BAMI-I 2025

Biannual Journal H2 2025

COMPLETED AND IMPLEMENTED: **TOWN OF SWITZ CITY'S AMP IN ACTION**

(Cover Story at page 9)

UNDERSTANDING THE ROLE AI CAN PLAY IN UTILITY INVESTIGATION

(See Page 31)

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Biannual Journal H2 2025
Published in August, 2025
West Lafayette. IN. U.S.

Message from BAMI-I President

Dr. Tom Iseley

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

BAMI-I's Next Major Move:

Indiana Water Innovation and Infrastructure Center (I-WIIC)
A BAMI-I / World Trade Center-Indianapolis Joint Venture

For over 20 years, BAMI-I has been instrumental in leading the way with major moves to advance water asset management principles and practices nationally and internationally. These major moves include the development of the CTAM (Certification of Training in Asset Management) online and certification program as well as the development of the Global Buried Asset Management Congresses (GBAMC). Now the water industry is ready for BAMI-I's next major move with the establishment of the Indiana Water Innovation and Infrastructure Center.

At the Indiana Water Innovation and Infrastructure Center, we see water as more than a utility service. It is the foundation of our economy, our communities, and our quality of life. Yet too often, water is still treated as a liability, an aging cost center, a risk to be managed, a compliance obligation to meet. This mindset limits our ability to protect health, control costs, and make the right long-term investments.

Our mission is to shift that perspective. We help Indiana turn water from a liability into an asset by building the knowledge, tools, and capacity to understand systems, manage risks, and meet requirements like those in HEA 1459. Then we take the next step, turning water into a catalyst for economic development, workforce growth, regional planning, and smarter infrastructure decisions.

Liability → Asset → Catalyst

This is not about replacing the important work already being done by Indiana's water leaders. It is about making their work more impactful. The Indiana Finance Authority is investing heavily to protect public health and financial integrity. The Indiana Utility Regulatory Commission is building the state's first regulatory framework for asset management. The Alliance of Indiana Rural Water is providing trusted technical support statewide. I-WIIC connects these missions into a coordinated platform, allowing Indiana to move further, faster, and with less burden on any single agency or utility.

Our vision is clear: by aligning action, Indiana can reduce risk, comply smarter, and build a stronger water future. I-WIIC is designed to deliver that alignment, starting now.

To accomplish such a huge major move requires a team. The team wishes to take this opportunity to express our gratitude to Chuck Burtron, Water Industry Lead for TekSouth, for being the visionary and primary author for the I-WIIC approach proposal. Most of the comments in this editorial were taken from this proposal.

Indiana Water Innovation and Infrastructure Center (I-WIIC)

Established with State sponsorship and headquartered in Indianapolis, I-WIIC serves as a statewide hub for water infrastructure innovation, compliance support, and workforce development. Managed in partnership with BAMI-I and WTC Indianapolis, I-WIIC is designed to help Indiana lead nationally in sustainable water management. With satellite locations in Bloomington and West Lafayette, the Center provides utilities and regulators with practical tools, shared data resources, and capacity-building programs that strengthen compliance outcomes and advance statewide infrastructure goals.

BAMI-I

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Message from Journal Editor

Ms. Wei Liao

PWAM

The buried asset management industry continues to evolve at a remarkable pace, and this issue of the BAMI-I Journal captures both practical stories from the field and emerging technologies that are shaping the future of our work.

One of the highlights is the Town of Switz City Asset Management Project. From the start, we approached this effort with a learner's mindset. That was the most rewarding part—not rushing to meet deadlines, but focusing on getting the fundamentals right and exploring how to better manage utility assets. Rather than limiting ourselves to "what the industry can currently do," we challenged ourselves to set higher standards and worked to create the conditions needed to meet them. That's the essence of transformation: if we only aim for outcomes that look good, we risk being led by constraints rather than leading with vision. Switz City shows how even the smallest communities can pursue meaningful asset management. What began as a volunteer effort to build a foundational framework quickly gained momentum and institutional support—including significant funding from the Indiana Finance Authority, far beyond our initial expectations. What stood out most was the collective commitment: from state agencies to technical partners, and from local officials to residents, everyone brought energy and dedication. This spirit of collaboration turned a grassroots initiative into a full-scale effort. Our feature article captures the full arc of this journey.

Another centerpiece of this issue is a contribution from Sakari Kuikka on Finland's sewer asset management practice. Dr. Iseley has known Sakari for many years—Sakari purchased an SSET system (Digital Sewer) from him and has kept the technology active ever since. After several recent discussions admiring his work, we invited him to share what he is doing in Finland with our readers. Finland often ranks high in global water governance, yet its utilities face many of the same challenges we do: aging sewers and limited condition data. In "Data-Driven Sewer Network Asset Management—Experiences from Finland," Sakari presents a screening-first strategy that combines manhole zoom-camera inspections with cloud-based summaries and expert triage—reserving CCTV for only the segments that truly require it. The result is broader system coverage, reduced inspection costs, and clearer maintenance priorities.

AI in subsurface infrastructure is another key theme in this issue. Greg Jeffery, a BAMI-I Board Member and Executive Committee member, offers thoughtful insights into the emerging role of the "Subsurface Engineer." I personally appreciated his perspective and hope you will too. Once considered theoretical, AI is now becoming a practical tool for mapping and managing buried assets. By synthesizing data from records, surveys, and imagery, AI can help infer utility locations and support smarter project planning. Still, as our article emphasizes, AI must be used under professional oversight. Standards such as ASCE 38-22 affirm that only qualified engineers can validate and certify results. AI should be seen as a powerful assistant—one that enhances accuracy and efficiency, but never replaces sound engineering judgment.

BAMI-I's commitment to education also continues, with several important developments. The CTAM program, which has trained asset managers for more than a decade, is undergoing a major upgrade. The revised curriculum will place stronger emphasis on small utilities, simplify delivery, and expand into live, instructor-led formats. This ensures that the next generation of water asset managers—whether working with gravity systems or pressure systems—are equipped with the most up-to-date tools and methods.

We are also proud to announce the launch of a new course on Pipeline Installation for Inspectors. Proper inspection and installation are cornerstones of effective asset management, and this new training will equip inspectors and engineers with the skills necessary to ensure long-term system performance and safety.

Lastly, we would like to inform our community that the third Global Buried Asset Management Congress (GBAMC), originally planned for 2025, has been rescheduled to October 2026. This extended timeline will allow us to build a stronger program, engage more international thought leaders, and deepen the dialogue around policy, technology, and best practices in infrastructure management.

I hope this issue sparks new ideas and strengthens our shared commitment to smarter, more resilient buried infrastructure.

COMPLETED AND IMPLEMENTED

TOWN OF SWITZ CITY'S AMP IN ACTION

BAMI-I Journal Editor: Wei Liao

In the southwest corner of Indiana lies Switz City, a town of fewer than 300 residents that has taken an unusual path over the past two years. Once reliant on a "fix it when it breaks" approach, the community has now moved toward a data-driven Asset Management Plan (AMP) for its water and wastewater systems.

The project, led by the Buried Asset Management Institute–International (BAMI-I) in partnership with the Alliance of Indiana Rural Water (AIRW), Purdue University's Underground Infrastructure Team, and several technical and financial partners, spanned two and a half years (January 2023–July 2025). It began with no startup funding—built instead on volunteer contributions—before securing $650,000 in support from the Indiana Finance Authority (IFA) to complete system assessments and develop a comprehensive plan.

What makes this effort noteworthy is not only the outcome, but also the model it represents for other small communities:

- **Phased implementation:** an initial stage to establish baseline data, followed by a funded stage for full-scale technical execution.
- **Cross-sector collaboration:** pooling resources from academia, industry, and government to lower barriers for small utilities.
- **Integration with education:** Purdue students engaged with the case study as part of their coursework, blending classroom learning with real-world application.
- **Risk-based planning:** adapting IFA guidelines to produce a locally tailored 20-year capital improvement and financial plan.

The final AMP addressed both water and wastewater systems, identified high-risk assets, and laid out a 20-year investment roadmap. For Switz City, it offers a blueprint for the future; for Indiana, it provides a timely reference as AMP requirements become mandatory under HB 1459 (2025).

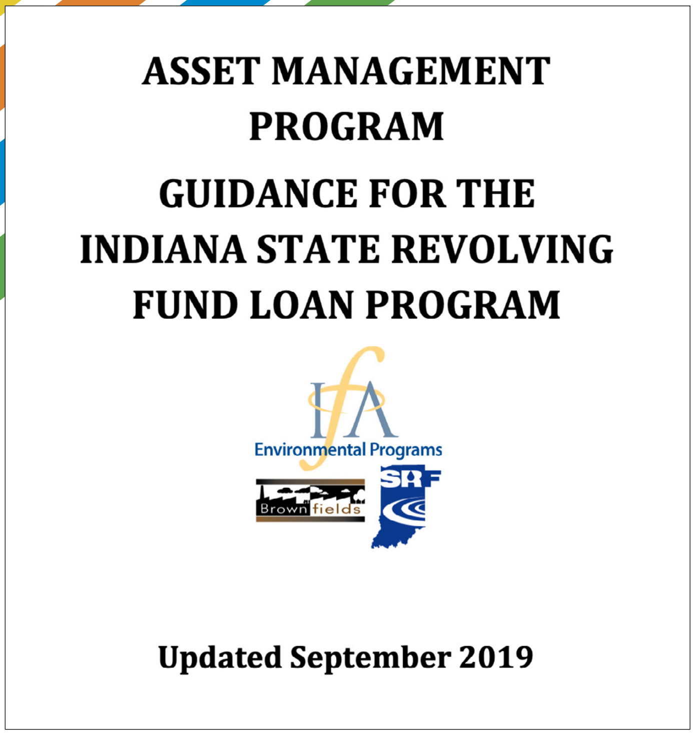
Origins and Policy Context: From the IFA Guide to SEA 272 (2022)

For years, many small and mid-sized Indiana communities faced the same challenge in their water and wastewater systems—"repair, but not manage." Aging facilities, reactive maintenance, and the absence of long-term planning drove up repair costs, reduced service reliability, and heightened public-health and environmental compliance risks.

To respond, the Indiana Finance Authority (IFA) issued an Asset Management Plan (AMP) Guide in 2019, providing a framework and roadmap for utilities: asset inventories, condition assessment, prioritization, life-cycle cost control, and long-term financial planning.

However, many small utilities—hampered by limited funding, staffing shortages, and knowledge gaps—struggled to advance AMPs. The state recognized that voluntary participation and financial incentives alone would not achieve widespread capacity building.

A turning point arrived in March 2022: SEA 272 required that, after June


ASSET MANAGEMENT PROGRAM

GUIDANCE FOR THE INDIANA STATE REVOLVING FUND LOAN PROGRAM

Updated September 2019

30, 2023, utilities must have an approved AMP to be eligible for State Revolving Fund (SRF) loans, grants, and other state funding. AMP thus shifted from "advocacy" to a prerequisite for funding, directly shaping and propelling the Switz City project.

Project Initiation

Against this policy backdrop, BAMI-I introduced AMP training at the AIRW annual conference in fall 2022 and formed an intent to collaborate with Ziptility. Both parties recognized the bottlenecks small communities faced implementing the IFA Guide, and agreed to start with a pilot to capture methods and lessons.

Switz City—with a population of 268, operating both drinking water and wastewater systems, and relying on contract operations—was an ideal demonstration site. In January 2023, the Town Council authorized BAMI-I to lead the project; Ziptility and Bynum Fanyo Utilities (BFU) provided field and technical support; project management was handled primarily by Purdue UIT, who provide administrative services to BAMI-I. This decision launched the Switz City AMP and a cross-sector collaboration that began with volunteer contributions. As Adam Hershberger moved from Ziptility to AIRW, AIRW formally joined the collaboration, adding resources and support.

Phasing: Volunteer Phase / Formal Execution Phase

• Volunteer Phase (Jan 2023–June 2024): A self-initiated effort to establish the technical framework, build the data foundation, complete preliminary inspections, and earn community trust.

• Formal Execution Phase (July 2024–present): $650,000 from IFA enabled full-scale inspections, in-depth assessment, financial planning, and emergency project activation.

Notably, after the project entered formal execution, HB 1459 (2025) elevated AMP requirements beyond SEA 272's funding condition to a mandatory regulatory framework under

Indiana Utility Regulatory Commission (IURC). This means Switz City's experience meets current compliance needs and provides a replicable reference for statewide mandatory implementation.

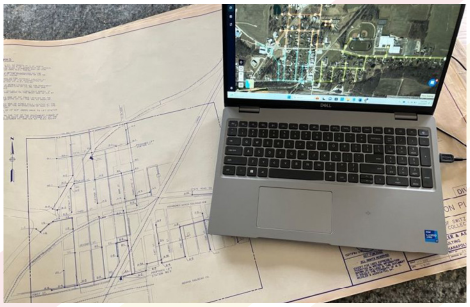
Volunteer Phase (Jan 2023–Jul 2024)

This phase was entirely pro bono, initiated by a core team from BAMI-I, Ziptility, AIRW, and BFU, and soon joined by subject-matter experts and 22 Purdue graduate students in Civil Engineering and Construction Management. The goal was to create, with zero budget, a practical AMP framework and data foundation for Switz City—and build trust with the community.

Key outputs and activities

- **Technical framework:** Based on the IFA 2019 AMP Guide and industry best practices, the team established a risk-based AMP methodology tailored to small systems, defining data collection, analytics, and prioritization routes.
- **Data foundation:** Integrated paper records, GIS, equipment inventories, and maintenance history to complete the core asset registry and spatial database, enabling higher-precision inspections and financial modeling.
- **Preliminary fieldwork:** Manhole checks, network alignment confirmation, water plant reconnaissance, and initial I/I (infiltration & inflow) analysis to identify key issues.
- **SL-RAT acoustic screening:** InfoSense and AIRW rapidly screened ~90% of the wastewater collection system, producing color-coded GIS blockage maps.
- **CCTV & manhole inspections:** Utility Inspection Services (UIS) inspected critical segments and laterals, identifying structural defects and potential blockage points.
- **AI + satellite asset location:** 4M Analytics produced comprehensive subsurface asset maps and geodatabases—the first such application in Indiana.
- **Expert contributions:**
  - o Adam Hershberger: Asset data gathering, GIS updates, multi-round meetings and fieldwork.
  - o George Kurz: In-depth I/I analysis—magnitude, impacts, cost, and payback.
  - o Jeff Farmer (operations contractor): Practical insights on daily operations, data practices, and energy-reduction strategies.
- **Education & workforce development:** Purdue's Asset Management of Underground Infrastructure (AMUI) course used the project as a core case. 22 students in 5 teams produced AMPs, with guest lectures by Ross Waugh, Kurt Wright, Gregory Baird, etc., integrating asset management with advanced inspection technologies.
- **Interim AMP:** The technical team synthesized student work with volunteer-phase data and expert input to create the Switz City Interim AMP. Conservative by necessity (limited full-system condition data), it still provided a robust framework for the final plan.
- **Community trust:** Multiple briefings


BFU



to the Town Council, operators, and residents built local support by explaining AMP's value for compliance, funding, and long-term operations.

The core value of this phase lay not only in technical and data foundations but also in forging a cross-sector collaboration model and community trust—critical for the funded execution that followed.

