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All-Terrain Sewers Got A Good Beat, And Indy Dances To It

By Joseph Harmes

When Susan Raccoli penned "Beneath the Ground, Raw Sewage" (to the tune of "St. Christopher") in 1993, her hometown of Indianapolis inspired the lyrics. "Our septic failure is a curse," she wrote, with verses alluding to its "Third World" smells, high water tables, clay soil "which does not perk," typhoid, cholera, mosquitoes singing "with glee," and the "expensive" but desired transition to gravity sewers. She ended with this plea:

*The septic men have been here / They shake their heads and say:
'Repairing septic systems / Should not be the long-term way.'*

*For septic is not how to serve / A growing place like this.
Put sewers in now and / You will have not sewage but pure bliss!*



Three decades later, residents pipe a new tune inspired by the Septic Tank Elimination Program (STEP), which might be the most aggressive project of its kind in any U.S. metro. STEP originally migrated thousands of septic tanks to gravity sewers, which in turn were retired for the cost-effective and robust All-Terrain Sewer (ATS). Its performance and innovation — augmented by STEP delivery enhancements like design-build, a geographic information system (GIS) database, and horizontal directional drilling (HDD) — dovetails nicely with the challenge of navigating major infrastructure projects within densely populated urban environments, while maintaining minimum disruptions to commuters and homeowners.

Indy's Moment Of Clarity

Historically, the two million residents of coterminous Indianapolis-Marion County faced two major wastewater issues: miles of combined sewers constructed over a century ago conveying a cocktail of sanitary wastes and stormwater in tandem with an estimated 16,000 to 30,000 perilous septic tanks lurking in neighborhoods of every socio-economic status. Public health was jeopardized as each contributed to the contamination of waterways and threatened sources of potable water.

(By comparison, an estimated one million people use septic systems or cesspools on Long Island, one of the densest concentrations in the country. In Miami-Dade County, septic serves about 105,000 properties. Jacksonville, FL numbers 65,000.)

Overhauling both wastewater systems was prioritized in 1998 after an infrastructure assessment identified their hazards. A year later, Mayor Bart Peterson released a plan to tackle combined sewer overflows and the septic plight. In a nod to urgency, its 60-year schedule was accelerated to only 20. In 2005, STEP was formalized to convert septic to gravity sewers. Notably, it established a more affordable connection fee than that required by the onerous 1905 Indiana Barrett Law used to fund sanitary sewer extensions into unsewered areas.

Separately, STEP was followed in 2006 by the \$2 billion DigIndy Tunnel System program, created in part to comply with a consent decree mandating the city abide by the U.S. EPA's Combined Sewer Overflow (CSO) Control Policy. Its major component calls for 28 miles of 18-foot-diameter tunnels to be built 250 feet beneath the city to rectify a combined sewer system prone to pollute waterways during a quarter-inch rainfall. The DigIndy Tunnel System — including upgrades of wastewater treatment plants as well as construction of other sewer system improvements — is on track to be complete by the end of 2025.



Indianapolis, IN

New Ownership Endorses The ATS

In 2011, Citizens Energy Group (hereinafter Citizens) — a public charitable trust — acquired all water and wastewater assets and liabilities of the Indianapolis Department of Public Works and became responsible for every duty from compliance with the consent decree to capital planning, design, and construction; billing and collections; and operations, maintenance, and repair.

Citizens adhered to STEP's template until 2016 when it was reorganized into a new "more customer service oriented and cost-effective" program anchored by the ATS. Among gravity sewers' disadvantages cited by Citizens: "Large open trenches, very messy and disruptive, extremely expensive."

Environment One Corporation (E/One) of Niskayuna, NY pioneered All-Terrain Sewers in 1969. Its installed base of pressure sewers is found in over 40 countries and U.S. territories on almost every continent and tasked to operate in any climatic extreme and geological lay of the land. E/One units serve over two million end users daily.

The ATS begins with a grinder pump station inside a tank about the size of a refrigerator that is buried in the ground, its lid easily camouflaged with minor landscaping. The primary component is a 1-hp, semi-positive displacement pump.

(The ATS and Septic Tank Elimination Program should not be confused with a septic tank effluent pump — commonly nicknamed STEP — pressure sewer system. The ATS installed by the Citizens program of the same acronym is just the opposite and does not require a septic tank for prolonged treatment like a septic tank effluent pump system. Wastewater in an ATS tank is quickly emptied throughout a 24-hour period.)

