MIDWEST JOURNAL OF

TRENCHLESS TECHNOLOGY 2025

OFFICIAL PUBLICATION OF THE MIDWEST SOCIETY FOR TRENCHLESS TECHNOLOGY

MSTT: A NON-PROFIT ORGANIZATION

2025 Midwest Regional Trenchless Technology Conference

Thursday, September 18

Harley-Davidson Museum, Milwaukee WI

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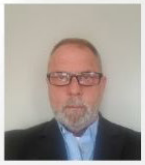

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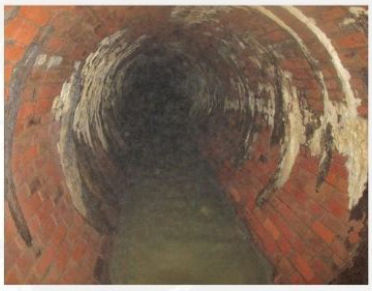

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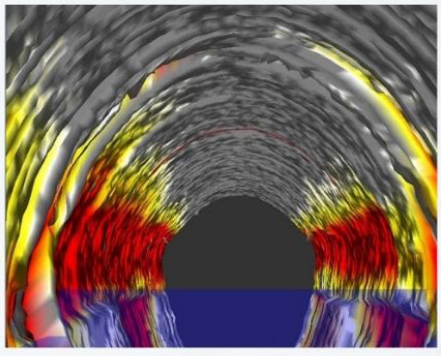

Pipe Assessment | Pipe Cleaning |Trenchless Rehabilitation

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MESSAGE FROM THE CHAIR

Steve Matheny, MSTT Chair

Thanks to everyone for your support over the years. We are now celebrating the thirteenth annual publication of ***Midwest Journal of Trenchless Technology***. We could not do it without the continued support of the many companies and individuals that comprise the MSTT community.

About MSTT: Established in 1998, MSTT is one of the oldest and the largest of the twelve NASTT Regional Chapters. MSTT encompasses the nine states of Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio, and Wisconsin.

2025 Seminars: MSTT conducted one in person seminar in 2025. On September 18, 2025 MSTT will be hosting a seminar in Milwaukee, WI, at the Harley Davison Museum showcasing the wide ranging trenchless technology projects undertaken by the Metro Milwaukee Sewer Department. Special thanks to Kevin Shafer, Executive Director, and his team from MMSD for their support! MSTT has now hosted over 41 seminars since 2003 in 15 different cities across the Midwest Chapter's nine state area. These seminars have engaged over 2200 underground infrastructure professionals in total over this period, facilitating meaningful direct networking between industry and owner groups. We appreciate our presenters, sponsors, and exhibitors who make these events tremendous successes!

2025 No-Dig Show:

The 2025 No-Dig Show was well attended in Denver, CO. We all are looking forward to the 2026 show in Palm Springs, CA March 29 -April 2.

MSTT:

Advancing the science and practice of Trenchless Technology for the public benefit, to promote and conduct education, training, study and research in said science and practice for the public benefit.

"MSTT is your organization, and this is your publication."

Future of MSTT

With NASTT support, we were able to conduct our first full year and second seminar without an executive director. We will be very reliant on our board and member participation moving forward to continue to offer resources to our trenchless community.

Additionally, please reach out to others who are not already involved in NASTT and MSTT and share your wonderful experiences with them.

I want to personally thank Chris Shuler for his efforts during the transition and after for all he has done for MSTT, NASTT, and me over the years. I also want to thank all the board members and all members of MSTT for your support and help!

We have made some strides over the past year to better our organization without the help of our executive director and we are making great strides as a totally volunteer organization. Much work remains and I am confident we will work together to make ours an even stronger chapter of NASTT.

MSTT is your organization, and this is your publication, so please support us and let us hear what you think. To provide feedback, suggest a location for future events, place an ad, or submit an article for next year's journal; please contact me, or one of our directors. Your support and involvement is critical to our success and the success of the Industry as newer faces enter and greater challenges present themselves.

Sincerely,

Steve Matheny
Chair, MSTT
248-977-8652
stevem@loganclay.com

MSTT SITE

HDPE PE4710 PIPE

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	TOP 10 Features & Benefits	HDPE	D. Iron	Sample References
1	**Applications:** Potable Water (Lead Free), Raw Water, Reclaimed Water, and Wastewater	✓	✓	AWWA C901, C906, C151, and NSF 61 + Health Effects of HDPE Pipes and Fittings for Potable Water Applications, NSF 2024
2	**Open Cut Construction**: Design and install per AWWA Standards and Manuals	✓	✓	AWWA M55, M41 + MAB-3, MAB-6
3	**Trenchless Construction**: Material of choice for HDD, Creek Crossings, Pipe Bursting, Sliplining, and Compression Fit	✓	✗	ASTM F585, F1962, F3508 + MAB-5, MAB-7, MAB-11
4	**Fully Restrained Joint-Free System:** Minimize need for fittings to facilitate horizontal and vertical deflections	✓	✗	AWWA M55, M41
5	**Longevity & Corrosion:** Pipes, Fittings, and Joints have the least potential for corrosion or tuberculation	✓	✗	Durability and Reliability of Large Diameter HDPE Pipe for Water Main Applications, EPA/WRF/WERF 2015 + The Critical Need for Corrosion Management in the Water Treatement Sector, NACE 2019 + PPIPPACE.com + Long-Term Aging of Polyethylene Pipes, UKWIR 2020
6	**Flow Capacity:** New pipes have similar flow capacity per AWWA Standards and Manuals	✓	✓	AWWA M55, C906, M41 + PPIPACE.com
7	**Water & Energy Conservation**: Fused joints have zero allowable water leakage, zero infiltration, and lowest carbon footprint	✓	✗	AWWA M55, M41 + ASTM F2620, F3190, F3565 + MAB-1, MAB-2, MAB-8 + TEPPFA Polyethylene Plastic Pipe Systems vs Ductile Iron Environmental Impact Comparison, TEPPFA EPD Calculator
8	**Cost Effective:** Has the lowest initial cost, lowest life cycle cost, and lowest restoration cost for trenchless installations	✓	✗	Life Cycle Analysis of Water Networks, CSIRO 2008 + Annual Drinking Water Quality Report for 2014, Kittery Water District, 5/31/2015
9	**Resilient**: Ability to resist ground movements due to droughts, freeze/thaw, earthquakes, hurricanes, with ability for flow control/squeeze off	✓	✗	Recent Earthquakes: Implications for U.S. Water Utilities, WRF 2012 + Polyethylene Pipeline Performance Against Earthquake, Kubota 2018 + MAB-9
10	**Permeation/BTEX:** Pipes and elastomeric joints need to be properly engineered for contamined conditions	✗	✗	AWWA C901/C906 and C111/C151, Sec. 4