Formal Execution Phase (July 2024–July 2025)

In July 2024, the project received $650,000 from IFA—$250,000 to develop a comprehensive asset management plan and $400,000 for urgent Town of Switz City repairs and system upgrades—ushering in a funded, systematic execution stage.

The focus shifted from "framework and foundations" to deep inspections and implementation mobilization, targeting data-driven decisions and precision investments to quickly improve system condition and fully support the final AMP.

Core tasks and technical actions

- **Systematic leak detection (aligned with annual water audit):**

In Jan 2024, with AIRW's help, town-wide acoustic surveys of hydrants and surface patrols identified three active leaks; The project began with a recommendation to replace aging water meters. As the planning matured, the team proposed advanced upgrades, including ultrasonic meters with integrated leak detection and improved tracking at both weekly and annual levels to support Non-Revenue Water (NRW) reduction.

- **ACE Pipe Cleaning: Cleaning + CCTV + Smoke Testing + Manhole Survey:**

Sep 2024: Priority segments cleaned and CCTV-inspected (previously "missing" manholes located).

Oct 2024: System-wide smoke testing identified missing/broken cleanout caps, vent defects, private lateral issues, and structural defects; priority repairs were proposed in Fletcher/Chestnut, Hwy 54, Meadowview, etc.

- **ADS flow monitoring (Sep 2024–Jan 2025):**

Meters at three key points captured flow and storm events to quantify I/I patterns and magnitude, informing risk assessment and network optimization.

- **Hydrant flushing & booster station assessment (Mar 2025):**

Inventory of hydrants and system flushing confirmed normal pressures, flows, and recovery; booster station structures, pumps, and SCADA reviewed with O&M advice.

- **Town Elevated Tank inspection (Mar 3–14, 2025):**

200,000-gal multi-leg steel tank: exterior coating Fair with localized peeling/biofouling; interior lining Good, but bottom sediment requires cleaning. Recommended 1–3 yrs. exterior maintenance and 8 –10 years interior chemical cleaning/mixer.

- **Independent engineering & facility assessments:**

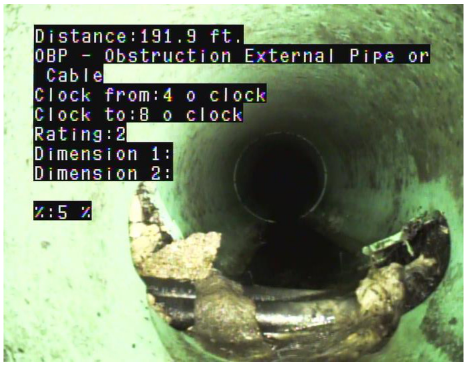
  o George Kurz: Engineering analysis of I/I with "multiple-evidence convergence" prioritization and post-construction verification monitoring.









o Kurt Wright: WWTP site assessment identified structural risks, operational bottlenecks, and aging components; findings and upgrade recommendations were integrated into the AMP.

- **Financials & rate structure (WFA):** Affordability and rate analysis produced 20-year funding scenarios and rate strategies to support "leak reduction + facility renewal + AMI/ultrasonic meter replacements."
- **Energy efficiency (Feb 2025):** Profiled energy/ demand charges; recommended LED retrofits, quick-connect backup generation, and routine leak detection to reduce unnecessary pump cycling; set mid- and long-term goals.
- **Quality control & data integration:** Smart Views performed QC on PCA data to meet industry standards; the team integrated CCTV, I/I, WWTP, financial, energy, and tank/hydrant assessments into the AMP's technical chapters and project lists.
- **Stakeholder coordination:** The core execution team (BAMI-I, AIRW, BFU) held 15+ stakeholder meetings for progress, data reviews, priority setting, and resource alignment; ongoing engagement with the Town Council and operators aligned plans with community needs and allowed responsive reprioritization.
- **Integration into the final report:** All inspection, analysis, and assessment results were incorporated into the 2025 AMP, including:

o Condition results and risk-priority;

o Targeted programs for I/I, WWTP, pump stations, and meters;

o A 20-year M/R/R plan (mainte-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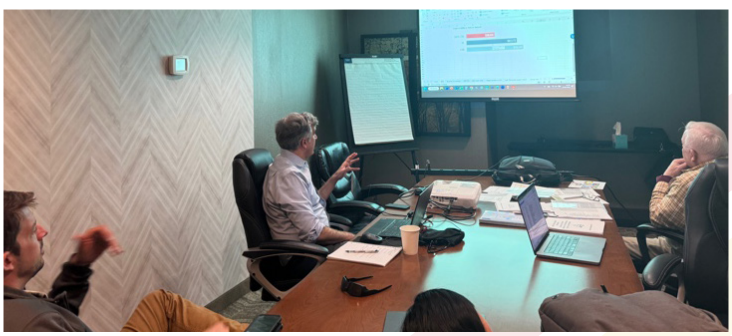


nance, repair, replacement);

o Funding pathways and rate adjustments.

These actions not only advanced local system improvements but also provided a useful reference standard for small systems statewide.

These actions not only advanced local system improvements but also provided a useful reference standard for small systems statewide.

System Diagnosis: A Comprehensive Assessment

After multiple rounds of data collection, inspections, and evaluations across both phases, Switz City's water and wastewater systems were, for the first time, comprehensively assessed and documented. The results provided a clear picture of system conditions, highlighting the spatial distribution of defects and quantifying key health indicators.

With four months of ADS flow monitoring, George Kurz's I/I analysis, and InfoSense acoustic screening of approximately 90% of the collection system, a relatively complete understanding of system performance emerged.

A water audit revealed that between 2019–2023, non-revenue water losses rose from $60,428 to $107,941—accounting for 78.6% of the system's total increase over that period. The Infrastructure Leakage Index (ILI) reached 16.86, far exceeding the industry benchmark of 3.0, indicating severe leakage. For a town with a daily demand of only 120,000 gallons, such losses represent not only wasted resources but also a heavy fiscal burden.

The wastewater system faced similar challenges: 46% of WWTP loading was due to I/I—groundwater and stormwater that should not enter the system—significantly raising treatment costs and operational stress.

A comprehensive assessment found that 32% of critical infrastructure was in high-risk condition. Many pipes, pump stations, and process units—installed in the 1970s–80s—are at or beyond their design life. CCTV inspections revealed previously unlocatable breaks and structural defects, while Kurt Wright's detailed WWTP revealed.

Together, these datasets provided the foundation for targeted solutions. As BAMI-I Project Director Dr. Tom Iseley noted:

> "We aim to give Switz City a long-term plan grounded in real data"

Capital Improvement Plan (CIP) and Funding Overview

Building on the comprehensive assessment, the team developed a 20-year CIP with supporting funding strategies, following risk-based prioritization to direct limited resources toward assets with the greatest impact on safety, compliance, and operational efficiency.

Core objectives

- **Reduce NRW and I/I** – phased pipe renewal, smart meter deployment, and repair of illegal connections and leakage points.
- **Extend critical asset life** – priority repairs and protections for high-risk segments and structures to defer large-scale replacements.
- **Optimize O&M costs** – combine energy-efficiency measures (LEDs, pump efficiency) with routine monitoring to lower energy and maintenance costs.

Priority investment areas

- **Water system:** System-wide ultrasonic smart meters and renewal of high-leakage segments.
- **Wastewater system:** Renewal/lining in high-I/I areas, manhole rehabilitation, pump station upgrades.
- **Cross-system improvements:** Energy optimization, sustainable operations, and institutionalizing SL-RAT, CCTV, and flow monitoring.

The CIP is tightly coupled with funding pathways, providing a clear roadmap and measurable targets for grant/loan applications, project delivery, and regulatory compliance—not just a project list, but a long-term strategy for sustainable infrastructure management.

Funding & Implementation: 20-Year CIP and First-Year Rate Actions

CIP investments are grouped into six categories: long-term compliance, critical renewals, system expansion, regionalization opportunities, technology & energy upgrades, and climate resilience. With comprehensive risk/criticality scoring, projects are prioritized high/medium/low across a 20-year schedule.

- **Phase 1 (2026):** Risk control and system stabilization—deploy smart meters and data integration for continuous monitoring and pinpointing issues; renew key facilities (WWTP core equipment—pumps, critical valves, effluent metering), high-risk pipe segments, and major I/I sources; launch top-priority projects and set annual data/ performance tracking.
- **Phase 2 (2027–2029):** Systematic pipe renewal and pump station upgrades to progressively cut I/I and leakage, ensuring resilient operations under peak loads and extreme weather.
- **Phase 3 (2030+):** Institutionalize preventive maintenance and periodic assessments; optimize energy profile and unit process efficiency; continue pushing leakage and I/I toward reference levels, and prepare for future expansion and climate adaptations as funding and policy allow.

Financial sustainability is pivotal. Glenn Barnes from Water Finance Assistance (WFA) evaluated Switz City's finances and proposed a phased strategy that spreads the $3.72 million (20-year) investment into annual budgets and diversifies funding sources, including SRF/ state loans, operating revenues, and grants.

Collaboration & Governance: Many Hands Driving "Small but Excellent" Change

The AMP is the product of multi-party collaboration. The coordinating body set overall direction and methodology; the on-the-ground team contributed operational know-how and local support; academia supplied analytics and research methods to ground the plan in both science and practice.

Technical support spanned flow monitoring, storage facility assessment, network inspections, and data quality control. Specialist consultants provided deep dives on I/I, WWTP optimization, and financial feasibility, aligning technical solutions with funding.

At project closeout, Heather Himmelberger (Southwest Environmental Finance Center) served as an independent reviewer of AMP technical content and execution plans.

Across the project, the team held 15+ stakeholder meetings, forming a "Problems → Solutions → Funding" loop: early identification through field data and risk analysis, mid-stage cross-disciplinary solution design, and late-stage financial/management alignment for delivery. This model leveraged complementary strengths to advance a "small but excellent" system transformation.

Education & Outreach: Bringing a Real Project into the Classroom

Another key contribution was education and workforce development. Purdue transformed this live project into a valuable teaching resource, giving students hands-on experience and cultivating professionals with modern asset-management mindsets.

In Fall 2023, 22 graduate students in the Underground Infrastructure Asset Management course formed five teams to develop complete AMPs for Switz City under IFA principles—working with imperfect data, resource constraints, and competing objectives, just like real practice.

In Spring 2024, the Pipeline Condition Assessment & Integrity Management course deepened understanding of SL-RAT, CCTV, satellite imaging, and field measurements through lectures and cases.

This educational model benefited the project team as well: dialogue between veteran engineers and inquisitive students often sparked unexpected innovation.

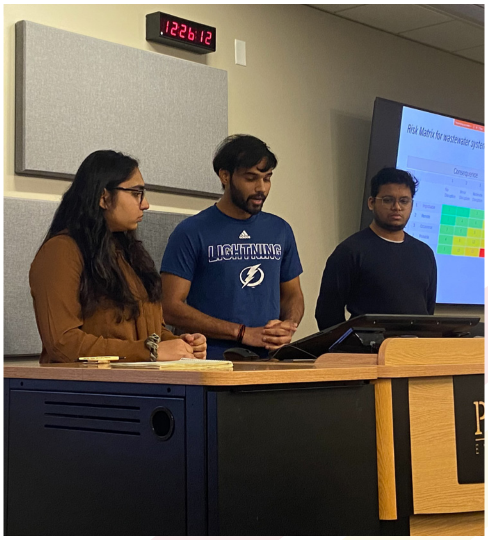
In addition to classroom integration, the Switz City AMP was also shared broadly across professional and regulatory forums. The project was presented to the Indiana Senate Utility Committee and Underground Infrastructure Conference, the Alliance of Indiana Rural Water conference, and at other group meetings. Each of these venues provided opportunities to highlight the project's methods, lessons, and practices—further raising awareness of asset management and inspiring other communities to take action.

Implementation Readiness

With the AMP finalized, Switz City has entered implementation. Of the $650,000 budget, $400,000 for construction is in place, and some critical works—smart meter replacements, selected high-risk renewals/repairs—have already begun. Remaining construction


OUTSTANDING DEBTS AND LEASES


Town of Switz City AMP Project
BAMI-I
ALLIANCE INDIANA


LIGHTNING


Switz City, IN Asset Management Plan
BAMI-I
ZIPTILITY


PURDUE ONLINE

is being sequenced and will proceed in phases as funds and resources are secured.

The team recognizes that the plan-to-execution transition is the biggest challenge. Even the best plan must be executed accurately to deliver outcomes. BAMI-I and AIRW will continue to provide technical support and project management to ensure each implementation step adheres to the AMP.

Toward Replication

With Indiana's evolving regulatory landscape, HB 1459 shifts asset management from encouragement to mandate, with deep statewide implications.

Switz City's experience has drawn industry attention as a realistic path for small utilities to plan and implement systematic improvements under resource constraints. While conditions vary and direct copy-paste is unlikely, the project's methods, processes, and collaboration model offer a foundation for broader adoption.

Building on these lessons, the team proposed I-WIIC (Indiana Water Infrastructure Innovation and Collaboration)—an industry collaboration platform to accelerate innovation and cooperation, especially for small and mid-sized utilities facing aging assets, funding gaps, limited technical capacity, and tighter regulation. WIIC's core idea is cross-sector collaboration—associations, academia, technology vendors, and operators—to share knowledge, reduce costs, and speed deployment. Priorities include advancing inspection/asset-management methods, providing standardized frameworks and practice manuals, building training pipelines, and conducting multi-community pilots to validate and codify replicable models. The long-term goal is a statewide/national network enabling small utilities to access advanced technology, management methods, and funding channels.

Within WIIC, the team envisions additional AMP pilot developments across varied utility sizes and the drafting of a Manual of Practices spanning data collection, technical evaluation, financial planning, and project delivery—an actionable pathway for small utilities.

Conclusion

Looking back from concept to completion, the most striking feature is the collective persistence toward improving the town's infrastructure—from IFA's Jim McGoff's support, to Dr. Tom Iseley's coordination, to George Kurz's analyses, to Purdue students' learning and contributions.

Completion of the AMP marks Switz City's shift from "problem identification" to "solution implementation." In the coming years, we will watch this sub-300-resident town pursue improvements: Will water loss drop as planned? Will I/I be effectively controlled? Will high-risk assets be renewed on time? Time will tell.

The project's meaning extends beyond one town. It shows other small communities that with a systematic approach, multi-party collaboration, sound planning, and persistent execution, infrastructure challenges can be improved. While contexts differ, the underlying methodology is transferable.

As BAMI-I's mission states: "Extend asset life by sound methods, improve system efficiency, protect public health, and enhance quality of life." Finishing the Switz City AMP is an important step toward that goal. Uncertainties remain, but at least there is now a data-driven plan for action.