The pump blends waste into a fine slurry before its robust torque propels it through small-diameter, inflow-and-infiltration-free pressurized pipe buried just below the frost line (reaching distances of more than two miles or even straight up 185 feet) to an existing gravity sewer (STEP's method) as well as a force main or treatment plant. The total dynamic head provides a nearly identical flow rate regardless of the network's contours and fluctuating elevations.

Constraints Of Gravity Sewers

"Indiana is a relatively flat landscape, so when you do use gravity sewers, ultimately you need to install lift stations in order to bring them to a reasonable depth," says Joseph Nagy, Citizens' Manager of Wastewater Renewal. "All-Terrain Sewers can help eliminate the need. They are a cost-effective option versus gravity."

Other impediments negated gravity's expansion: established neighborhoods with small lots, narrow roads, mature trees, existing utilities, and infrastructure. Some sit in flood zones or above high water tables.

"The housing density is fairly tight, so on less than an acre, you have multiple septic systems working in close proximity to one another. During rain events, with all the septic systems working at the same time, that soil can become overly saturated," says Nagy. "When you have pooling from failed septic systems, sewage can very easily be spread through the neighborhood ditches and streams."

STEP incorporates a GIS database with information collected by 7NT Engineering in Indianapolis, the project's design team, for site surveys, verifying right-of-way and easement locations, and existing utilities assets including water, electric, gas, and communications. GIS is used to help design HDD maneuvers under and around man-made and environmental obstacles, making installation minimally intrusive and cost effective.

"There's all kinds of things we can pull up with it," says Bob Jordan, director, Engineered Systems Sales at Covalen, an E/One distributor. "When going into new neighborhoods, we've got the route, the elevations, the other utilities to stay away from, and it helps with the future design."

Dollars And Sense

HDD's automatic trenching and drilling machines operate at up to half the price and 60% less time than gravity when installing economical small-diameter pipe in shallow and narrow trenches. The expensive rebuilding of roads, curbs, and driveways damaged by gravity installations is avoided.

"We can directional drill with three- or four-inch low-pressure main 800 to 1,000 feet a day, whereas if it was going to be a gravity installation (15 to 20 feet deep) you might be looking at 80 or 100 feet a day," says Jess Testerman, president TSW Utility Solutions, Citizens' STEP construction partner.

"The cost savings associated with this project approach is used to heavily subsidize the cost that the homeowner is required to pay per connection, which leads to more people enrolling in the program," says Jeremy Kosegi, Citizens' Manager of Capital Project Delivery, including STEP's design and construction.

Cost efficiencies are furthered with lower operations and maintenance budgets. The ATS average mean time between service calls is 12 years with no preventive maintenance (Covalen Service Group handles maintenance and repairs). The ATS' 14-to-35-year lifecycle is the best in the industry and one-third to one-half that of gravity.

"Lifecycle cost was a big consideration," says Kosegi. "E/One provided case studies where they had looked at what those costs were and that was key for us in our evaluation."



Slow But Steady Acceptance

The ATS became the major component of STEP after a decade of collaboration between Citizens and E/One, evolving with sporadic yet incremental utilizations of the ATS as a system supplement, usually where gravity was impractical. Citizens maintained its proclivity for gravity even though it was aware of the technology and the fact it worked: Indiana has more than 70,000 ATS installations, including a project in Twin Lakes numbering more than 5,000 pumps networked by 219 miles of HDD pipe. While Indianapolis installed gravity, five neighboring regions swapped septic for ATS.

Citizens preferred to see successful demonstrations of the technology before committing to full-scale implementation, which took some time. They fully implemented ATS in 2016 after an extensive vetting process.

"They said they would consider grinder pumps in special circumstances," says Jordan. "They called and said, 'We missed three houses in two sewer projects. Can a pressure sewer work there?' Then it was, 'Done in six weeks? That's easy.'"

Eventually, Jordan adds, "They said 'we'll go this far and this deep with gravity. If farther or deeper we want to go with grinder pumps.' Gradually, this increased every project we did from two pumps to eight to thirty. "

"Then I got a phone call, the most critical in the whole project," Jordan recalls. "There's a neighborhood (35 connections) on the north side of Indy and they said 'the only place we can put the project is down the middle of the main street.' Everyone said 'No, you can't do that.' They told the engineer to find out about the grinder pump. So, we worked with them, did the design, and picked the grinder pumps to fit the project, which included the old Eli Lilly estate. Lots of bathrooms."