Additional information including MAB-3 Model Spec Guide can be found at www.plasticpipe.org/mabpubs

MUNICIPAL ADVISORY BOARD

MESSAGE FROM NASTT CHAIR

Greg Tippett, P.Eng., NASTT Chair

Dear Midwest Members & Supporters:

As Chair of the NASTT Board of Directors, I want to take a moment to thank you for your continued commitment to the trenchless industry and your active engagement within your regional community. Our success as a society depends on the strength of our Regional Chapters, and the Midwest region continues to lead by example.

One of the most inspiring aspects of our organization is the dedication of our volunteers. Whether you're serving on a committee, mentoring a young professional, organizing local events, or simply showing up to lend a hand at chapter activities, your time and energy are what make this society thrive. Your expertise, generosity, and passion for trenchless technology are the heartbeat of our mission, and I want to express my deep appreciation for everything you do.

Looking ahead, we're thrilled about the upcoming **Midwest Chapter Trenchless Technology Conference**, which will be held in **Milwaukee, WI on September 18 at the Harley-Davidson Museum**! This event is a fantastic opportunity for our local trenchless professionals to connect, learn, and share best practices. The agenda is shaping up with a strong lineup of technical presentations, networking sessions, and regional project spotlights that reflect the ingenuity and diversity of our field. I encourage all members, whether you're a long-time veteran or new to the industry, to attend and take full advantage of what this regional gathering has to offer.

"One of the most inspiring aspects of our organization is the dedication of our volunteers!"

While our regional events are essential to strengthening local networks, NASTT also provides you with opportunities to engage with trenchless leaders on a global scale. First up is the **2025 No-Dig North & ISTT International No-Dig**, taking place in **Vancouver, British Columbia, October 27-29**. This combined conference will bring together trenchless professionals from around the world, offering a unique platform to showcase North American innovation alongside global advancements. It's a rare and valuable chance to learn from international peers and share the outstanding work being done across our region.

Then, in 2026, we'll head to **Palm Springs, California for the NASTT 2026 No-Dig Show, March 29-April 2**. Palm Springs promises to be an exciting and memorable destination, and our team is already hard at work planning a world-class event with technical sessions, networking opportunities, and the unmatched energy that makes the No-Dig Show such a cornerstone of our industry calendar. If you've ever considered presenting, volunteering, or exhibiting at a national level, now is the perfect time to start planning for your involvement.

These events, local, national, and international, are only made possible by the engagement and leadership of members like you. As we grow and expand our impact, I encourage you to consider how you might get involved in the months ahead. Whether it's submitting a paper, nominating a deserving peer for an award, supporting student and young professional programming, or participating in one of our many outreach initiatives, your voice matters and your presence makes a difference.

On behalf of the entire Board of Directors, thank you for being a valued member of the Midwest region and the larger NASTT family. Your contributions help move our industry forward, one innovative, trenchless step at a time. I hope you'll join the Chapter in Milwaukee this fall, and perhaps in Vancouver or Palm Springs soon after!

Greg Tippett

Greg Tippett, P.Eng.
NASTT Board of Directors Chair

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MSTT BOARD EXECUTIVE 2025-2026

Steve Matheny - *Chair*

Steve Matheny, P.E., F.ASCE, has been a business consultant engineer for Logan Clay Products since 2016 where he brings over 30 years of technical experience and knowledge in the construction industry. He has been part of the Midwest Society of Trenchless Technology's (MSTT) board since 2017 where he is committed to advancing both his own technical knowledge and the use of trenchless techniques. Steve has consulted and been involved with multiple trenchless projects (Pilot Tube Method) and has authored several papers and presentations for the North American Society for Trenchless Technology (NASTT). Steve has also written several articles for the MSTT Journal. He is currently consulting on numerous PTM projects throughout the Midwest and East Coast.
He is the recent past president of the ASCE Southeastern Branch where is been a member for over 30 years. His bachelor's and master's degrees in civil engineering are from Wayne State University and is professionally registered in the State of Michigan.