Acknowledgments

Core Partners

Buried Asset Management Institute–International (BAMI-I)
Underground Infrastructure Team (UIT), Purdue University
Alliance of Indiana Rural Water (AIRW)
Bynum Fanyo Utilities, Inc. (BFU)

Funding Support

Indiana Finance Authority (IFA)

Technical Support & Data Collection

Ziptility, Inc.
George Kurz
Kurt Wright
ADS Environmental Services
ACE Pipe Cleaning Company
InfoSense
Utility Inspection Services (UIS)
4M Analytics
Smart Views, LLC
Water Finance Assistance (WFA)
USG Water Solutions

Education & Knowledge-Sharing Contributors

Ross Waugh, Waugh Infrastructure Management Limited — AMP development expert
Smith F. Rangel, M.Eng. — NASSCO Certified Trainer
Adam Hershberger — AIRW expert (formerly Ziptility)
Purdue AMUI graduate students — contributors to the initial AMP drafts
Glenn Barnes, Water Finance Assistance
Kurt Wright, Independent Consultant
Chris Callahan & Alex Churchill, InfoSense
Joseph Eberly, 4M Analytics
Jim Harris, Independent Consultant

Special Thanks

Heater Himmerlberger, Southwest Environmental Finance Center – for her guidance, expert review, and practical recommendations that greatly strengthened the structure and clarity of this plan.
Switz City Town Council and residents – for their trust, collaboration, and unwavering support throughout every phase of the project.

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- Asset Worth Value & Life-Cycle Analysis • Risk-Based Budgeting

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- Life-Cycle Costing
- Case Study Examples

Why offer courses in Asset Management?

The Buried Asset Management Institute-International (BAMI-I) created the Certification of Training in Asset Management (CTAM) program to increase awareness and train utility personnel on the best way to implement and use asset management to extend the life and efficiency of their water and wastewater systems. CTAM is an educational series for obtaining certification of training in the management of water asset infrastructure.

Levels of Certification

- Certificate of Completion – requires completion of each course
- Associate Water Asset Manager (AWAM)–requires completion of CTAM 100-400 and an application submitted to the BAMI-I Asset Management Certification Board
- Professional Water Asset Manager (PWAM) – requires completion of CTAM 100-400, four years of relevant asset management experience, and an application submitted to the BAMI-I Asset Management Certification Board

Benefits of the CTAM Series

- Expand your knowledge and access to resources to enable you to initiate, continue or improve your own asset management program.
- Earn internationally recognized certification in the field of asset management.
- Earn CEU / PDHs* for each course.

AN EVALUATION OF

The Switz City WWTP

The Switz City Wastewater Treatment Plant (WWTP) is located at 5429 County Road 200 N., Switz City, IN. The National Pollutant Discharge Elimination System Program or NPDES Permit Number is IN0042650, and the Town of Switz City is registered as the Permittee. It is classified as a Class I, minor municipal WWTP, rated at an average daily influent flow of 0.036 MGD, or 36,000 GPD.

As part of the Switz City Total Asset Management Plan (Plan), SDG Engineering had the privilege of evaluating this WWTP as part of that Plan. SDG Engineering (SDG) served as a subconsultant to the Buried Asset Management Institute – International (BAMI-I), which managed and wrote most of the Plan.

The Town of Switz City owns the WWTP; however, operation of the WWTP has been provided for many years under a contract with Bynum Fanyo Utilities (BFU), located at 3499 W. Maple Grove Road, Bloomington, IN.

SDG conducted a reconnaissance of the WWTP on Wednesday, November 13, 2024. A few highlights of the evaluation are provided in this article.

Original Construction

The original WWTP was designed in 1990 by M.D. Wessler & Associates, Inc., Consulting Engineers, Indianapolis, Indiana. It was constructed between 1990 and 1991. The WWTP was constructed under EPA Project Number C180450 02. Based on this EPA Project number, the EPA indicates that a construction grant of $888,977 was provided for this WWTP, which is equivalent to approximately $2 million in current dollars.

A point of interest

SDG conducted a cost estimate to replace this WWTP in fourth-quarter 2024 dollars. The result of this effort revealed that the total replacement of this WWTP, in rough order of magnitude dollars, would be around $1.9 million. This is equivalent to the EPA grant, adjusted to the current value of money as noted above. The methodology for this is described below.

The methodology used to determine its value was based on examining the cost of replacing the WWTP with a new one on the same piece of property as the existing one, which would perform the same function as the existing WWTP. SDG discussed replacement costs with various contractors experienced in WWTP construction, specifically in terms of the unit cost in dollars per gallon. The "gallon" referred to here is the average daily design flow (ADF) for the WWTP. The "grossed-up" unit price values were calculated by aggregating the construction costs for various WWTPs, whether new, a major expansion, or a rehabilitation project, and then dividing that total by the design ADF for those plants. With this knowledge, one can understand the context of these values; they are general because they do not take into account

BFU
BYNUM FANYO UTILITIES

TABLE 1

	Quantity or Loading			Quality or Concentration			Monitoring Requirements	
Parameter	Monthly Average	Weekly Average	Units	Monthly Average	Weekly Average	Units	Measurement Frequency	Sample Type
Flow [1]	Report	----	MGD	----	----	----	5 X Weekly	24-Hr. Total
$CBOD_5$								
Summer [2]	4.5	6.9	lbs/day	15	23	mg/l	Weekly	Grab
Winter [3]	7.5	12.0	lbs/day	25	40	mg/l	Weekly	Grab
TSS								
Summer [2]	5.4	8.1	lbs/day	18	27	mg/l	Weekly	Grab
Winter [3]	9.0	13.5	lbs/day	30	45	mg/l	Weekly	Grab
Ammonia-nitrogen								
Summer [2]	0.3	0.5	lbs/day	1.1	1.6	mg/l	Weekly	Grab
Winter [3]	0.5	0.7	lbs/day	1.6	2.4	mg/l	Weekly	Grab

TABLE 2

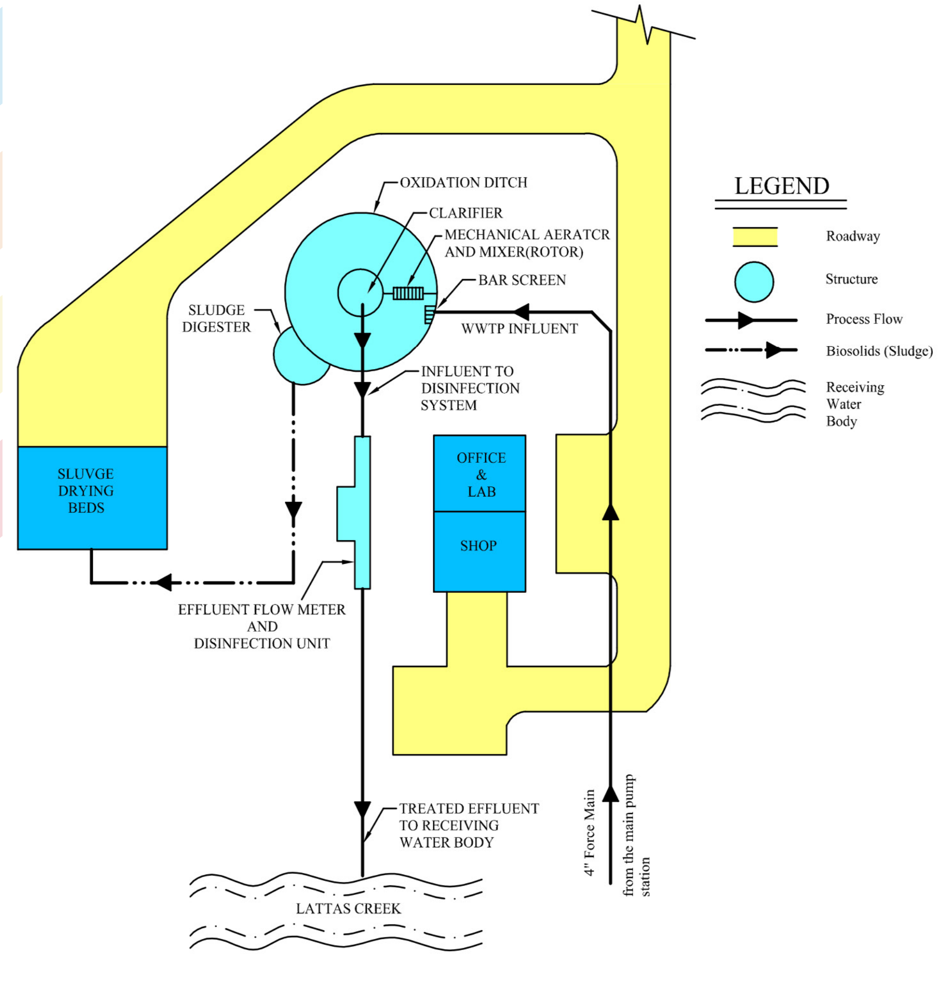
	Quality or Concentration				Monitoring Requirements	
Parameter	Daily Minimum	Monthly Average	Daily Maximum	Units	Measurement Frequency	Sample Type
pH [4]	6.0	----	9.0	s.u.	2 X Weekly	Grab
Dissolved Oxygen [5]						
Summer [2]	6.0	----	----	mg/l	2 X Weekly	2 Grabs/24-Hrs.
Winter [3]	5.0	----	----	mg/l	2 X Weekly	2 Grabs/24-Hrs.
Total Residual Chlorine [6]						
Contact Tank [7]	0.5	----	Report	mg/l	2 X Weekly	Grab
Final effluent [8]	----	0.01	0.02	mg/l	2 X Weekly	Grab
E.coli [9]	----	125 [10]	235 [11]	cfu/100 ml	Weekly	Grab

the specifics of a particular project for which they are being applied. Thus, they are to be considered something akin to a Rough Order of Magnitude or ROM cost range. When estimating the ROM cost for a replacement WWTP, one key consideration is the phenomenon of economies of scale. In the construction industry, certain fixed overhead costs must be taken into consideration. As the project grows in size, the per-unit cost of construction tends to decrease because these fixed costs are spread over a larger number of units, such as excavation, concrete, reinforcing steel, square footage, amount of equipment and fixtures, and other factors. For this reason, the unit cost of a small WWTP would be higher than that of a large WWTP due to the phenomenon of economies of scale. The unit cost in terms of dollars per gallon utilized for the Switz City WWTP is on the higher end because it is a small WWTP. The estimated unit cost is presented in a range of $30 to $35 per gallon. It is essential to note that the Rated Design Capacity of the Switz City WWTP, or ADF, is 36,000 gallons per day. It is unlikely that additional capacity will be necessary in the near future. It is with these provisos that replacement values are presented in the Table that follows.

A Total Project Budget is a dollar figure that represents all the possible costs involved in a particular endeavor. The elected leaders of a municipality need to know the total expected costs because they must legally authorize the expenditure of the funds to engage in any significant project. It would be unfortunate for them to authorize a project to proceed and later discover that it costs significantly more than originally anticipated. This is why it is important to attempt to capture all the anticipated costs of a potential project. Some jurisdictions require the adoption of an official Resolution for this purpose, such as a Project Budget Ordinance. Its function is to allocate town funds for a specific project officially. A Total Project Budget is usually the basis for the costs presented in the Project Budget Ordinance.

To determine a Total Project Budget for a replacement WWTP, which would be a major undertaking for the Town of Switz City, other factors must be taken into consideration. For example, a ten percent construction contingency would be appropriate. Further, there are many non-construction related costs, otherwise known as "soft costs," associated with a new WWTP, including but not limited to:

- Grantsmanship (that which is necessary to secure funding for the project)
- Preliminary Engineering Report (usually required by EPA or a state agency if Federal or State funds are involved)
- Environmental Issues and Permitting (Federal, State, and Local regulatory compliance)
- Engineering Design



PROCESS FLOW DIAGRAM
SWITZ CITY WWTP
NTS

- Preparation of Construction Documents ("Plans and Specifications")
- Advertisement for Construction Bids and Recommendation of Award of Contract ("Bidding")
- Contract Administration and Construction Observation (CA/CO or Construction Phase Services)
- Start-up services
- Legal Services (If any)
- Final Certification of Construction Compliance by the Consulting Engineer and submission thereof to the regulatory authority

Soft costs are highly variable for each project and are difficult to estimate during the very early planning stages. A typical placeholder number used to budget for these potential soft costs is around 35 to 40% of the construction cost. Therefore, adding the 10% construction contingency and 40% of soft cost expenses results in a factor of 1.5 times the estimated construction costs. Taking the higher unit cost value discussed earlier of $35 per GPD, the replacement cost for a WWTP of this size would be $1,260,000. Therefore, the Total Project Budget for a new replacement plant located on the same piece of property as the existing one would look something like this: $1,260,000 X 1.5 = $1,890,000. In summary, it is suggested that the value of this significant town asset for the second quarter of 2025 should be approximately $1.9 million.

Process

The following figure shows the process flow diagram for this WWTP. It is a biological treatment plant based on the extended air activated sludge treatment process utilizing an oxidation ditch. The treated effluent is discharged to Lattas Creek.

Effluent Limits

The NPDES permit effluent limits are presented in Tables 1 and 2 below.

The WWTP generally meets all of the NPDES permit effluent limits.

A summary of the findings

The evaluation found that the replacement value of the WWTP is about $1.9 million. It is performing well, generally speaking. However, there is an issue with excessive rain-dependent infiltration and inflow (RDII) that requires attention. The evaluation recommended that the town consider the possibility of regionalization with a nearby municipality, with Bloomfield or Linton being the two possible options. A long-term Capital Improvement Plan (CIP) provided several recommendations totaling $1.5 million worth of repairs, rehabilitation, and replacements.

Author

KURT D. WRIGHT, P.E.
Owner/President, SDG Engineering, Inc. – Bostic, N.C.

Mr. Wright's experience with Asset Management began in 2012 with his membership in BAMI-I (Buried Asset Management Institute – International). Mr. Wright was the chief author of the Asset Management Plan for the town of Spindale, NC, which was approved by the state of North Carolina in 2013. He holds a certificate of completion for CTAM 100, 200, 300 & 400, is a Professional Water Asset Manager (PWAM), and contributed to the development of the CTAM 200 and 400 training manuals.

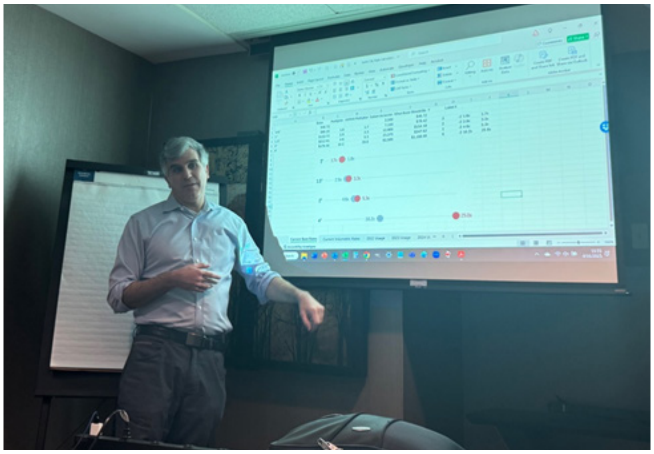
SWITZ CITY'S ASSET MANAGEMENT PLAN:

An Opportunity to Re-Examine Rates

Asset management plans identify capital projects that must be completed so that the utility can continue to provide safe and reliable service, and those capital projects require money. In conjunction with the asset management plan for Switz City, team partner Water Finance Assistance conducted a rate study to determine what rates Switz City needed to charge in order to cover rising operating costs and the costs of implementing the asset management plan. This analysis also gave Switz City an opportunity to think about how it wished to structure its rates.

