounts of information, but processing information and establishing its reliability are two different things.

An AI system might identify a probable water line from several historical drawings. It might reconcile different street names, align old mapping with current GIS, interpret handwritten construction notes, or infer a likely utility alignment from incomplete records. Those capabilities can be extremely useful. But the professional responsible for the utility investigation must still evaluate the underlying evidence and determine whether the conclusion is reasonable. AI does not eliminate professional judgment.

In many respects, AI makes professional judgment even more important.

We Must Be Able to Get Back to the Original Evidence

One of the greatest risks associated with AI-generated information is the creation of a data product that appears authoritative but has become disconnected from its original sources. That cannot be acceptable in professional utility engineering. Any AI-derived utility dataset should include a complete accounting of the source information used to develop it.

That means identifying the original:

- utility owner records;
- as-built or record drawings;
- GIS datasets;
- construction plans;
- permits;
- survey information;
- field investigation data;
- photographs;
- test hole information;
- geophysical results;
- historical mapping; and
- other documents or datasets considered by the AI system.

The professional reviewing the information should be able to move backward through the process and answer a very simple question: “Where did this information come from?” If that question cannot be answered, the information has a significant credibility problem.

Chain of Custody Matters

Source identification alone is not enough. There should also be a documented chain of custody describing where the information originated and how it was obtained. For each significant source, we should be able to identify things such as:

Who provided it? Where was it obtained? When was it obtained? In what format was it received? Was it complete? Was it altered before being processed? What happened to it after it entered the AI workflow?

This becomes particularly important as AI platforms begin assembling information from multiple repositories. Imagine an AI-generated utility map developed from twenty different records obtained from five different sources over several decades. The

resulting map may look exceptionally good. But appearance is not evidence. Without documentation of those underlying records and their provenance, the professional reviewing the map cannot properly evaluate the reliability of the information.

Show Us What AI Changed

There is another component that I believe will become increasingly important:

AI modification must be transparent.

For AI-derived utility information, there should be a source utilization and modification table identifying how each record contributed to the final product.

For example:

Source Record → Information Used → AI Action → Modification Made → Resulting Data

Did the AI simply extract information from the document? Did it georeference the drawing? Did it adjust an alignment? Did it interpolate between known points? Did it infer a missing connection? Did it resolve a conflict between two records? Did it convert raster information into vectors? Did it assign an attribute that did not explicitly exist in the original record?

Those are fundamentally different actions. They should not be hidden inside an algorithm.

The documentation should also provide direct access to the original, unaltered source information so that the professional can independently compare the AI-derived result against the evidence from which it was created. That provides something critically important: auditability.

AI Cannot Manufacture a Higher Level of Confidence

This may ultimately be one of the most important concepts for our profession.

Processing uncertain information through a sophisticated AI system does not automatically make the underlying information more reliable. If five questionable records are provided to an AI system, the resulting analysis may be extremely sophisticated—but the underlying records remain questionable. AI may help identify inconsistencies. It may highlight relationships. It may recognize pat-

terns a human reviewer could easily miss. It may help develop investigative hypotheses.

But AI cannot manufacture certainty that does not exist in the underlying evidence.

Nor should an impressive visualization, digital twin, GIS layer, or 3D model be confused with verification. Utility information must still be evaluated in the context of the investigation performed, the evidence collected, and the professional judgment applied.

The Black Box Is the Problem—Not the Technology

I believe the utility engineering profession should strongly consider AI. The potential benefits are simply too great to ignore. But utilizing AI does not mean abandoning the principles that made Subsurface Utility Engineering successful in the first place. The issue is not whether AI was used. The issue is whether the professional responsible for the information can explain:

What information went into the process. Where that information came from. How the AI used it. What the AI changed. What assumptions were made. What evidence supports the resulting conclusion.

If we can answer those questions, AI can become an extraordinarily powerful tool. If we cannot answer those questions, we have created a black box. And a black box has no place at the foundation of an engineering decision. The future of utility engineering should not be AI versus professional judgment. It should be AI supporting professional judgment—with complete transparency, traceability, and accountability.

Technology will continue to change.

Our obligation to understand and defend the information upon which engineering decisions are made should not.



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Half year in review

Selected developments from April to August 2026

Iqaluit links infrastructure investment to housing

April 7, 2026

Canada announced a federal investment of approximately C\$108.7 million in water and wastewater infrastructure in Iqaluit, Nunavut. Planned work includes improvements to trucked water and sewer services and expansion of the utilidor network. The announcement links the work to approximately 2,000–2,500 new homes by 2031. Funding is subject to a contribution agreement and applicable requirements; these are planned benefits rather than completed results.