Luke Erickson - *Vice Chair*

Luke is a Principal for Delve Underground based in Columbus, OH. Luke serves as Delve Underground's Columbus Office Manager and is also one of Delve Underground's Trenchless Engineering Practice Leads. Luke has 19 years of experience focusing on geotechnical, civil, and construction engineering for heavy civil and underground construction projects with a focus on trenchless installation methods.
Luke brings a wealth of trenchless experience in a wide range of methods that include conventional tunneling, microtunneling, pipe ramming, auger boring, pilot tube, small boring unit, and horizontal directional drilling (HDD). He is a recognized expert in trenchless construction methods and has served as the engineer of record on several HDD and trenchless pipelines for both owners and contractors for water distribution and wastewater systems across the nation.
Throughout his career, Luke has attended numerous NASTT No Dig Conferences while also authoring and presenting papers for both the national conference and various regional chapters. Luke is passionate about everything trenchless and enjoys networking with owners, engineers, and contractors within the MSTT Region.

Robert Martin - *Secretary*

Robert Martin, P.E. has been with Jacobs Engineering Group since 2007 and has over 26 years of comprehensive underground engineering experience on projects including those for the rail transit, water supply, wastewater, and mining. Robert is the Past President of the ASCE Wisconsin Section Southeast Branch and was a contributor of the ASCE/ UESI Manual and Reports on Engineering Practice No. 106, Horizontal Auger Boring Projects, Second Edition. Robert's experience includes construction feasibility assessments, design of soft ground and rock tunneling using various methods including; drill-and-blast, road header excavations, full-face tunnel boring machines in rock and soil, microtunneling, horizontal directional drilling (HDD) and other trenchless methods and has worked on projects all over the world. Robert is an active member of NASTT in addition to his role as Secretary of the MSTT Board.

Mark Onken - *Treasurer*

Mark is a consulting engineer based in the Minneapolis Metropolitan Area. Throughout his professional journey, he has been dedicated to leading design and construction management of utility and roadway improvement initiatives, serving a diverse clientele that spans rural municipalities to regional sanitary districts across the Midwest. Mark's proficiency lies in the intricacies of design, constructability, and hydraulics, with a specialized focus on large wastewater conveyance systems. His comprehensive skill set extends to planning and capacity analysis of existing systems. Mark is also always spearheading multiple ongoing innovation efforts with his current employer.
Mark is a strong advocate for utilizing less impactful construction methods and possesses extensive knowledge in trenchless construction technologies. As an active member of NASTT, Mark's curiosity drives him to remain at the forefront of emerging trenchless technologies. Currently, his interests are centered around exploring methods such as pipe bursting, horizontal directional drilling, cured in place pipe, and various manhole rehabilitation techniques.

MSTT BOARD EXECUTIVE 2025-2026

Chris Schuler - *Past Chair*

Chris Schuler joined Underground Solutions as Vice President of Operations in December of 2024 with the acquisition of the Weko seal technology from Miller Pipeline by Azuria. He will be focused on expanding the Weko product line and supporting other products provided by Underground Solutions. Prior to that, he joined Miller Pipeline in 1984 in Indianapolis, Indiana. Over the next four decades, he served the company in many capacities, including laborer, operator, foreman, superintendent, General Manager, and ultimately Vice President of their Water and Wastewater market segments.
Chris attended Indiana University from 1983-1986 focusing on Economics and Business. He graduated from the University of Missouri with a B.A. in Commercial Economics in 2001. He is also a member of the NASTT Board of Directors and the NASTT Program Committee in addition to his role as Past Chair of the MSTT Board of Directors.

MIDWEST SOCIETY FOR TRENCHLESS TECHNOLOGY
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Meet Us in Vancouver

October 27-29 | Vancouver Convention Centre

No-Dig North is the premier annual conference focused on trenchless technology in Canada. Attendees include engineers, contractors, manufacturers, and municipal representatives who seek to learn about and discuss sustainable, cost-effective solutions for infrastructure needs. The 2025 No-Dig North and ISTT International No-Dig conference is coming to Vancouver, BC at the Vancouver Convention Centre, October 27-29, 2025.

Learn more at

nastt.org/no-dig-north

NASTT 35 YEARS
Connecting Trenchless Partners

No-Dig North is owned by the North American Society for Trenchless Technology (NASTT), a not-for-profit educational and technical society established in 1990 to promote trenchless technology for the public benefit. For more information about NASTT, visit our website at nastt.org.

NASTT MIDWEST CHAPTER

Join Us In

DYNAMIC MILWAUKEE WISCONSIN *at the* HARLEY-DAVIDSON MUSEUM

2025 Annual Midwest Regional Chapter Trenchless Technology Conference

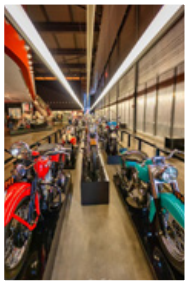
September 18, 2025

Harley-Davidson Museum
400 W Canal St, Milwaukee, WI

Spotlighting the latest developments, cutting-edge case studies, pioneering research, and technological innovations in trenchless technology.

The Midwest Chapter is pleased to work with the Harley-Davidson Museum to provide our attendees with a truly unique and thrilling venue for our event. Learn about the latest innovations in our industry while exploring iconic American motorcycles.

Don't miss this opportunity to stay at the forefront of trenchless technology. Join industry experts, network with peers, and gain invaluable insights that will propel your work forward.



For more information and to register:

https://s2.goeshow.com/nastt/MSTT25/

Keynote Speaker

Kevin Shafer, Executive Director,
Milwaukee Metropolitan Sewerage District (MMSD)

KEYNOTE SPEECH:

The enactment of the Clean Water Act in 1972 catalyzed a transformative legal and environmental initiative in the Milwaukee region, culminating in the $2.3 billion Water Pollution Abatement Program.