The purpose of a rate study is to determine if the utility's current rates will generate sufficient revenue to cover future expected expenses. The rate analysis predicts the future expected operating costs by looking at trends in expenses, as well as any expected debt service payments, capital outlays, and contributions to reserve funds. Taken together, these represent the annual financial target for the utility. The analysis then anticipates future revenues by projecting the number of customers, usage, and bill payment rate and applying the current rate structure. If projected revenues meet or exceed the financial target, the utility can retain the current rates. If not, the rates should change.

The financial target calculation tells a utility how much money they will need



for the coming year but not how to generate that total. The utility could make small adjustments to its current rate structure to generate the extra money, but an asset management plan presents an opportunity for utilities to step back and ask if their current approach to rates makes sense.

The overall goal of any rate structure is to generate sufficient revenue for the utility, but that is not the only priority in rate setting. Utilities, for example, may wish to have stable revenue each month since most of the cost of running utilities do not depend on the volume of water or wastewater treated. Utilities may wish to have rates that are affordable for their least fortunate customers. Utilities may wish to encourage customers to conserve water. They may wish to have rates that are simple for customers to understand and easy for the utility staff to administer. Finally, all utilities should strive for rates that are fair to their customers.

The analysis for Switz City showed that both the drinking water rates and the wastewater rates would need to rise in order to generate sufficient revenue to cover increasing operational costs and substantial debt service related to several high-priority capital projects. The question became how best to structure the rates to meet the appropriate priorities for Switz City.

The rate study first examined the issue of affordability. Switz City serves many less fortunate customers. A review of census data showed that almost half of all families in Switz City are at or below 200 percent of the federal poverty level and would be considered low-income or near-poverty. The median household income in Switz City is more than $28,000 less than the median household income for Indiana as a whole. Income growth in Switz City over the past 15 years has been slower than state and national figures, and incomes are not keeping up with inflation. The lowest income households are barely covering basic necessities such as housing, food, utilities, and health care. Affordability should be a consideration when Switz City structures and prices its rates.

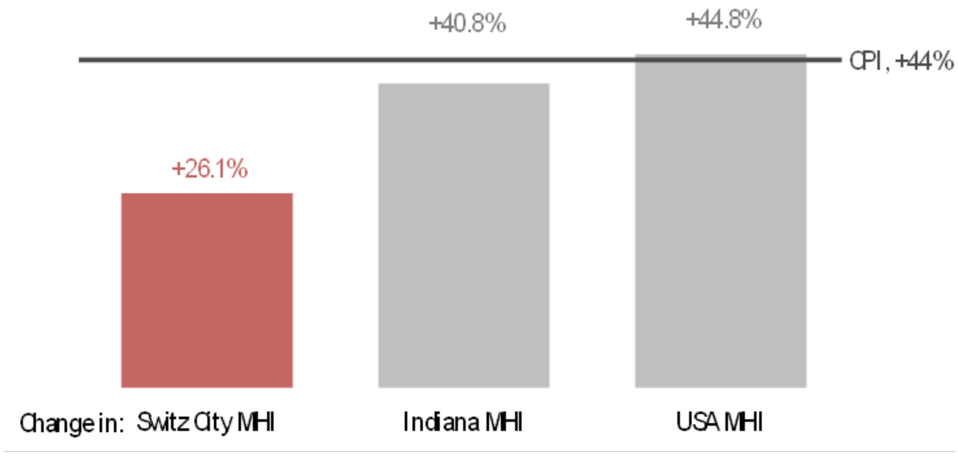


Figure 1: Income growth has been slow in Switz City.

The rate analysis then examined the rate structure itself. Switz City currently has different rate structures for water and for wastewater. Wastewater customers have a monthly minimum charge and then pay a single rate per 1,000 gallons of wastewater generated. This is a straightforward approach to billing that customers can easily understand. Water customers have a different and more complex rate structure. Water rates also have a monthly minimum charge but are then structured as decreasing block, where the price per 1,000 gallons of water used goes down as usage goes up, and there are six blocks.

This type of rate structure can be appropriate in communities with many large users, but Switz City is a largely residential community, and most of its non-residential customers do not use a lot of water each month. Very little usage was in the highest blocks.

The price differential between the five highest blocks is also relatively small. There isn't much point of having separate blocks if the price differential is so tiny. It only creates work for the utility without actually saving the customer a lot of money.

Utilities with block rate structures should evaluate the effectiveness of block rate structures on an annual basis, and that involves examining the usage of each customer each billing period. Switz City, however, does not have an easy way to export customer-by-customer usage data in a format that allows for easy analysis.

All these factors suggest that Switz City's water rate structure was unnecessarily complicated. Customers are more likely to accept rates and rate changes when the rate structure is easily understood.

The rate analysis proposed two potential drinking water rate options for Switz City. The first would keep the current structure in place and increase all prices evenly. The second would simplify the rate structure to one that mirrors the wastewater rate structure, with a monthly minimum charge and then a single price per 1,000 gallons at all levels of usage.

Both rate options would generate the same amount of revenue for the utility. Which option, then, is "right"? There is no definite answer to that question. The current rate structure may be complicated, but customers are familiar with it, and since most customer usage was low, their bills only involved the first block or two of the rate structure. On the other hand, lower use customers (who may also be low-

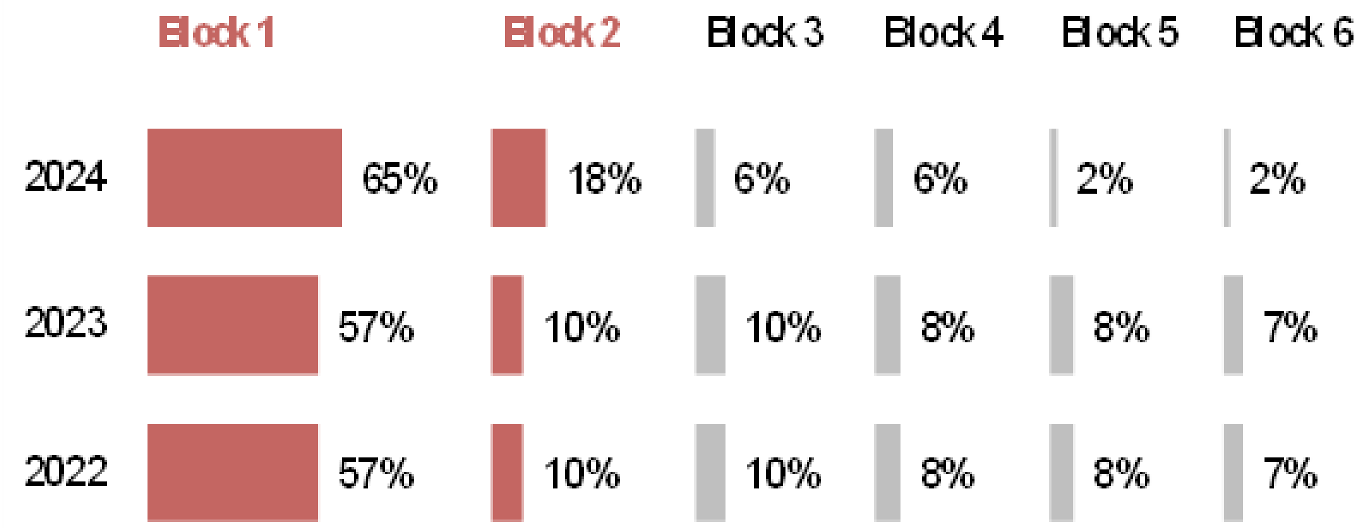


Figure 2: Most revenue comes from the first two blocks.

er income customers) would fare better under a simplified structure because the price per 1,000 gallons at lower usage levels would be lower.

Utilities should not feel that they need to restructure their rates during the asset management process, but it is a good time to ask why the rates are structured the way they are and if that makes sense for the community. If the answer is that the rates are structured that way because "that's the way they have always been," it may be a good idea to consider alternatives.

Author

GLENN BARNES

Glenn Barnes is the Director of Water Finance Assistance, a training and technical assistance organization dedicated to building the financial and managerial skills of drinking water and wastewater utility employees. He has worked for more than 15 years with utilities of all sizes across the country. Glenn's work focuses on rate setting, asset management, affordability, increasing bill payments, accessing infrastructure funding, water loss and conservation, and workforce retention. All the work of Water Finance Assistance is rooted in data analysis, allowing utility staff to make informed and objective decisions to improve their sustainability and to serve their communities for years to come. Glenn is based in North Carolina.

CTAM UPGRADE COMING

In the rapidly evolving landscape of utility management, the need for comprehensive and data-driven asset management practices has never been greater. The CTAM (Certification Training in Asset Management) program provides education and tools for utility management, government, staff, and engineers seeking not only to deepen their technical knowledge but also to solidify their role as leaders in the industry.

The BAMI-I CTAM program has served the asset management community well for the past 10 years. So that it continues to serve well, it is in the process of receiving an upgrade regarding both its content and procedures.

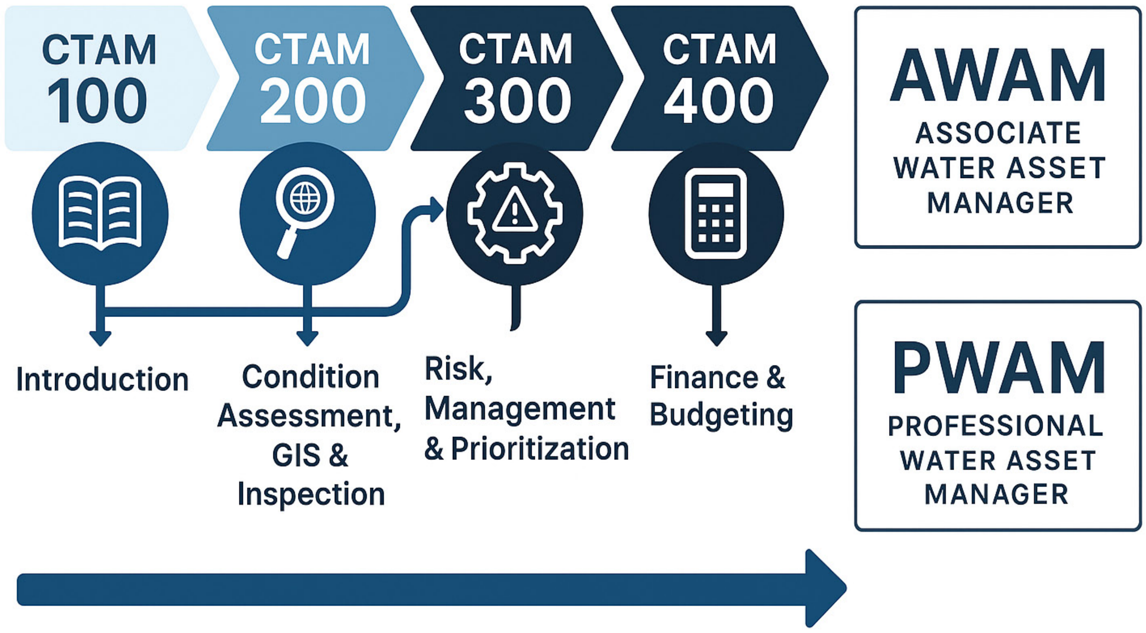
The goal of the CTAM program has always been to assist small communities regarding their ability to manage their buried gravity pipe assets, particularly wastewater and storm water. The management of pressure pipe assets, including water mains and force mains, though not being ignored, has not received sufficient emphasis.

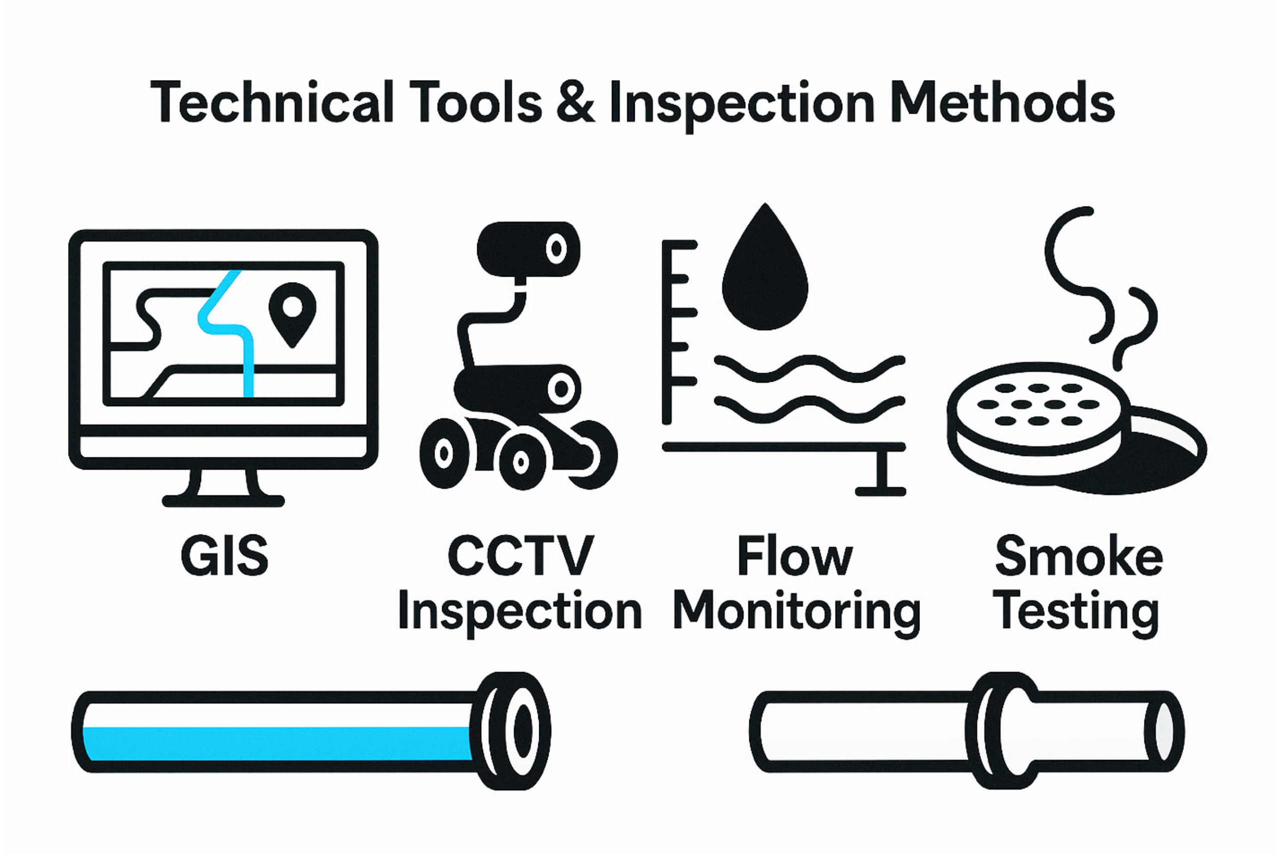
The current CTAM certification consists of four courses. CTAM 100 is an Overview of Asset Management. CTAM 200 involves the Development of an Asset Management Program. CTAM 300 trains the Managing of an Asset Management Program. Finally, CTAM 400 regards the Financing of an Asset Management Program. Courses are available online at your own pace or in a classroom with an instructor.

Through this process asset managers were able to become an Associate Water Asset Manager (AWAM) or with sufficient experience a Professional Water Asset Manager (PWAM).