Editorial perspective: The project illustrates why an asset plan needs to explain the service it enables. Network capacity, service reliability and development plans belong in the same discussion.

Source: Housing, Infrastructure and Communities Canada

NIST brings infrastructure operations into AI risk work

April 7, 2026

NIST released a concept note for an AI Risk Management Framework profile on trustworthy AI in critical infrastructure. The planned profile is intended to guide operators toward risk-management practices for AI-enabled capabilities. The underlying framework is voluntary. The April announcement marks a development step, rather than the publication of a final infrastructure standard.

Editorial perspective: For a utility pilot, define the intended use, preserve the input records and assign a reviewer. Those steps make the resulting information easier to evaluate alongside the source-traceability issues explored in this issue's AI article.

Source: NIST AI Risk Management Framework

Renewal and financing remain leading concerns

April 30, 2026

AWWA's 2026 State of the Water Industry report placed infrastructure renewal and replacement first among respondents' challenges, with financing upgrades close behind. The report was based on a voluntary, anonymous survey of 2,171 water-sector professionals across North America. Infrastructure and financing have exchanged the top positions over the past decade.

Editorial perspective: A renewal proposal is stronger when it explains which service risks the investment addresses. Condition evidence, remaining uncertainty and the consequences of delaying work help connect inspection findings with capital priorities.

Source: AWWA 2026 report announcement



Residential demand study offers a fresh reference point

June 15, 2026

WRF published the third edition of its Residential End Uses of Water study, updating work from 1999 and 2016. Its announcement reports average indoor single-family consumption of 38.5 gallons per capita per day in the 2026 study, compared with 69.3 in 1999. The new edition also examines multi-family homes.

Editorial perspective: These findings can prompt a review of local planning assumptions. They do not substitute for local demand analysis: indoor residential averages exclude outdoor use and do not establish peak design demand for an entire system.

Source: WRF residential end-use study announcement



EPA announces WIFIA fee relief for small communities

June 29, 2026

EPA announced waivers of WIFIA application and credit-processing fees for small communities applying in fiscal years 2026 and 2027. The announcement identifies communities with populations of 25,000 or fewer and notes that credit-processing fee relief is subject to program requirements and available administrative funds. WIFIA provides loans; the fee announcement is not a grant award.

Editorial perspective: Lower transaction costs can matter when a small system has limited staff and cash. Project preparation still requires a defined scope and an explanation of how the investment supports reliable service.

Source: EPA WIFIA announcement



Workforce funding addresses the people behind the assets

June 29, 2026

EPA announced \$10.8 million in available funding for water-sector workforce training. The program covers internships and apprenticeships, education, regional workforce collaboration and training for decentralized water workers. EPA cited anticipated retirements, aging infrastructure and evolving technical skills among the sector's challenges. The announcement concerns funding availability, not completed awards.

Editorial perspective: A technology purchase should identify who will operate the equipment, interpret its output and retain the knowledge. Including those responsibilities in project planning connects workforce development with the long-term usefulness of the asset.

Source: EPA workforce development program

BAMI-I AD INDEX

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2	Open Cut Construction: Design and install per AWWA Standards and Manuals	✓	✓
3	Trenchless Construction: Material of choice for HDD, Pipe Bursting (Pneumatic + Static), Sliplining, and Compression Fit	✓	X
4	Fully Restrained Joint-Free System: Minimize need for fittings to facilitate horizontal and vertical deflections eliminating the need for thrust blocks	✓	X
5	Longevity & Corrosion: Pipes, Fittings, and Joints have the least potential for corrosion or tuberculation	✓	X
6	Flow Capacity: New pipes have similar flow capacity per AWWA Standards and Manuals	✓	✓
7	Water & Energy Conservation: Fused Joints have zero allowable water leakage and zero Infiltration	✓	X
8	Cost Effective: Has the lowest initial cost, lowest life cycle cost, and lowest restoration cost for trenchless installations	✓	X
9	Resilient: Ability to resist water hammer and ground movements due to droughts, freeze/thaw, earthquakes, and hurricanes with the ability to control flow with squeeze-off	✓	X
10	Permeation/BTEX: In contaminated conditions, pipes and elastomeric joints require proper engineering.	X	X

Sample References

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- 9 WRF 2012 Recent Earthquakes: Implication for U.S. Water Utilities, Kubota 2018 Polyethylene Pipeline Performance Against Earthquake, MAB-9, MAB-10
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Additional information including MAB-3 Model Spec can be found at www.plasticpipe.org/mabpubs



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