Central to this program was the development of a $1 billion deep tunnel system, designed to mitigate sewer overflows into Lake Michigan. Completed using tunnel boring machines, the original 19.4-mile system provided 405 million gallons of storage capacity and has since been expanded in 2006 and 2010 to a total of 521 million gallons. Since becoming operational in 1993, the tunnel system has enabled the Milwaukee Metropolitan Sewerage District (MMSD) to capture and treat 98.6 percent of all water entering its system. This achievement has positioned MMSD as a national leader in urban water management and environmental protection.

Today, MMSD is using trenchless approaches to a variety of projects that will help to improve the operation of the regional sewer service even more.

This keynote presentation will trace MMSD's strategic, technical, and policy-driven journey to becoming a leader in sustainable wastewater infrastructure and outline the trenchless technology projects of the future.

Kevin Shafer serves as Executive Director of the Milwaukee Metropolitan Sewerage District (MMSD). MMSD is a regional government agency that provides water reclamation and flood management services for more than 1.1 million customers in 29 communities in the Greater Milwaukee, Wisconsin Area. The District serves 423 square miles that cover all, or segments of, six watersheds. Established by state law, the District is governed by 11 commissioners with taxing authority.

Since assuming this role, Kevin has transformed the MMSD into one of the leading wastewater utilities in the country through the integration of green infrastructure with traditional infrastructure. Kevin's 2035 Vision has propelled MMSD forward with climate change adaptation through an aggressive program to convert to renewable fuels, install green infrastructure, and preserve floodplains. Kevin's leadership has brought MMSD recognition as the recipient of almost every major award in the industry, including the 2012 U.S. Water Prize.

Kevin currently serves on the boards of The Water Council, The Nature Conservancy-Wisconsin, and US Water Alliance. He served as past president of the National Association of Clean Water Agencies and The Water Environment Research Foundation, past co-chair of The Water Research Foundation, past Board member of the Great Lakes Protection Fund, Mequon Nature Preserve, River Revitalization Foundation, and Discovery World, and a past member of the EPA's Local Government Advisory Committee. Kevin holds a master's degree in civil engineering, water resources, from the University of Texas, and a bachelor's degree in civil engineering from the University of Illinois.

Midwest 2025 Trenchless Technology Conference

Thursday, September 18, 2025
Milwaukee Harley-Davidson Museum
400 West Canal Street - Milwaukee

Conference Event Schedule			Time
Thursday, September 18, 2025			
Registration and Breakfast		Rumble Room & 1903 Bridge	7:30 - 8:20 am
Welcoming Remarks		Steve Matheny, Chair MSTT	8:20 - 8:30 am
Presentations		**Speakers**	
Session 1		Room: Rumble	Time
1.1	**Key Note**: MMSD's Integrated Watershed Approach	Kevin Shafer, Executive Director Milwaukee Metropolitan Sewer District	8:30 - 9:30
1.2	Listening to Your Pipes: Smarter Water Main Decisions	Francisco Sobral, RJN Group	9:30 - 10:00
1.3	Edgewood Ave 72 inch Microtunneling for Wet Weather Relief	Bridget Henk, PE, MMSD	10:00-10:30
Break 10:30 - 10:45 Rumble and Bridge			
Session 2		Room: Rumble	Time
2.1	Northbrook Dundee: HDD Installation	Michael Callaghan, Delve Underground	10:45 - 11:15
2.2	Why Did Perrysburg Use FELL Under the Maumee River?	Paul Pasko, Arcadis	11:15 - 11:45
2.3	Trenchless in a Mixed Neighborhood: Waukesha Greemeadow Interceptor	Joshua Zimmerman, Brierley Associates	11:45 - 12:15
Lunch 12:15 - 1:30 Rumble and Bridge			
Session 3		Room: Rumble	Time
3.1	Calculating and Managing Buoyancy During Annular Grouting	Kirk Roberts, CJGeo	1:30 - 2:00
3.2	Working Together - Utlizing Multiple Rehabilitation Technologies to Solve Complex Sewer System Issues	Mike Figlio, Michels Trenchless, Inc.	2:00 - 2:30
3.3	Two Sizes One Machine	Cory Street, Engineering & Construction Innovations	2:30 - 3:00
Break 3:00-3:15 Rumble and Bridge			
Session 4		Room: Rumble	Time
4.1	A Tale of 2 Pipes: A Comprehensive Force Main Condition Assessment for the City of Sartell, MN	Luis Sandia, SEH Inc.	3:15 - 3:45
4.2	Trenchless Slipline Installation Chosen to Replace Critical Water Mains	Jason Bordewyk, Underground Solutions	3:45 - 4:15
4.3	Protecting a Park Using CIPP and CIPMH Rehabilitation	Lexi Duve, PE, Foth Infrastructure	4:15 - 4:45
Closing Remarks		Steve Matheny, Chair MSTT	4:45 - 5:00
Reception 5:00 to 7:00 in the Museum (Rumble)			

MODERNIZING URBAN SEWERS: THE TRENCHLESS APPROACH TO CSO MITIGATION

By: Jason Holden, Akkerman

Across the United States, well over 700 municipalities grapple with the challenges of combined sewer overflows (CSOs). These systems, originally designed in the 19th and early 20th centuries to collect both stormwater and sewage in a single pipe, are now struggling to meet modern environmental standards. When heavy rainfall or rapid snowmelt overwhelms these aging networks, untreated sewage is discharged directly into rivers and lakes, posing significant risks to water quality and public health.

