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## Horizontal directional drilling for gravity sewers

**City's satisfied with process that consistently achieves slopes of less than 1%.**

By [John Coogan](#)

Three years ago, the City of Germantown, Tenn., began making plans to install a new gravity sewer system in a 1970s-era subdivision to relieve an overburdened concrete sewer line. The sewer was running near full capacity every day and occasionally overflowed during heavy rains. And that was before a zoning ordinance allowed five-story buildings to be built in the sewer basin's upper reaches.

"We wanted to improve service for existing customers and make sure future developments aren't hindered," says Public Services Director Bo Mills, who is also the American Public Works Association's Region III director. "We decided to create a bypass to collect and divert the flow from this basin and pump it away from the heavily charged area."

Ultimately, the bypass will consist of 1,900 feet of gravity sewer leading to a pump station and another 2,000 feet of force main going to an outfall sewer.

### Overcoming skepticism

The project presented a challenge, though: installing a gravity sewer line in a well-established neighborhood with curved streets. "We didn't want to dig a 17-foot trench or close off any roads, and dirt management alone would have been a nightmare," Mills says. "Directional boring was the best way to minimize residential impact, but with a manhole every 300 to 400 feet we had to find technology that would keep the sewer ongrade. There was very little slope in the proposed bore path."

Horizontal directional drilling (HDD), however, hasn't always had the best track record of producing ongrade sewers.

The city's consulting engineer, [Allen & Hoshall](#) of Memphis, Tenn., recommended ArrowBore, a patented tight-tolerance HDD method developed by Ted Dimitroff, president of Columbia, Mo.-based Trenchless Flowline Inc. Dimitroff developed ArrowBore 13 years ago in response to changing attitudes among sewer and water contractors, who were looking for an easier way to complete infrastructure projects as well as to provide a more eco-friendly and less invasive alternative to existing open-excavation methods.

Allen & Hoshall learned about it from [R.H. Tauser & Associates](#), a pipe manufacturer's representative firm in Chesterfield, Mo.

ArrowBore allows licensees to use standard HDD equipment to install pipelines ongrade and online with help from laser technology and vertical sight holes drilled along the bore path. Because it would allow the pipe to be installed at the bore path's bend radius without putting excessive side-load pressure on the pipe joints, the city and engineer deemed it their most effective installation option.

How it would maintain the required slope (0.28% of grade) was also a strong selling point.

"I had some experience with directionally drilled sewers, and I was skeptical about any method allowing us to keep the sewer line ongrade because of how flat it was," Mills says. "But I felt more comfortable after learning about the sight relief holes and how they're used for monitoring and maintaining the grade."

## How it stays ongrade

Bored vertically at 30-foot intervals, the 16-inch holes let engineers verify grade accuracy during, rather than after installation — a key improvement over traditional directional boring. Pilot stem depth is checked at each hole with a laser sight and measuring rod dropped into the hole. If the drilling head's offgrade, it's realigned with another rod that's inserted down the hole and hooked onto the drill's pilot stem.

The sight holes also serve as slurry outlets, as all slurry is forced up through them — not into the pits — by the pipe during pullback.

The process uses back reamers to widen the bore a quarter-inch larger than the pipe's outside diameter. This prevents the pipe from floating within annulus space around the pipe, another feature that contributes to ongrade installation.

As general contractor, Madden Phillips Construction Inc. of Collierville, Tenn., subcontracted the directional boring to Trenchless Flowline. The city approved the subcontractor's recommendation of 12-inch [CertaFlo GreenLine](#) pipe manufactured by CertainTeed. Introduced in 2007, the PVC pipe features the company's Certa-Lok Integral Bell restrained joint system, which locks pipe joints together. Available in 10- as well as standard 20-foot lengths, the light green color makes the pipe easy to see during televised sewer inspections.

"The shorter joint option was a big advantage," says Dimitroff, who's installed the pipe as deep as 42 feet on previous ArrowBore projects. "We used the 10-foot joints because it cost too much to dig the deep pits at each manhole to accommodate the 20-foot joints. CertainTeed's never failed us in more than 13 years of installations. CertaFlo GreenLine is the only PVC pipe we've found that offers pullback strength and holds up to our push method without over-belling."

Work began in June 2012 after two years of design development with Madden Phillips Construction handling excavations and connections.

## Step-by-step installation

Trenchless Flowline's five-member crew used a standard Ditch Witch JT4020 directional drill (40,000 pounds of pullback; 4,000 pounds of torque) and a Ditch Witch JT2720 vertical HDD rig modified to drill the sight relief holes along the bore path and establish line and grade coordinates. Trenchless converts used rigs to vertical drilling for use with Ditch Witch's patented technologies. The rigs are rubber-track, lightweight, and drill up to a 48-inch vertical hole very quickly. In the near future, Trenchless will have rigs capable of drilling up to 8-foot vertical holes.

The crew was also supported by electronic locating and monitoring devices from [Digital Control Inc.](#)

The crew then used the JT4020 drill to make a series of five ongrade bores at depths ranging from 10 to 22 feet through dry river bottom silt, with some areas of sugar sand and sandstone. The hard-packed soils created a challenge, but with the help of customized drilling fluids from [Baroid Industrial Drilling Products](#), and a Ditch Witch MM9 mud-mixing system, the crew overcame this obstacle.

During pullback, crew members followed behind with a [Vac-Tron Mini Combo 855SDT trailer-mounted sewer jetter](#) to remove slurry from the sight relief holes. A total of 1,900 feet of pipe was lowered into the receiving pits with an excavator and assembled, joint-by-joint, during pullback.

Trenchless Flowline completed the gravity sewer line in August 2012, meeting the open-cut specification of line and grade with only minimal disturbance to the neighborhood.

“Everything worked out well,” Mills says. “I don’t think we could have gotten any more ongrade with a different method. And the pipe was great. It held up well in a hard drag through dense soil and didn’t pull apart or elongate.”

Madden Phillips Construction is expected to complete the pump station and force main this summer, allowing the full system to be brought online.

With more than 40,000 feet of CertainTeed pipe installed to very tight grades in a variety of soils, Trenchless Flowline offers training, tools, and equipment support for public works departments (and contractors) interested in the method for sewer and water mainline projects. The process takes two weeks to learn and requires little or no experience in HDD.

The company also offers the service itself in the form of pilot projects to customers in regions where trained contractors aren’t available.

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