The BAMI-I Board, desiring to assure that CTAM materials remains current, focused on the small utility goal, and more readily and frequently available has authorized a thorough review and revision to both the content and process of CTAM.

The content of CTAM will become even more focused upon assisting small utilities. These utilities of less than 25,000 customers are, by far, the ma-





jority of communities, have the same issues as larger utilities, but typically lack available resources. Our goal will also be to simplify and reorganize the content. In addition to continuing limited self-paced and local in-house training, our ultimate goal will be to also develop live, trainer-led courses to provide high-quality training without the need for travel or venue arrangements.

The current plan is to restructure CTAM 100 into an introductory, virtual, online, self-paced course focusing on the need for and history of asset management. It will consider the long-term and short-term goals of asset management and briefly introduce the eight basic questions to be answered by any asset management plan:

1. **What assets do we have?**
2. **What is the asset's location?**
3. **What are the asset's conditions and remaining useful life?**
4. **What actions are required next?**
5. **How much will it cost to maintain or repair each asset?**
6. **What is the priority of the action?**
7. **What is each asset's current value?**
8. **What is each asset's current value?**

CTAM 200 and CTAM 300 will each be developed into a one-day course that will be taught either in a live or virtual classroom by a trainer. We hope that this will enable a broader interest by making courses more accessible, feasible to develop, and attend. While much of the material will be the same, these two courses will be separated into two modules – gravity pipe management and pressure pipe management. Our desire is for both gravity and pressure pipe managers to receive targeted training.

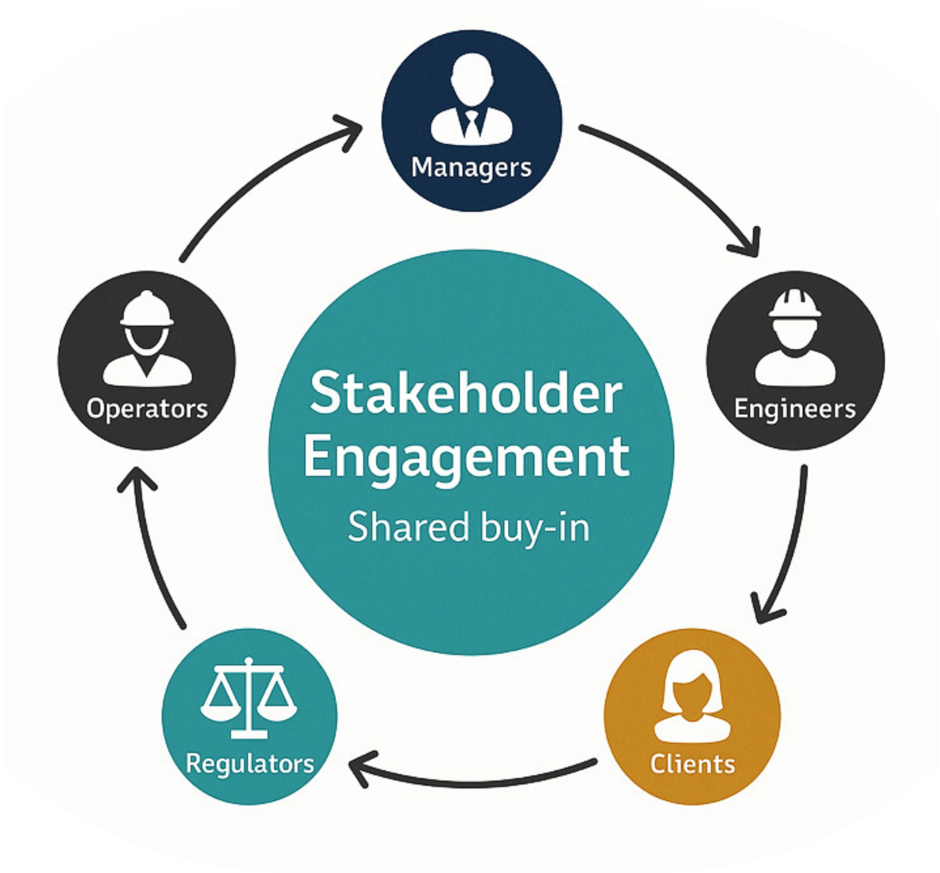
CTAM 200 will focus upon condition assessment. It will focus on the first three of the basic questions:

1. **What assets do we have?**
2. **What is the asset's location?**
3. **What are the asset's conditions and remaining useful life?**

This course explains how GIS mapping can be employed to identify the assets a utility possesses and the locations of these assets. It will then address how flow monitoring, flow isolation, smoke testing, manhole inspection, and closed-circuit television (CCTV) inspection cab be used to determine the condition of the assets as this relates to the structure of the asset and the capacity issues related to an asset. It will also explain how the GIS process links assessment to the mapping. CTAM 200 will explain how a utility will obtain the essential information necessary to develop an asset management plan.

CTAM 300 will focus upon using the foundational information gained by mapping and condition assessment to develop and manage an asset management plan. To do this, it will focus upon the next few questions:

1. **What actions are required next?**



2. How much will it cost to maintain or repair each asset?

3. What is the priority of the action?

We will consider how Likelihood and Consequence of Failure (LoF/CoF) can be developed and used to establish what risk an asset has and how to use this to prioritize immediate, ongoing, and future asset rehabilitation, replacement, maintenance, and ongoing assessment priorities either to eliminate gaps or build upon existing benchmark data. These are essential for setting and maintaining a utility's asset management current, ongoing, and future budget. All of this must be based upon the codified Level of Service that a utility expects to deliver.

CTAM 200 and 300 courses will be designed specifically for engineers and asset managers who handle the intricate aspects of each asset's management.

CTAM 400 targets utility managers, accountants, and government officials. This discussion will address the final two financial based questions:

1. What is each asset's current value?

2. What is each asset's current value?

This will also be a live class that can either be virtual or in a classroom. It will examine how asset management principles can determine the overall value of utility assets, set rates, and budget for future needs.

The entirety of CTAM will emphasize the need for all the stake holders in a utility – management, engineering, operations, board/council, regulators, and customers – to share in the process and "buy in" to the plan. Without this, a plan, regardless of how well it is constructed, will have limited chances of success.

By fostering collaboration and transparency among all parties involved, utilities can create resilient asset management strategies that adapt to changing regulatory, technological, and financial landscapes. Encouraging ongoing professional development through initiatives like the CTAM courses ensures that personnel remain equipped with the latest methodologies and tools. Ultimately, when stakeholders are actively engaged, utilities are empowered to make data-driven decisions that optimize resource allocation, protect critical infrastructure, and uphold their commitment to reliable, high-quality service delivery for the communities they serve.

Author

JIM HARRIS
Senior Project Engineer, Retired from Jacobs Engineering
BAMI-I Board of Directors

Workshop: Certification of Training in Asset Management CTAM 100, 200, 300 & 400

Dates:

October 20 - 23, 2025

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Understanding the role **AI can play**

IN UTILITY INVESTIGATION

There has been a lot of discussion lately around Artificial Intelligence (AI), and the role it plays, or can play in our lives and professions. Emerging technologies, particularly Artificial Intelligence (AI) is looking to transform how we locate and map buried utilities. This article explores how AI-derived data integrates with the ASCE 38-22 Standard Guideline for Investigating and Documenting Existing Utilities, focusing on the implications for Quality Level D (QLD), professional judgment, liability, and the need for rigorous documentation. Insights from technology leaders and practicing professionals frame a cautious but forward-looking approach to incorporating AI into SUE practice.

AI is rapidly expanding its influence in many professional domains, including civil and utility engineering. One of the uses for AI is within my professional specialty, Subsurface Utility Engineering & Investigation, or utility investigation more broadly. Among its emerging applications is the use of AI to locate, infer, and depict buried utilities, tasks traditionally performed by utility engineers through records research, and field surveys. With the growing availability of digital utility records, historical maps, and satellite imagery, AI offers promising capabilities to consolidate data and suggest utility locations. As this technology advances, a pressing question emerges: can AI-derived data meet the standards of utility investigation as defined by ASCE 38-22? This article evaluates that question through the lens of Quality Level D (QLD), examines the role of the Utility Professional, and provides guidance for responsibly integrating AI into the SUE process.

While many companies and individuals are exploring various aspects of AI, notable among these are:

- 4M Analytics: Uses AI to synthesize massive utility record datasets, satellite imagery, and publicly sourced data to deliver a utility map meant to support early project planning.
- Exodigo: Combines multi-sensor geophysical data (GPR, EM,

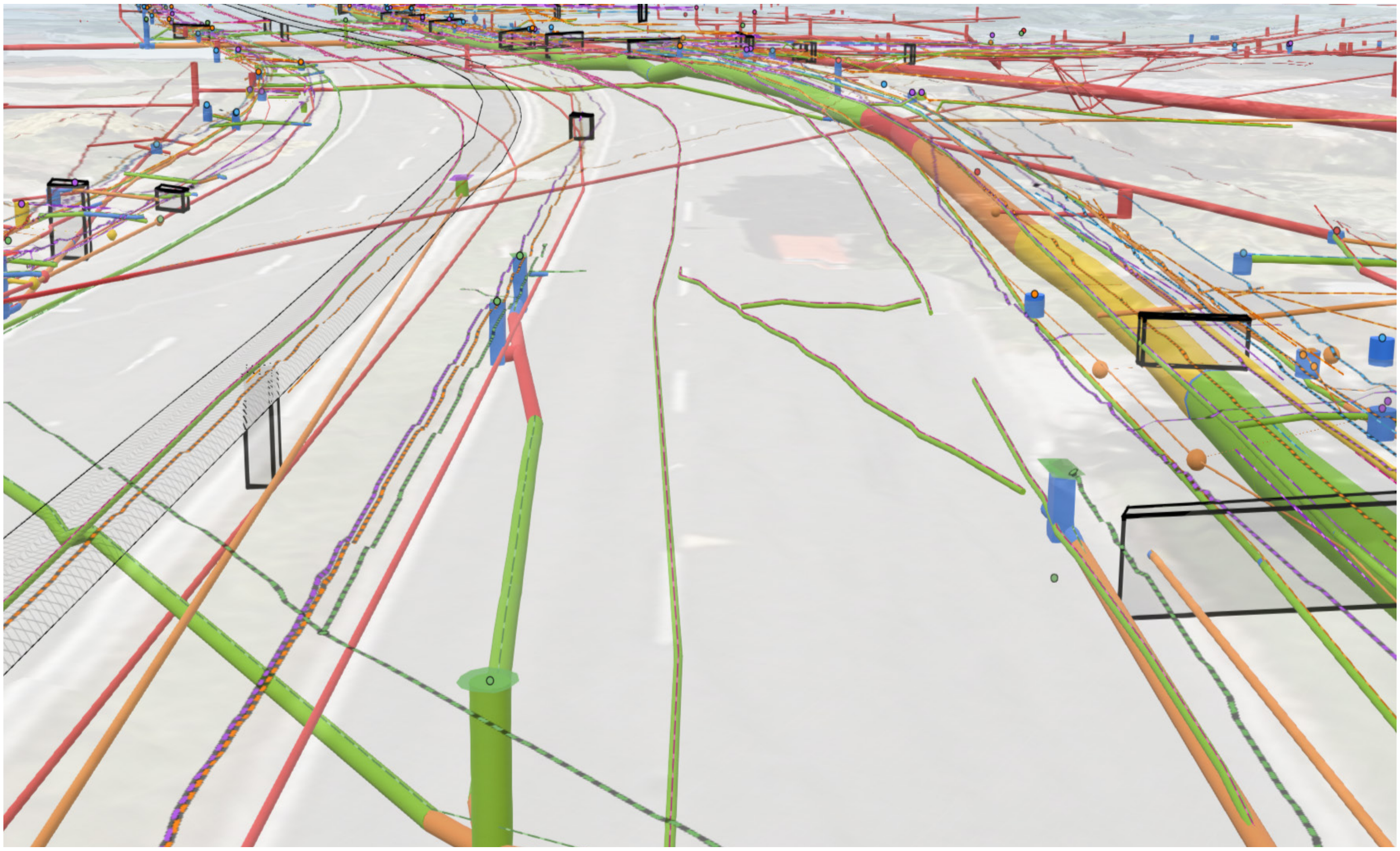

Figure 1, AI-Enhanced 3D SUE - Reveal

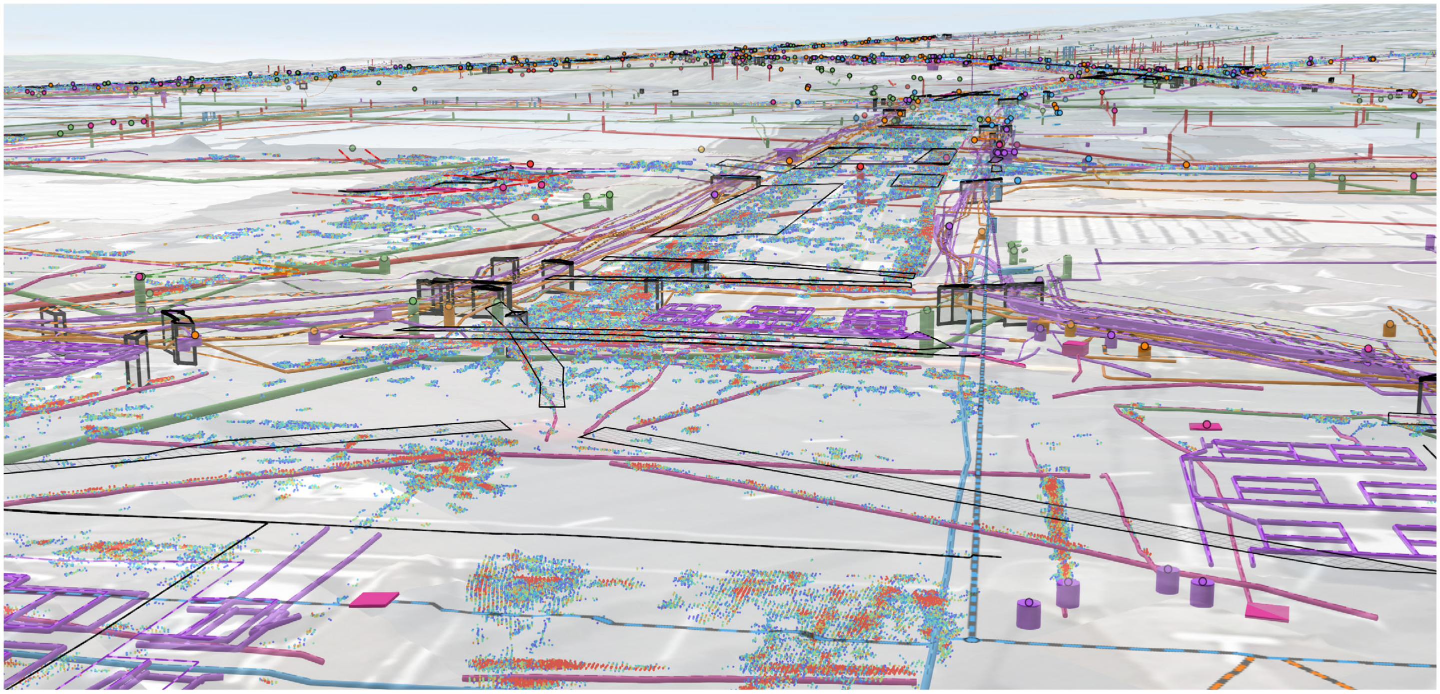

Figure 2, AI-Enhanced Utility Imagery - Reveal

magnetics) with AI algorithms to locate and identify underground utilities without excavation.