The severity of the CSO issue cannot be overstated. Many municipalities face not only environmental degradation but also the looming threat of steep EPA penalties. Under the Clean Water Act, the Environmental Protection Agency (EPA) holds municipalities accountable for preventing CSOs from contaminating water bodies. Failure to implement effective long-term control plans (LTCPs) can result in substantial fines that often translate into higher taxes and increased utility rates for local residents – burdens that ultimately fall on taxpayers already stretched thin by budget constraints.

Municipalities must navigate a complex regulatory landscape while modernizing infrastructure that is often decades old. The financial impact of EPA fines is significant. For example, cities that repeatedly violate water quality standards may incur penalties running into the millions of dollars. Such costs eventually trickle down to taxpayers, either through direct tax hikes or cuts in essential services. As a result, local governments are under mounting pressure to find innovative, cost-effective solutions that not only address immediate CSO issues but also offer sustainable, long-term benefits.

> "The severity of the CSO issue cannot be overstated."

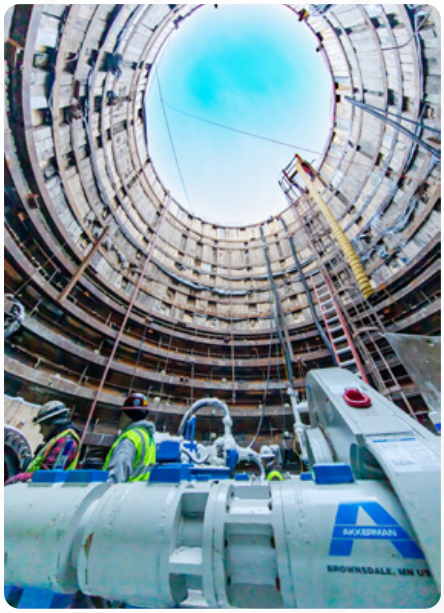


Figure 1: Akkerman Pipe Jacking System

"Many municipalities have turned to trenchless technology."

Figure 2: Rehabilitation crews sliplining FRP with an Akkerman SLS-100 frame.

In response to these challenges, many municipalities have turned to trenchless technology as a key component of their LTCPs. Unlike open-cut construction, which involves extensive excavation and disruption, trenchless methods offer a less invasive, more efficient alternative that addresses the underlying issues of outdated sewer systems. Among the most promising trenchless solutions are pilot tube microtunneling, pipe jacking, slurry microtunneling, and slip lining. These techniques allow for the rehabilitation or installation of new sewer systems with minimal surface disruption, a crucial factor in urban areas where road closures and construction disturbances can have a significant economic impact.

For instance, pilot tube microtunneling uses a guided pilot tube to create a small diameter crossing that serves as a pathway for installing larger diameter sewer pipes. This method minimizes excavation, offers high accuracy, and reduces the risk of damage to existing structures. Similarly, pipe jacking involves the precise installation of new sewer pipes by advancing a tunnel boring machine while the product pipes are being thrust from the launch shaft. Slurry microtunneling employs remote-controlled technology and face balancing to ensure accurate installation under sensitive conditions such as beneath rivers, roads, or sensitive structures. With new pipe technologies and installation equipment, it may be possible for large CSO collectors to be rehabilitated with better flow characteristics and longer life expectancy than when first constructed nearly 100 years ago.

"Trenchless methods offer a less invasive, more efficient alternative."

Companies like Akkerman are at the forefront of providing advanced trenchless solutions for CSO mitigation. Akkerman equipment integrates seamlessly with these modern techniques, offering robust performance and long-term durability. By leveraging such technology, contractors can help municipalities upgrade their sewer systems more efficiently – reducing the frequency and volume of CSOs and ensuring compliance with EPA regulations.

Ultimately, as municipalities face the dual pressures of environmental protection and financial accountability, investing in trenchless technologies becomes not just a technical decision but also a fiscal imperative. Effective mitigation of CSO issues can avert costly EPA penalties, lessen the burden on taxpayers, and protect vital water resources for generations to come.

ABOUT AKKERMAN:

***Akkerman**, a renowned producer of high-grade tunneling and boring equipment has recently been taking ground-breaking steps in enhancing operator training for construction companies specializing in trenchless underground construction. This move again demonstrates that innovation and customer-centric strategies are the pillars of Akkerman's continued success and growth. For more information visit www.akkerman.com*

SUB-FREEZING CONDITIONS AND AERIAL CROSSINGS

Innovative Rehabilitation with Flexible Fabric-Reinforced Pipe (FFRP) Robert Street Bridge 16-inch Watermain, Saint Paul, MN

By: Ahmed Hassan, J. Fletcher Creamer & Son, Inc.

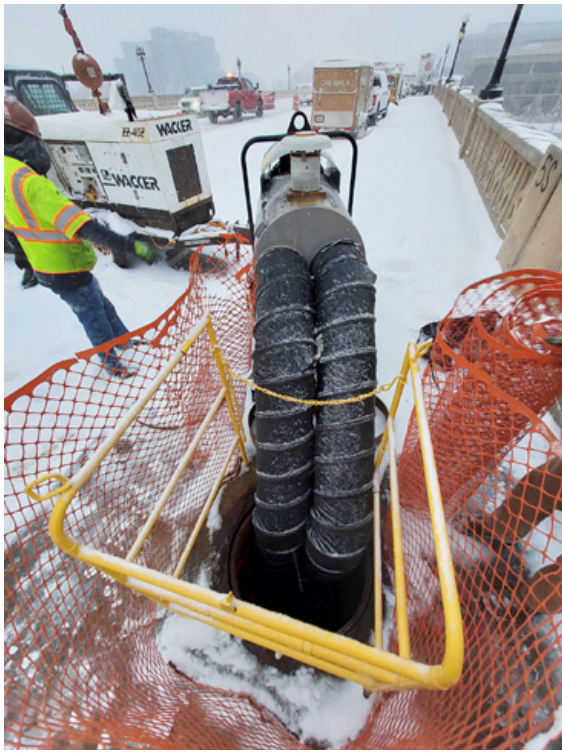
This article outlines the main advantages of utilizing Flexible Fabric-Reinforced Pipe (FFRP) rehabilitation technology for watermain assets located in aerial crossings under sub-freezing weather conditions. It demonstrates how FFRP technology effectively overcomes such challenges and safeguards pipelines that are continually affected by bridge movements and repeated exposure to extremely cold temperatures.