A few years later came the "watershed event," says Jordan, "a neighborhood on the north side of Indy that's probably got 400-plus homes along the White River that constantly flooded and needed sewer. It had poorly installed septic systems and big houses, smaller houses, a kind of river community that grew up into a city. They called and said 'Can you do this project in a flood zone?'

"We did a presentation to about 30 people and described the installation and techniques. As we were getting ready to leave the meeting, the fellow in charge asked us, 'Can you do this at least 7,000 to 8,000 more times?' Yes, we can. We're happy to do that."

Transformational Resistance And Education

Educating regulators, utilities, and engineers was only the first step. A buy-in from septic owners became critical when grinder pumps entered the equation.

"There's reluctance (of septic owners) for sewers in general," says Jordan. "The resistance was, we don't need another bill. We don't need to be connected to a utility. We're just fine."

"Citizens Energy Group's biggest task with the STEP program is educating residents," says Nagy. "Most people have never heard of an All-Terrain Sewer or a grinder pump, so there's an instinctual fear of something new. Once you're able to explain it to them, in most cases people are pretty amiable to it and accepting of it. But that education is critical in the forefront of the project in order to get their buy-in."

For Sam Jacobi, general manager of Covalen in Indianapolis, who has been involved with STEP since 2013, this meant a lot of phone calls.

"We would make contact with each one of the homeowners," Jacobi says. "We would introduce ourselves, come to their property, and spend at least 30, 40 minutes with that homeowner educating them on the system and telling them what to expect."

The ATS roll-out also included town hall meetings where, months before anything happened in the ground, Covalen demonstrated the pumps to homeowners.

"Citizens was very open," says Vasant Akala, former Vice President of 7NT. "Transparency was very, very important in terms of getting the buy-in. Cost (per homeowner) was another thing. I think that brought them into the system pretty fast."



Citizens Expands STEP Incentives

Homeowners are not required to enlist in STEP, but the program has averaged a 95% voluntary connection rate since 2016.

"Those who choose to opt out of STEP run the risk of not being able to replace their existing septic tank with a new one," says Kosegi. "If a septic tank fails and a permit cannot be obtained for a replacement, the Marion County Public Health Department will require homeowners to connect, and the cost of that connection will be entirely at the homeowner's expense."

For homeowners enrolling prior to a project, Citizens installs all components, performs all work on a property, connects to the sewer system, abandons septic tanks, and restores yards. Previously, each homeowner had to hire a contractor to obtain permits, construct their laterals, connect to the sewer, and unearth their septic systems.

Construction costs per home have shown a dramatic decrease, according to Citizens. The total cost of open-cut septic-to-gravity sewer per home remained steady at \$31,766, shared equally by the homeowner and the City of Indianapolis under the Barrett Law Program and STEP 2005-2016. From 2016 to present it has been reduced to \$17,000 per home utilizing septic-to-ATS. The typical homeowner cost under Barrett Law was \$16,768; \$6,766 during STEP's first phase after Barrett Law's repeal; and \$2,766 since the ATS' introduction.

Streamlining Project Implementation

Another hurdle was explaining the design-build delivery method, an alternative to the traditional design-bid-build approach where design and construction are split between separate entities with separate contractors performing separate work. With design-build, the design and construction are contracted by a single entity.

Citizens is "a public charitable trust, so that affords us the opportunity to select contractors and vendors," says Kosegi. "We can select on best value. That serves to build synergies in the design and execution of construction for each job. Having contracts with 7NT and TSW allows us to limit the amount of time spent explaining projects to multiple parties and more time executing work," he adds.

"The design-build program allows us to order materials earlier in the process at the 90% design level, which allows us to get them in when we're ready to build," Kosegi says. "We look at relationships to be long-term. If a contractor is having an issue with price increases, if they can show us where the costs are increased, we will work with them to make sure that they can still execute the project with the budget that they've had or adjust the budget to account for the increases."

Citizens has installed more than 2,000 grinder pumps and expects 600 more before STEP is scheduled to end in 2025 — although, Kosegi says, "after that I believe there will still be some iteration where we're able to connect other residents. I see, as we install more All-Terrain Sewers, it increases the awareness of the system and the acceptance of it. That grows the opportunity for more installations."

"For the future of All-Terrain Sewers in this area, I see it being the predominant method of installation, definitely for Citizens," says Testerman, noting other cities outlying Indianapolis "are moving towards the technology. They're asking questions. They're learning about E/One grinder pumps. I think they're becoming more open to this technology."

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