- Reveal: Integrates utility survey data and geophysical detection into a model that is AI-processed for pattern recognition and utility inference.

Each of these entities offers technology that provides insight into utility information through AI-driven analysis of information to derive a report of likely or potentially existing utility placements. These representations are often presented as meeting or approximating QLD—but can they truly be adjudged as such under ASCE 38-22? Though I have some familiarity with the process in general, I will not pretend to know exactly how these providers apply their methodologies, processes, or algorithms, so I have reached out to each for some insight for this article.

In the broad sense, and likely grossly oversimplified, the AI-derived utility information is compiled from multiple sources to deliver a singular report of the information. As I understand the process, the information sources include information gathered from Geospatial Information Systems (GIS), as-built or as-constructed plans, utility records, utility atlases, records of previous utility investigation efforts, permit databases, satellite imagery (i.e., Google Earth, Bing, etc.), and even publicly sourced imagery (public photos, CCTV images, etc.). These disparate data sources are then geo-aligned or geo-referenced and amalgamated, layered, and conflated, through one or more algorithms to determine the likely position of the existing utilities in a given area. The output is then delivered in various formats (CADD, Shapefile, KMZ, etc.) for consumption by the requesting party. This is where the subject gets interesting, and the questions start arising.

Before jumping into the questions, it is important first to discuss the standard we recognize for depicting utility information, the ASCE/UESI/CI 38-22 Standard Guideline for Investigating and Documenting Existing Utilities. “Endeavors to safeguard public welfare by providing guidance on performing utility investigations and documenting results in a standardized fashion. It serves as both a prescriptive standard and a performance standard. As a prescriptive standard, it provides a series of minimum actions necessary to achieve utility quality level documentation. As a performance standard, it describes the professional judgment necessary to determine the appropriate timing, sequencing, location, and scope of a utility investigative effort” (ANSI webstore, 2025). The ASCE 38 standard presents a credible system for classifying the quality of utility location information that is placed in design plans. The quality levels for documenting existing utilities are Quality Level D (QLD), Quality Level C (QLC), Quality Level B (QLB), and Quality Level A (QLA). These quality levels are probably most easily understood in terms of traditional grammar school letter grades, with D being the lowest passing grade, and A being the highest passing grade.

Of course, this is a basic simplification of the quality levels, but it does reasonably summarize the point. If you are depicting existing utility information on a set of construction plans, such information as adjudged by the utility professional to be QLD would be the lowest grade of information acceptable. This does not mean that the depicted information is correct, it merely indicates that an effort was made to identify the existing utilities within the project scope, through researching available utility records and qualifying their relevance to the project scope and limits. QLD information is not understood to be sufficient to design an invasive construction project, it is a foundation to guide additional investigation through the application of engineering survey and geophysical instruments.

ASCE 38-22 defines QLD as follows: The Utility Professional for the project may

> "A value assigned to a Utility Segment or Utility Feature not visible at the ground surface whose estimated position is judged through Utility records information from others, or from visual clues such as pavement cuts, obvious trenches or existence of service."

assign QLD to utility attributes, segments or features after review and compilation of existing records, oral recollections, One Call or "private locate" markings, managed data repositories in context with other achieved Utility Quality Levels, and/or other evidence of existence. QLD data is more uncertain than QLC, QLB, and QLA. QLD data is less uncertain than utilities documented without any Utility Quality Level barring a Professional's statement of fact to the contrary" (ASCE/UESI/CI 38-22 - Standard Guideline for investigating and Documenting Existing Utilities, 2022).

Using this tiered system, project designers can manage risk: for instance, they might rely on QLD for an initial project analysis, QLC and utility feature surveys for a more significant review, and QLB data for more specific planning, and perform QLA test holes at key conflict points. ASCE 38-22 not only defines these levels but also gives a more prescriptive process for achieving them than the previous standard (ASCE 38-02), emphasizing thorough documentation and professional oversight. Now that we have defined the standard by which this data is judged, we need to determine if the AI-derived data meets the QLD standard, or if it can be adjudged by the Utility Professional to achieve this level. One of the key elements is data sources and the chain of custody for the data utilized to provide the AI-derived output. The Utility Professional should insist that the AI platform provides references for the data. For example, if a line appears on the AI map, there should be metadata like "sourced from City Water GIS (2020)" or "inferred from 1985 aerial photo showing utility cut". Without this, the professional cannot assess reliability. ASCE 38-22 QLD allows info from "other sources", but it also states that QL-D data is uncertain and must be vetted. Knowing the pedigree of each piece of data is part of that vetting. Utility Professionals must question what they cannot control. Since AI algorithms are often proprietary and opaque, there is an inherent limit to how confidently one can verify their outputs without direct access to their logic or training data.

AI technologies can assist subsurface utility engineering in many ways, from identifying utility indicators in images to interpreting remote-sensing data and consolidating information into representative maps. In short, AI excels at recognizing patterns in large or complex data sets. Obviously, such an ability can be well-suited to the challenges of finding utilities hidden underground. The data derived from the AI sources is potentially very good information and may indicate the presence of previously unknown, or undocumented facilities.

An AI-driven system can take inputs like old utility records, GIS data, surface survey and feature data, and pieces of geophysical investigation results, and use interpolative reasoning or machine learning to predict where unobserved utility lines are likely to run. The AI system looks at patterns, the algorithms can be trained to detect manhole covers, fire hydrants, valve boxes, utility poles, and other surface appurtenances that indicate the presence of subsurface infrastructure, cross-references details like pipeline routes, cable markings, and historical plans, and fill in gaps to propose an AI-derived map of underground facilities. A major challenge is the lack of large, vetted datasets for training the AI systems. As Utility Professionals know, real-world underground scenarios are infinitely variable. AI models trained on limited data sets may not perform well where there is significant variations in surface types or where a large variation of utility types exist.

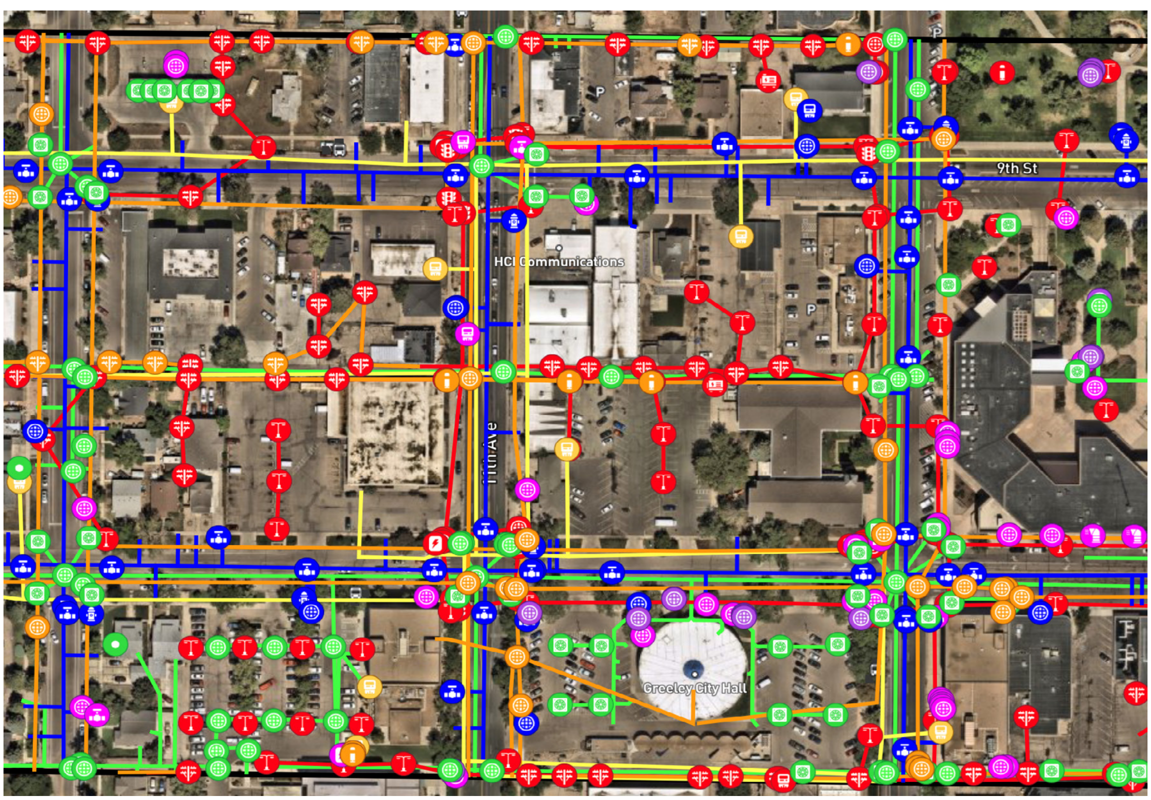

Figure 3, AI-Derived Utility Data - 4M Analytics

Figure 4 AI-Derived Data Analysis - 4M Analytics

One of the issues encountered is, in some instances, AI-derived utility data has been represented as QLD information. This could not be further from the truth. While AI is a powerful tool, it is not a magic solution and must be viewed within the framework of prudent and professional engineering practice. Utility record data received or obtained for a project is not automatically QLD data, neither is AI-derived utility data. Such data received for a project must be scrutinized to ensure relevance to the project, to ensure it is within the project limits, within the ROW or specific design limits, and is representative of utilities that could reasonably be presumed to exist within the project scope. AI-derived utility data may indeed meet the coverage/limit criteria, but this does not mean that it achieves QLD. It is important to reiterate that a QLD assignment is a judgment of the Utility Professional that the data meets the criteria for assignment.

Subsurface utility engineering deals with public safety and potentially significant liability, so any AI-generated results must be treated with appropriate scrutiny. AI will not replace the need for experienced utility engineers and geophysicists. The Utility Professional remains responsible for the final utility maps and any decisions made as a result of the mapping efforts. AI-derived data may prove valuable for analysis, but it cannot be permitted to make autonomous decisions. The Utility Professional must determine the value of the AI-derived data and adjudge any quality level of that data. When incorporating AI-derived data, professional oversight is mandatory. AI companies might generate utility maps, but unless a qualified SUE provider is vetting and signing off on that information, it does not meet the standard of any quality level. If utility data lacks the involvement and analysis of licensed engineers/surveyors, it cannot be considered reliable under the ASCE 38-22 standard, thereby leaving clients at legal risk. In other words, no matter how advanced an AI tool is, its results must be reviewed and stamped by a Utility Professional for those results to carry the weight of a true SUE deliverable.

Professionals should view AI as an aid that can handle repetitive tasks or suggest insights, while the Utility Professional in charge must interpret and validate those insights. Ultimately, the engineer's seal on a deliverable means they take accountability for accuracy, regardless of whether AI was used to produce it. And therein lies another issue; the Professional does not control the algorithms used by the AI system. How can the professional truly determine the validity of the AI-derived data if its creation is outside of the professional's control? Notably, ASCE 38-22 places specific emphasis on documentation and professional oversight throughout the SUE process. Each utility depiction should trace back to how that information was obtained, and the professional responsible for certifying said SUE results. This provides accountability – if a utility's location is shown as QLD, there should be a corresponding record that depicts the utility information shown, essentially the data provenance. Record data assembled and adjudged at QLD by a Utility Professional involves recording where each piece of information came from and determining its reliability. AI must be held to the same standard. One interesting aspect of ASCE 38 is the inclusion of oral recollections in QLD data, like asking a tenured employee about past utility work. AI cannot obtain such recollections. Capturing those inputs and adding them to the record with notes on who said it and when is part of chain of custody. For instance, if a utility is shown at QLB, a record of the geophysical investigation and survey that determined the utility position should be maintained and a qualified professional must stand behind that data's accuracy.

Another concern is the data foundation for the AI model. AI-derived data is only as reliable as the data it learns from and works with. If the input data is inaccurate or biased, the AI's output will reflect those flaws. Under ASCE 38-22, documentation of existing utilities must be scrutinized and verified; similarly, any data that an AI system uses should go through a regimented quality control process. Since these sources and algorithms are outside of the direct oversight and control of the Utility Professional, how can it be adjudged or assigned a quality level? To this end, AI-derived data should likely be considered as an information tool. There has been discussion of indicating a separate quality level for AI-derived data, however, doing so would provide immediate legitimacy to an as-yet unproven process. AI-derived utility data should be specifically tagged to ensure it is not confused with data derived from more traditional methods. It should remain incumbent on the professional in charge to determine the relevancy and applicability of AI-derived utility data and determine if it can be assigned a quality level. Providing a separate quality level for AI-derived data that absolves the professional from any associated liability would open the door to broad inclusion without vetting. Since the AI-derived data is outside of the direct control of the professional, it would require additional focus and scrutiny by the professional before inclusion in any deliverable.

While discussing these points with Itzak Malka, Co-founder and CEO of 4M Analytics, he noted two critical concerns, "One concerns the way we deal with the abundance and absence of observable data, and the other concerns the profession of SUE and how AI can fit within that world.". Both concerns seem to evoke a common theme and were similarly noted in discussions with Reveal. Itzik addressed the former concern by looking at AI as a "method to unlock a massive abundance of data that historically was unavailable for observation, even when putting boots on the ground". Indeed, SUE data is likely best analyzed in total by experts visiting the project site in person with all available data in hand.

Current examples of AI-derived data likely incorporates, and may actually confirm data derived from traditional methods, but it may also provide false positives. Any results produced by AI need to be checked and validated just as any field technician's work would be checked. In the long run, these checks, whether confirming or disproving the AI-derived results, will help to improve the learning capabilities of the AI systems. AI's contributions must be reviewed under the project's quality assurance procedures and must follow the traditional SUE practice of identifying the data sources. AI-derived data will provide "positives and negatives, mislabeling, and errors in conflation, etc., but as Itzak pointed out, the data and process.

While discussing the various potential inputs for AI models and possible outputs, Sam Wiffen, Founder and Director of Reveal discussed the "detections" in the Reveal process by incorporating utility survey and geophysical detection data as well as record information into the AI process. This procedure provides an AI-assisted look at the conflated data that may reveal additional utility information that requires analysis or investigation. This is a new frontier in SUE and challenges the traditional way of thinking. With the onset of AI and ways in which AI can provide output, (i.e., AI-derived, AI-assisted, AI-processed) instead of the Utility Professionals asking "How can we use this in our existing model?", Sam suggests an alternative approach, "What does this tech enable that was previously impossible, and what would we do differently because of that?". It is likely that as AI continues to evolve, the latter question will become more commonplace, but the question of liability must continue to be considered. AI-derived output is still outside of the direct control and oversight of the Utility Professional, so how this data is classified and potentially incorporated into a certified SUE deliverable is a question that must be pondered.