As defined by ASTM F3314 and the recently published ASTM F3708 standards for non-interactive pressure pipeline rehabilitation, the Flexible Fabric-Reinforced Pipe rehabilitation approach offers the best sustainable solution, as demonstrated in this project case study.

The 16-inch Cement-Lined Steel watermain pipeline was constructed in 1990 and operated by Saint Paul Regional Water Services, the watermain is situated beneath the Robert Street Bridge, which spans the Mississippi River in Saint Paul, Minnesota.

In 2024, the watermain experienced a rupture resulting from a combination of freezing temperatures and dead-head hydraulic conditions. This incident

"Successful completion of this project is attributable to exceptional partnership and collaboration."



Blower heaters were installed in the access manholes on the bridge deck and within the access chambers beneath the bridge

"The Primus Line System accommodates continuous bridge movement."

Access to the watermain limited to manholes located on the bridge deck

caused significant damage to the pipeline, its supports, and the concrete structure extending from Pier 3 to the South Abutment of the bridge.

The ruptured watermain comprises of two sections: a 510-foot segment extending from Pier 3 to Pier 4, and a 250-foot segment from Pier 4 to the South Abutment, necessitating prompt and efficient repairs. Compounding the situation, access to the affected watermain is limited to manholes located on the bridge deck, with restricted space available in the access chambers beneath the bridge.

A comprehensive evaluation of all project aspects, along with close collaboration among stakeholders, resulted in the selection of the Primus Line System as the optimal and sole long-term flexible fabric-reinforced pipe rehabilitation solution. Its robust, engineered design provides both strength and flexibility, ensures full compliance with ASTM standards, and allows for installation under any weather conditions.

Furthermore, the Primus Line System accommodates continuous bridge movement and is capable of withstanding maximum internal operating pressures independently of the host pipe.

In November 2024, J. Fletcher Creamer & Son, Inc. (Creamer) was awarded the contract to clean and inspect the watermain, as well as to install and test the 16-inch Primus Line System within the two compromised pipe sections.

Creamer's team coordinated with the onsite general contractor and the client to

Space was restricted in the access chambers beneath the bridge

commence work on December 17, with the objective of completing the project before the Christmas holidays.

Amid forecasts of a snowstorm and persistent below freezing temperatures ranging from 21F degrees to as low as 9F, Creamer installed blower heaters in the access manholes on the bridge deck and within the access chambers beneath the bridge to ensure safe and suitable working conditions for both personnel and equipment.

After inspecting both pipe segments and confirming they were clean and free of obstructions, Creamer proceeded to pull the liner through access manholes on the bridge deck. This was accomplished using snatch blocks and chain guides positioned within the access chambers below.

The Installation was successfully completed within only four days, including liner inflation, connectors' installation, and pressure testing. The team demobilized from the site on the morning of Friday, December 20.

The efficient, timely, and successful completion of this project is attributable to the exceptional partnership and collaboration among, J. Fletcher Creamer & Son, Inc., Saint Paul Regional Water Services, and Minger Construction Co., Inc.

ABOUT THE AUTHOR:

***Ahmed Hassan** has been the Trenchless Technology Lead at J. Fletcher Creamer & Son, Inc. since October 2022 in the areas of Spray-in-place Pipe (SIPP Epoxy and Cement lining), and Flexible Fabric Reinforced Pipe (FFRP) modified slip-lining. He has over 25 years of experience in pumps and pumping systems, serving numerous water and wastewater markets and clients. Ahmed is a member of NASTT & NASCO.*

Installation was successfully completed in only four days

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EVALUATING CULVERT REPAIR OPTIONS

Twice A Culvert Failure - Case Study Near Cincinnati

A Shaft with a View

By: Erin Cribbs, Turn-Key Tunneling, Inc.

While traveling the roads of America, an untrained observer may take notice of things like the condition of the pavement, adjacent vegetation, or a river or stream passing beneath. A civil engineer, however, sees these simple things as a complicated web of underlying infrastructure laden with design considerations, reliability, and long-term performance of these structures. The first structure that comes to mind is that of a culvert. With over five-million culverts in the United States alone this cost-effective solution can help a municipality keep and redirect water flow from anywhere from 20-50 years for singular percentage points of the cost to build and support a bridge. Unfortunately, sometimes culverts do fail and today we are going to look as to why that happens and what solutions are available to fix so that you can prevent flooding disasters, save time, and valuable financial resources.

There are seven primary reasons for failure of a culvert. The first and most common is age. While the typical service life of a culvert can range from 20-50 years, many continue to be in use beyond their lifespan, often exceeding 75 years with no plans of replacement or rehabilitation. Second, the original installation may have been inadequate. Improper backfill, misaligned/ defective joints, and poor compaction all can lead to early structural issues. Third, erosion of the backfill can compromise structural integrity and damage critical components such as the ring of compression zone,

Debris found within culvert pipe

Completed 13-Foot Shaft

Failure showing welded joints coming apart

Debris Collecting at the Failed Culvert

Fourth, lack of maintenance specifically, failure to monitor for and remove debris can lead to blockages at the inlet, which will cause hydraulic inefficiencies and even culvert floatation. Fifth, the design of the culvert may have been flawed from the beginning. An undersized, or under-engineered culvert can easily become overburdened during an extreme weather event or increased flow conditions. Sixth, contaminated runoff that derived from industrial, agricultural, or roadway might accelerate the degradation of the culvert's material thus, reducing the functional life. Finally, the geotechnical conditions at the time of construction or poor workmanship on the part of the installer may not have been accurately assessed by the geotechnical engineer, leading to long-term performance issues.

When evaluating repair options for your culvert, it is essential to partner with a service provider that demonstrates industry expertise and a proven track record. Turn-Key Tunneling, Inc. headquartered in Columbus, Ohio and is a recognized leader in trenchless construction techniques specializing in slip-lines, tunneling, vertical shafts, pipe jacking and boring. Now celebrating its 20th year in operation, the firm has consistently earned accolades as one of Central Ohio's Best workplaces and has been named Best Tunneling and Boring Contractor in the Eastern U.S. Turn-Key Tunneling has successfully executed numerous culvert rehabilitation and replacement projects across a variety of challenging conditions. The following case study details a culvert that experienced two structural failures within a five-year period and outlines the corrective actions taken.

In 2016, just beyond the Cincinnati city limits, a massive sinkhole-roughly the size of a football field formed for the second time since 2011. The initial event previously caused significant damage,

Installed InfraSteel Liner Pipe

Installing Steel Casing Liner Pipe

Massive sinkhole caused by failed culvert

Due to accelerated corrosion, culvert had significantly deteriorated

consuming part of a parking lot and over half of a local plant shop's inventory. While to the untrained eye the recurrence may suggest a mysterious or extraordinary cause, the underlying issue was entirely structural: a failed culvert. The culvert, constructed from corrugated metal pipe (CMP), had significantly deteriorated over time. The primary factor being accelerated corrosion driven by the area's heavy application of materials for winter snow and ice control. The proximity of these two failures underscores the importance of material durability and proactive infrastructure assessment in regions exposed to deicing agents such as road salt.

To address the culvert failure, Turn-Key Tunneling collaborated with Evans Engineering to develop a comprehensive rehabilitation plan. The initial phase involved conducting a full sewer assessment, beginning with the downstream outfall and extending upstream to the point of structural failure. A confined space entry and inspection were carried out via the nearest upstream access point including a video survey of the 36-inch line that connected to the compromised manhole structure. This investigation allowed for accurate evaluation of pipe condition and determination of the failure's extents.

Confined space entry inspection performed before lining

The proposed solution included the installation of a temporary bypass pumping system, consisting of four 12-inch hydraulic pumps with provisions for additional capacity if required. To access the failed section, a vertical shaft was constructed within the sink hole periphery. Flow calculations were recommended to ensure the bypass system could accommodate a minimum of a 10-year storm event. This was essential to avoid hydraulic overload, maintain site safety, and mitigate the risk of a secondary failure during construction. Turn-Key ultimately recommended deploying two independent bypass systems to manage anticipated flow volumes as this work took place in spring during periods of heavy rain and to ensure system redundancy.

During the initial sewer assessment, it was determined the downstream section of the pipe was over 50 percent obstructed with sediment and debris necessitating a full cleanout prior to the rehabilitation. Additionally on survey, multiple pipe joints within the failed section were found to be separated, requiring pressure grouting to prevent further infiltration or failure. A 20-foot self-supporting shaft was planned and installed with the hope of intersecting the most compromised portion of the storm sewer, to minimize the need for additional tunneling. However, an 84-inch diameter tunnel was ultimately constructed to provide adequate access and accommodate flow requirements.

Multiple pipe joints were separated

Once access was established, the sewer was cleaned and prepared for slip-lining, as the existing host pipe was deemed structurally sound enough for rehabilitation. The new liner was blocked to grade and the annular space was filled using cellular grout to ensure proper bedding and to eliminate voids. Using Manning's equation to assess flow characteristics, it was determined that the reduced internal diameter could be offset by using a liner material with a lower coefficient of friction. Both HDPE and fiber-glassed reinforced pipe both fit the profile, but HDPE was selected due to durability, flexibility and cost effectiveness. Upon completion, the access shaft was removed, the excavation was filled, and all existing sewer connections were re-established.

ABOUT THE AUTHOR:

***Erin Cribbs** is an Estimator at Turn-Key Tunneling in Columbus, Ohio bringing her expertise in the construction industry to the trenchless space. She previously served in various construction roles in the telecommunications industry, most recently as a Fiber Splicing Construction Manager. Erin graduated Summa cum laude from Capital University in 2021 with a Bachelor of Arts in Business Management Information Systems.*

HIBBING PIPELINE REPLACEMENT

Slipline Accelerates City's Pipe Replacement Schedule

By: Jason Bordewyk, Underground Solutions

Hibbing Public Utilities' water supply transmission mains developed several major leaks from external corrosion which led to the design of pipe replacement. The water and power utility in Hibbing, Minnesota along with their consulting engineer, Bolton & Menk, chose trenchless construction to replace the failing water mains and limit construction impacts to the community. In less than one year, three prominent trenchless projects have been completed to restore sound, reliable water supply to Hibbing by sliplining Fusible PVC pipe within the existing pipeline.