With AI tools becoming involved in engineering deliverables, there should be an

> "over time, with continuous R&D investments, the error rate will decrease, and the efficiency and sophistication of the software will increase"

It is important to identify false positives to assist the AI system in learning to identify the conditions that led to the creation of the false positives so that future outputs will continue to be refined and improved. Establishing means and methods for feedback to the AI provider and system is key to improving future use and applicability of

increasing call for transparency about their use. Practitioners should document when and how AI-assisted in the utility investigation. Specifically labeling AI-derived data as such would begin to address this issue. It is not enough to allow the professional to specially disclaim liability for the AI-derived results if proven erroneous, as erroneous data would create the need for additional investigation and would increase costs. The use of AI-derived data, the data chain of custody, the source or provider of the AI data, along with validation of any results, should be prominently disclosed in any deliverable. Wiffen noted that "the real barriers for wider testing, use, and evaluation, are likely policy, data security, regulatory and more." To further the use and application of AI-derived data, Wiffen suggests "accelerating the practical demonstration [of the technology] along with "use cases and measurable case studies" to shine a light on the potential benefits. Wiffen also states that one of the challenges with AI Derived data, "is that customers and consumers may incorrectly assume (either through hope or misdirection), that AI Derived data can be used as a proxy for robust SUE practices".

While AI is marching to establish a foothold in the SUE world, both Malka and Wiffen point to the continued struggle of SUE to gain full market adoption. While it is true that SUE continues to grow in usage, it still lacks mandated incorporation except in Colorado. Arguably, SUE would benefit a great number of projects if mandated, with SUE analysis representing roughly 2% of overall construction budgets yet offering backend project savings near 12% of the overall budget, the lack of statutory requirement is concerning. Similarly, it has been implied that AI-derived, or AI-enhanced SUE data represents approximately 10% to 15% of the 2% overall cost of SUE to a project, suggesting a reasonable threshold for consideration. Evaluating the use of AI in the overall SUE analysis for a given project may be considered now, and it will continue to gain traction as it proves itself worthy of consideration through continued refinement and precision.

As Malka stated.

Both Malka and Wiffen emphasize that AI must be a tool—an enhancement to the utility professional's work, not a replacement. It may enable faster compilation and broader data sets, but its outputs must be vetted with the same rigor as a junior engineer's work. While AI offers impressive capabilities in data aggregation and pattern recognition, its application in utility mapping must be approached with discipline. Ultimately, AI should serve the professional—not supplant the responsibility that only a licensed expert can assume under ASCE 38-22. Future standards may evolve to accommodate AI more explicitly, but today, the burden remains with the engineer to judge, validate, and document every utility line shown.

This article reflects the insights and observations of the author and incorporates commentary from leaders at 4M Analytics and Reveal. Exodigo did not respond to inquiries or request for comment.

"On the professional level, AI utility mapping will not replace SUE as a necessary step to begin excavation"

Author

GREG JEFFRIES, CUC, M. ASCE

Mr. Jeffries is an industry veteran with over three decades of extensive experience with utilities, survey and construction; subsurface utility engineering; and utility location services. An established utility construction/construction management expert with a specialty in addressing utility location and avoidance issues. He oversees SUE/UC projects and pursuits throughout the southwestern United States and internationally in Saudi Arabia, Dubai and Pakistan.

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Subsurface Utility Engineering Association – Founding Board Member

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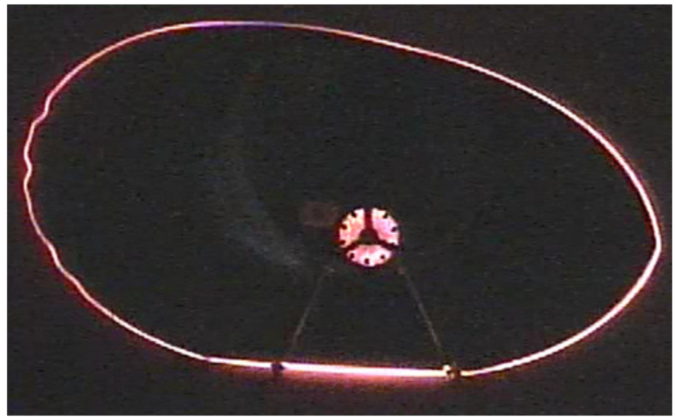
Invest Through Inspection

Inspect Today, Protect Tomorrow



35% Deflection in HDPE Storm Drain

Competent inspection during pipeline construction is more than a best practice—it's a smart investment. Ensuring proper installation from the start is critical to the long-term durability, safety, and performance of pipeline infrastructure assets. Identifying issues early helps prevent costly repairs, unexpected outages, and emergency interventions. Pipelines that are properly inspected during construction typically require less maintenance over time, resulting in lower operational costs.

Asset management and proper inspection are tightly interconnected in pipeline construction. For pipelines, this process begins during design and construction, where critical decisions shape long-term outcomes. Inspection ensures these decisions are correctly executed in the field, laying the groundwork for a reliable asset.

According to the American Water Works Association, roughly 16 percent of treated water—about 6 billion gallons—is lost every day, amounting to nearly $3 billion in annual revenue. Even more troubling, most of these leaks remain hidden underground, sometimes surfacing only after considerable damage has occurred. A buried defect can become an expensive liability. This is why reliable construction practices are essential—and why getting installation right the first time can help prevent both leaks and the financial consequences that follow.

Without thorough inspection during installation, undetected errors can become long-term liabilities. Deficiencies such as improper backfilling, poor joint alignment, or inadequate support can lead to pipeline failures years later. These failures not only drive up maintenance costs but also disrupt service and undermine public trust. Construction-phase inspection serves as a critical quality control tool for preventing such outcomes.

Inspect it now, or dig it up later.

Despite the clear value of inspection, a common misconception persists: that it is only necessary within the first 30 days after construction. In practice, inspection should begin before pipe installation, continue throughout construction, and extend well beyond project completion. A post-construction baseline inspection helps document initial conditions. A follow-up inspection after about one year can reveal issues that develop over time, such as deformation or cracking from increased loads, staining from leaky joints, or sagging caused by foundation differential settlement.

While advanced technologies like CCTV and laser profiling are increasingly used for post-installation assessments, they are not foolproof. These tools require skilled, certified operators—and even then, problems can be missed. That's why independent, qualified inspectors must oversee the process—not only to verify results, but also to catch issues that automated tools may overlook.

Digging up pipe unnecessarily is a waste of resources. A $2 million project escalated into a $35 million lawsuit and a pipe buried 50 feet deep had to be excavated and replaced. In another case, a $20 million pipeline had to be completely removed and rebuilt—doubling the cost. What did these costly failures have in common? No trained inspectors on site.

Do it right or do it twice.

Just as inspection protects the physical integrity of pipeline infrastructure, professional training supports consistency and competence in the field. A new online training course is now available for inspectors involved in water, sewer, culvert, and storm drain projects. The 14-hour course is self-paced and can be accessed at any time from a computer, tablet, or smartphone. It includes downloadable inspection checklists for field use. Participants also receive a copy of *Pipeline Installation 2.0* (a $125 value), which serves as the course text and a lasting reference. A certificate of completion and Professional Development Hours (PDHs) are awarded at the end of the course.

> *Specifications do not cause leaks, but not enforcing the specifications may.*

FUNDAMENTAL INFORMATION

New inspectors and new engineers will learn about the basic principles of pipeline installation such as:

- The difference between rigid and flexible pipe construction
- Terminology for buried pipe
- Soil classification for pipelines
- Trench excavation safety
- Compaction methods
- Soil testing
- Methods of joining pipe

Understanding these principles may help the inspector make on-site decisions that contribute to the success of the project, such as:

Rigid versus Flexible Pipe: Rigid pipe (concrete, clay) must be supported underneath and in the haunches. Flexible pipe (steel, plastic, ductile iron) depends on side support. Confusing the two can lead to failures—one contractor mistook a mortar-coated steel pipe for concrete and installed it incorrectly.

Terminology: Terms are not consistent in the industry. For example, one organization refers to bedding as the material under the pipe while another uses bedding to indicate the soil on the sides of the pipe. One may be uncompacted while the other may be compacted. Miscommunication between inspectors and contractors can shorten the life of the pipeline.

Compaction: Cohesive soils need impact or pressure; cohesionless soils need vibration. Soil type also determines the right testing method. Using the correct approach saves time, money, and effort.

Soil Testing: The course explains when to use standard vs. modified Proctor tests, and when to choose sand cone over nuclear density tests—ensuring a reliable installation.

Joining Pipe: Joints are often the weakest point in a pipeline, and improper construction can lead to significant leaks. Even if the pipe itself is designed to last 50 years, poor joint construction can render that durability meaningless. In one case, a 36-inch polyethylene sewer failed because of incorrect joint fusion. This highlights the importance of proper training in heat fusion techniques and the critical role of thorough joint inspection.

> *Consider one real-world example: a storm drain collapsed with just three feet of backfill over the pipe. The inspector had documented that "the contractor is pushing pipe down to grade with the excavator bucket," a practice that is prohibited for all pipe materials. The force applied by the bucket compromised the pipe's structural integrity, leaving it unable to support even minimal loading. This failure could have been avoided with proper training and oversight.*

USEFUL FOR NEW AND VETERAN INSPECTORS

The training is designed primarily for new inspectors, but experienced professionals may also benefit from updated guidance on recent innovations in pipeline construction. Topics include:

- Use of uncompacted bedding beneath the pipe
- Application of uncompacted padding above the pipe
- Techniques to prevent soil migration
- Employing composite soil stiffness in unstable trench walls
- A new method for measuring maximum density in cohesionless soils
- Cost-effective use of native soils to create flowable fill

These practices are supported by modern engineering principles, and the course explains the rationale behind each one. Understanding the "why" behind new procedures helps inspectors and contractors adopt them confidently and consistently:

Uncompacted Bedding: Using uncompacted clean gravel or crushed rock as bedding allows the weight of the pipe, its contents, and the overlying backfill to form a stable cradle. This also improves load transfer to the haunch zone and enhances long-term support.

Uncompacted Padding: Avoiding compaction directly above the pipe is a newer practice that helps protect the pipe from damage during backfilling. It also encourages soil arching, which redistributes vertical loads away from the pipe.

Migration: Clean materials like crushed rock or gravel have large void spaces between the particles. Without proper precautions, using these materials can result in surrounding soils migrating into these voids over time, reducing the stability of the embedment and compromising pipe support.

Composite Soil Stiffness: The embedment material supports the pipe, while the trench walls support the embedment. In areas with weaker trench walls, overall support is reduced. To address this, designers now consider both embedment and trench wall soil stiffness together. This concept of composite stiffness may explain why trench width varies along a pipeline. Contractors and inspectors should understand this to avoid misinterpreting it as a design error.

New Maximum Density Test: Proctor-type tests are not suitable for cohesionless soils. ASTM now recommends a vibratory hammer test, which provides more reliable and consistent results when determining the maximum density for these materials.

Native Flowable Fill: Flowable fill offers strong support for buried pipes but can be expensive when supplied from ready-mix plants. An alternative approach is to use native soil excavated from the trench to create a cost-effective flowable fill on site. This method reduces the need for imported materials and disposal of excess soil. The course includes detailed guidance on how to meet construction and inspection requirements for this type of pipe support.

PVC Pipe That was Placed on Rocks

Broken Back Crack in Concrete Pipe

Pipe placed directly on rock have failed due to point loading that creates concentrated stress on the pipe surface. These issues often remain hidden for years before problems emerge. This type of failure is preventable with proper inspection during installation. As one construction supervisor noted, “We continue to have failures… almost always involving rocks rubbing on the pipe over time.”

Do it once and do it right

Flotation of Pipe Before Backfilling Completed

COURSE SUBSTANCE

The course places strong emphasis on the geotechnical aspects of pipeline construction. It covers key topics such as soil classification, density, compaction, and the appropriate test procedures for each. In addition, the course outlines best practices for unloading, laying, joining, and inspecting pipe systems.

Equally important, it demonstrates how construction inspection supports long-term asset management. Data collected during installation becomes part of the asset’s permanent record, informing maintenance planning, regulatory reporting, and future decisions on repair or replacement. In this way, inspection and asset management reinforce each other throughout the pipeline’s life cycle.

Drawing on the author’s 60 years of experience investigating pipeline failures, the content includes numerous real-world case histories. These examples highlight the importance of following proper procedures and illustrate the costly consequences of inadequate inspection. One participant said:

> “I’ve been a heavy/civil construction inspector for over 30 years. I enjoyed this training, learned some things, and was a little disappointed when it ended.”

SUMMARY

Key benefits of in-depth inspector training include:

- Ensuring the pipe is installed in accordance with specifications
- Eliminating hidden liabilities that may surface later
- Creating records to support long-term maintenance planning
- Providing data for future repairs or replacements
- Supporting regulatory compliance through accurate documentation
- Enabling effective monitoring of pipeline performance
- Identifying exact pipe locations to prevent future construction damage

In-depth construction inspection is a foundational element of asset management, ensuring reliability, controlling risk, and supporting durability throughout the pipeline’s service life.

Pipeline Installation for Inspectors

Online Course - Available Anytime. Learn at Your Own Pace.

Register at BAMI-I.com

"Specifications do not eliminate leaks, inspectors do."

Why Inspection Matters

Proper inspection during pipeline installation is critical to ensuring system longevity. Issues overlooked during construction often resurface years later, costing time, money, and resources. This course teaches you to get it right the first time.

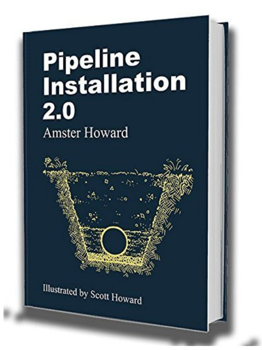
14
Hours of Content

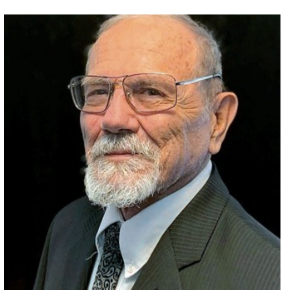
100%
Self-Paced Online

PDH
Credits & Certificate

- **Excavation**
- **Bedding**
- **Embedment**
- **Backfill**
- **Soil Density & Compaction**
- **Soil classification & Migration**
- **Flowable Fill**

This pipeline inspector course will pay for itself over and over again by helping to prevent leaks and cracks. This class uses case history after case history to illustrate how proper installation protects your assets.





About Course Developer: Amster Howard is a globally recognized authority on buried-pipe installation and soil–structure interaction, creator of the USBR E′ values adopted in ASTM/ASCE/AWWA standards and author of Pipeline Installation 2.0. A former U.S. Bureau of Reclamation researcher and longtime ASCE instructor, he's investigated failures, written key ASTM standards, and received ASCE's Stephen D. Bechtel Pipeline Engineering Award.

Fore more information, Contact: Wei@bami-i.com or 318-497-8288

DATA-DRIVEN SEWER NETWORK ASSET MANAGEMENT

EXPERIENCES FROM FINLAND

While Finland has been featured regularly at the top of international water governance rankings, but it still faces severe challenges maintaining its high-quality water and sewer management practices. This article presents experiences from a novel, cost-efficient and data-driven approach sewer network asset management.

Water utilities in Finland face a globally common challenge: their sewer networks are aging, but reliable condition data is scarce. Traditional inspection methods such as CCTV provide detailed information but are costly and time-consuming, making it unrealistic to achieve full network coverage. As a result, utilities often operate with incomplete knowledge, leaving them vulnerable to unexpected failures, costly emergency repairs, and inefficient capital spending.

At the same time, water utilities face a growing rehabilitation backlog. Aging parts of networks are often well beyond their intended service life. Utilities must balance the need to renew aging assets with financial pressures and increasing expectations for environmental performance.

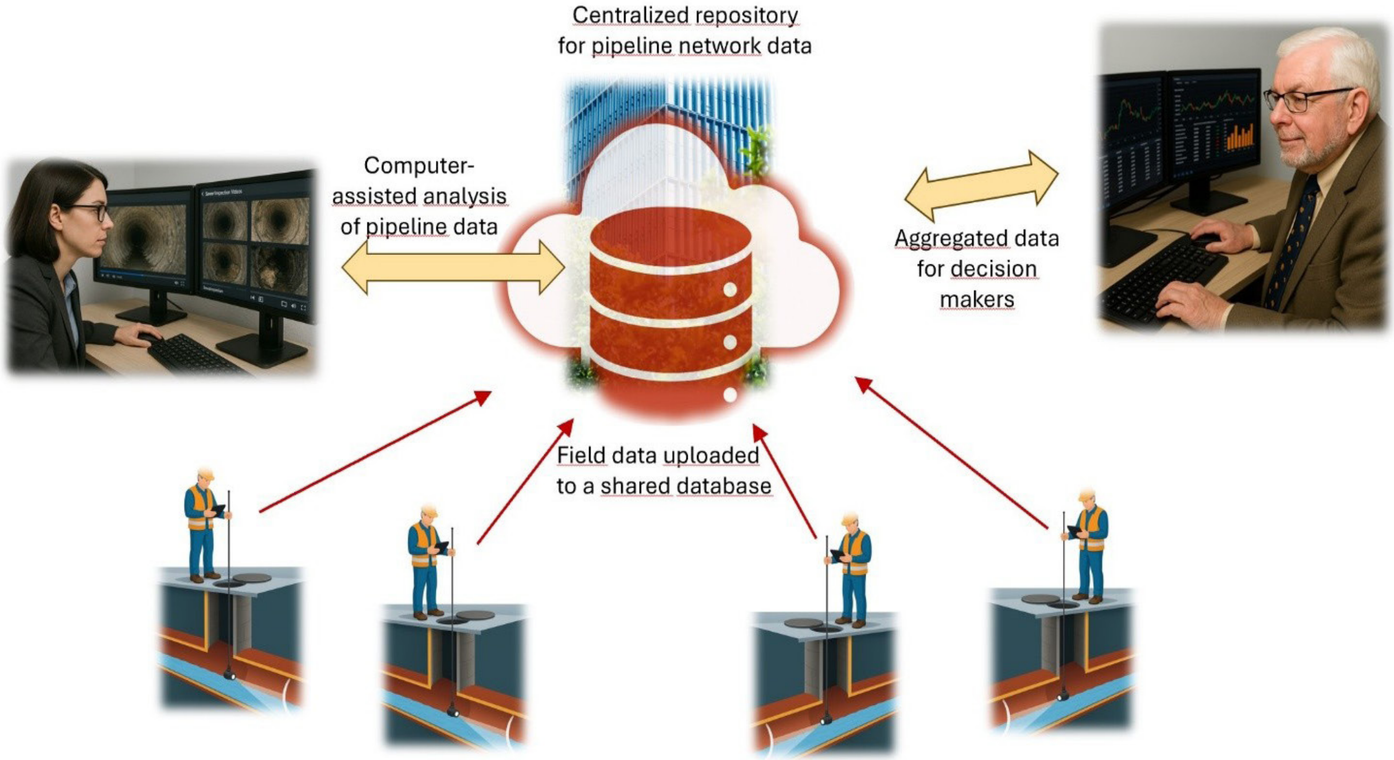
Asset management provides a framework for addressing these challenges. Ideally, decisions about rehabilitation and maintenance should be based on accurate data about asset condition and performance. In practice, however, many utilities lack sufficient information. Instead, they rely on assumptions, age-based models, or sporadic inspections. This creates inefficiencies: some pipelines are renewed too early, while others fail unexpectedly, causing environmental damage and costly emergency responses.

Traditional CCTV inspections with crawler cameras have been the main source of condition data. While valuable, these inspections are too expensive and slow to deliver full coverage. In most cases, only a small fraction of the network is inspected in any given year. Utilities therefore face a dilemma: they need better data to manage their networks effectively, but the methods available to collect it are not feasible at scale.

The industry needs more cost-effective methods to obtain and manage network condition data so that asset management is more effective.

Traditional Inspection Methods and Their Limitations

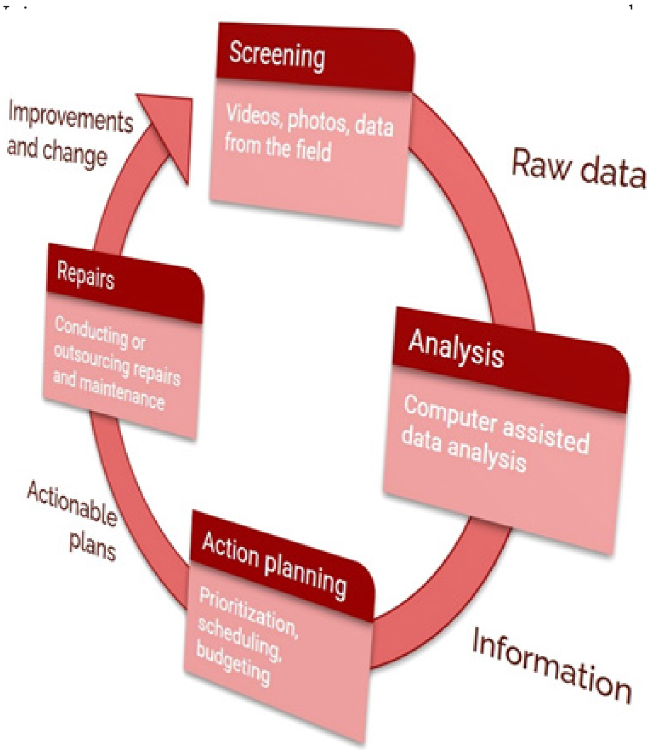
Closed-circuit television (CCTV) has been the standard method for sewer condition assessment for decades. Robotic crawler cameras provide detailed, standardized recordings of defects, which can be coded and stored in asset databases. These inspections produce high-quality evidence that supports rehabilitation planning. Their main advantage is the level of detail: structural cracks, joint dis-



placements, infiltration, and operational defects can be clearly documented and archived for comparison over time.

Despite these strengths, CC
spections have significant limi
tions. The first and most obvious is cost. A CCTV inspection requires specialized equipment, trained crews, and often pre-cleaning of the sewer line. This makes it one of the most expensive inspection methods. Because budgets are limited, utilities can only cover a small share of their networks each year. The result is fragmented coverage, with many kilometers left undocumented.

The second limitation is time. Robotic cameras move slowly, typically inspecting a fev hundred meters per day. In large works, full coverage would take if it could be achieved at all. For medium-sized utilities, the resources required are simply not realistic.



Underground City cycle

A third issue is the way data is generat-
CTV inspections produce long video
s and detailed reports that require
significant time to review. While the information is precise, it can also be overwhelming, and not all of it is directly useful for decision-making. Asset managers often struggle to convert this volume of data into clear investment priorities.

Finally, because sewers are typically cleaned before inspection, CCTV does not show the network's true operational state. Sediment build-up, flow restrictions, and minor obstructions are removed before the camera pass-
s through. While this improves
ility, it hides the conditions that
rs and operators experience during

normal operation.

Taken together, these limitations mean that traditional methods cannot deliver the broad and timely knowledge that utilities require for modern asset management. The challenge is to find a way of collecting condition data that is affordable, scalable, and operationally meaningful.

A Screening-Based Alternative

The motivation for developing a new approach is straightforward: utilities need more data, faster, and at lower cost. Complete CCTV coverage is neither realistic nor necessary. Instead, the goal should be to identify which parts of the network are in good condition, which require immediate attention, and which would benefit from more detailed investigation.

The method developed by Underground City rests on four central principles:

- Cost-efficient screening of the network
- Federated management of condition data in a digital platform
- Effective, experience-based analysis of the results
- A focus on actionable rehabilitation and maintenance planning

At the heart of the approach is the use of zoom cameras. Instead of inserting crawler cameras into every pipeline, inspections are performed through manholes. The camera is lowered and can record several meters in each direction, capturing the essential condition of the pipeline without the need for cleaning. In parallel, the manholes themselves are screened for structural and operational condition. Together, this provides a broad overview of the system at a fraction of the cost and time required for traditional CCTV. In fact, the screening method based on zoom cameras reduces costs by 80%, based on our experience, yet delivering good enough information for network maintenance.

The second element is data management. All inspection material is uploaded into a cloud-based platform, where it is linked to the corresponding assets in the geographic network model. Rather than storing thousands of hours of video, the platform organizes information into concise summaries. Utilities can view network-wide overviews, benchmark conditions across different areas, and generate reports tailored for stakeholders such as municipal decision-makers. This structured management of data ensures that the results are not only collected but also usable.

Analysis is carried out by experienced inspectors, supported by computer-assisted tools that help standardize classifications and highlight anomalies. While artificial intelligence is still in development for this field, semi-automated assistance is already possible and reduces the time required for data interpretation. Importantly, the analysis is focused on outcomes: the aim is not to produce an exhaustive list of

Sewer screening video view into the sewer

Sewer manhole inspection video

defects but to identify the most relevant issues for maintenance and rehabilitation planning.

The final element is the translation of data into action. Based on the screening results, assets are categorized into three groups: those in acceptable condition, those requiring further detailed inspection, and those in urgent need of maintenance or repair. This prioritization allows utilities to focus resources where they are most needed, while gaining confidence that large parts of the network can safely be deferred.

Case Study: Kirkkonummen Vesi

Kirkkonummen Vesi is a medium-sized Finnish water utility responsible for approximately 160 miles (250 kilometers) of sewer network, serving 40,000 residents. Like many utilities, it had previously relied on sporadic CCTV inspections, which provided detailed but limited coverage. This left significant uncertainty about the true condition of the network.

The motivation for change was twofold. First, the utility needed a more complete overview of its assets to support long-term investment planning. Second, it wanted to improve its ability to prevent failures and reduce the risk of unexpected service disruptions. The leadership recognized that traditional methods would not provide sufficient coverage within a reasonable timeframe or budget.

By adopting the screening-based approach in 2024, the utility was able to dramatically expand its knowledge. Within one year, condition data increased fivefold compared to the baseline. More than 2,000 manholes were inspected, many for the first time in a systematic way. Large parts of the pipeline network were screened, revealing both assets in good condition and sections with urgent problems.

The benefits were tangible. Sediment hotspots were identified, allowing targeted cleaning programs that reduced the risk of blockages. Root intrusions and infiltration points were discovered before they developed into serious failures. Several leaks were located and repaired, reducing both environmental risks and unnecessary treatment costs. By acting on these findings, the utility prevented potential sewer failures and improved operational reliability.

Equally important were the improvements in communication. For the first time, decision-makers had access to clear summaries and visual material that illustrated the condition of the network. This transparency strengthened trust and provided a stronger basis for prioritizing investments.

The results are promising. Within one year, Kirkkonummen Vesi increased its knowledge of network condition fivefold, improved transparency for stakeholders, and identified problems that could be addressed before they developed into failures. Most importantly, the utility has established a realistic plan to inspect its entire 160-mile network within three years. In contrast, achieving the same with CCTV alone would take decades and require resources far beyond what the utility could allocate.

This case demonstrates how Finnish utilities are pioneering data-driven asset management practices with relevance for other regions as well.

“This type of large-scale screening project brings a new level of transparency and control to sewer asset management. We no longer need to guess—we know,” explains Head of Unit Tiia Lampola from Kirkkonummen Vesi.

Asset Management Perspective

The implications of this approach for asset management are significant. At its core, asset management is about making informed decisions on how to operate, maintain, and renew infrastructure in a way that balances cost, risk, and performance. Reliable data is the foundation for these decisions.

In the past, utilities often had to choose between limited data from costly inspections or decisions based on age and assumptions. The screening method changes this equation. By rapidly generating a broad overview, it enables utilities to move from reactive to proactive management. Risks can be identified before they result in failures, and maintenance can be planned based on evidence rather than intuition.

This also represents a shift in investment optimization. Assets in good condition can be safely deferred, avoiding premature renewal. At the same time, critical sections are clearly identified and prioritized for rehabilitation. The result is a more balanced capital program, where resources are allocated according to real needs rather than statistical averages.

From a lifecycle perspective, this approach helps utilities smooth investment cycles. Rather than facing unpredictable peaks in emergency spending, utilities can plan rehabilitation in a systematic manner, aligning projects with long-term budgets. The environmental benefits are also notable: early detection of leaks reduces pollution, prevents groundwater infiltration, and lowers treatment costs. For customers, the benefits appear as fewer blockages, fewer service interruptions, and improved reliability.

In this sense, the method represents more than just a new inspection technique. It is a paradigm shift in how condition data is collected and used within asset management.

Broader Relevance and International Context

While the experience presented here is Finnish, the challenges are not unique. Across the Nordic countries, as well as across the globe, utilities face similar pressures: aging assets, limited budgets, and increasing demands for transparency and environmental responsibility.

Looking beyond the region, the situation in the United States provides an interesting comparison. Many American utilities are small in scale, often serving populations of only a few thousand. For them, full CCTV coverage is even less realistic than in Finland. Observations from colleagues in the U.S. confirm that the same dilemmas are present: utilities need data but lack affordable methods to collect it at scale. Screening offers a practical alternative that could be highly relevant in this context.

The lesson from Finland is that significant improvements are possible within a short timeframe, if utilities are willing to rethink their inspection strategies. By focusing on coverage and efficiency, rather than exhaustive detail in every pipe, utilities can build a foundation for more informed and sustainable asset management.

Conclusions and Future Development

The Finnish experience demonstrates that screening-based sewer inspection is technically feasible, operationally effective, and highly valuable for sewer network asset management. Within one year, knowledge of network condition can increase fivefold. Utilities gain transparency, prevent failures, identify leaks, and optimize investments. A full network overview becomes realistic within a four-year timeframe, something that would be unattainable with traditional methods alone.

These findings highlight the importance of rethinking how data is collected and used. Instead of focusing on detailed inspections of limited sections, utilities can adopt a strategy that emphasizes broad coverage and actionable outcomes. This represents a shift from reactive, assumption-based management towards proactive, data-driven decision-making.

Looking forward, there are opportunities to further develop the approach. Integration with other datasets, such as hydraulic models and customer feedback, could provide a more complete picture of network performance. Advances in computer-assisted analysis will make interpretation faster and more consistent. Benchmarking across utilities may also help establish best practices and support regulatory reporting.

Ultimately, the goal is simply to inspect 100% of sewer network to create a sustainable foundation for long-term asset management. By adopting data-driven methods, utilities can extend the life of their networks, protect the environment, and provide reliable service to customers in a cost-effective way.

Author

SAKARI KUIKKA

Over 40 years of experience in sewer network inspection and condition assessment. Pioneer in developing new inspection technologies, including DigiSewer® and CASI methods.

Active in European standardization, international training, and collaboration projects; recipient of the FiSTT Award 2022.

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