"In less than one year, three prominent trenchless projects have been completed."

18-inch Fusible PVC pipe insertion into existing 24-inch ductile iron pipe

Background

The Utilities' website documents the history of 130 years of utility service. "The Hibbing Light and Water Company was incorporated in 1894, one year after the incorporation of Hibbing under the village form of government, by Hibbing and Trimble of Duluth, prominent mining operators. An ordinance that year provided it the right to construct water works and lay water mains on the streets of Hibbing along with building a water supply tank."[1] In 1949, the Utility's name was changed to Hibbing Public Utilities (HPU). HPU continues to supply power, steam, natural gas, and water to residents and business.

HPU operates over 100 miles of water mains with nearly half of the water system installed prior to 1960. Portions of the existing water system are over 100 years old and HPU is regularly repairing water main leaks. Increased repair costs and several major water outages led HPU to develop a capital improvements plan for the water distribution system with major commitment to replacements and upgrades. The capital improvements plan sets projects and funding for the replacement of approximately 2 percent of the water system each year with specific projects prioritized for the following five to ten years.

In the first two years of execution, over 8,000 LF and 10,800 LF of water main and associated appurtenances were replaced or rehabilitated. With increased water main replacement and rehabilitation, HPU and their engineers have increasingly evaluated trenchless construction methods. Horizontal directional drilling

[1] Hibbing Public Utilities website: https://hpuc.com/our-history/

"Local and regional media highlighted the use of trenchless construction."

and pressure cured in place pipe (CIPP) lining have been used to replace or repair water main with reduced impacts to City infrastructure and community disruption.

A series of water main breaks occurred in 2023 on 24-inch water main that resulted in a 72-hour outage for a portion of the community. External corrosion of the 24-inch ductile iron pipe led to the large water main failure. HPU updated the capital improvement plan to prioritize the replacement of this water main.

Trenchless Project 1 – Fall 2024

HPU worked with engineering firm Bolton & Menk to design a water main replacement for the 24-inch ductile iron water main segment that failed most recently in 2023. The water main is located along the right of way of US Highway 169 within the City of Hibbing. Approximately 1,500 LF of water main was determined to be replaced and multiple construction methods were evaluated. The engineer reviewed traditional open cut replacement and trenchless construction methods including directional drilling, pressure CIPP rehabilitation, and loose-fit slipline replacement. The original water main was oversized for future water service to a neighboring community that never came to fruition. The extra capacity and reduced water usage through water conservation allowed HPU to install a smaller capacity pipe.

Sliplining of a new smaller water main through the existing ductile iron water main was determined to be the preferred installation method. Sliplining would provide a new water main pipe with limited disruption to the traveling public, adjacent utilities, existing pavement, and storm water channels. Additionally, sliplining was anticipated to be a lower cost option than several other construction methods evaluated.

The project was designed with approximately 1,350 LF of 18-inch Fusible PVC pipe to be sliplined into the 24-inch pipe. The project was competitively bid in July 2024 with Minger Construction of Jordan, MN the low bidder. Construction commenced in September 2024 and was completed within one month.

Waterworks distributor Core & Main supplied pipe fusion with their certified Fusible PVC fusion tech. The entire 1,350 LF of 18-inch pipe was fused into a single pipeline and laid out north of the water main to be replaced. Both ends of the water main where valves were located were excavated along with a tee fitting located in the middle of the run. The tee provides water service to Minnesota

Minger Construction completing slipline installation with excavator

"Success from trenchless construction methods was recognized by the owner and engineer."

Winter pipe fusion work by Core & Main occurred in a heated structure

Geislinger & Sons completing slipline installation at entry pit

North College along with a fire hydrant. Minger Construction installed the new Fusible PVC pipe by pulling the pipe forward into the open end of the existing pipe with their excavator. The excavator pulled the pipe forward with a nylon strap, while moving parallel to the pipe alignment. Once the strap location was near the insertion point, the excavator moved back north and began pulling again. This process was repeated until the entire new water main was installed. Once sliplined into place, the pipe was cut and maneuvered to install the new tee fitting in the middle. Standard mechanical joint fittings were used to make connections to the Fusible PVC pipe.

With all connections completed, the open access points were bulkheaded, excavations back filled, pressure testing completed, and bacteria tested passed. For grouting the annular space between the new and old pipes, 2-inch piping was installed through the bulkheads and brought to the surface. Once all testing was completed and the pipe was operational, the annular space was grouted with cellular concrete. Minger Construction completed the grouting using a continuous cellar concrete production pump to mix cellular foam with neat concrete and pump the grout through the annular space.

After the success of this initial trenchless project, the next phase of replacement from HPU's capital improvements plan was fast-tracked to replace one mile of existing 30-inch cast iron pipe. With cost and schedule savings along with reduced environmental impact, the work was also designed as a trenchless slipline project. HPU received funding for this 2025 project from a state development agency designed to support local projects in this part of Minnesota.

2025 Project Funding

As their website states, "The Iron Range Resources & Rehabilitation (IRRR) Board is a state of Minnesota economic development agency that reinvests local taconite [iron-bearing rock] production taxes back into

18-inch Fusible PVC slipline completed in existing 30-inch cast iron pipe

northeastern Minnesota businesses and communities to strengthen and diversify the economy."[2] Tax dollars have been reinvested into the local communities for a variety of public and private projects through the IRRR Board since its creation in the early 1940s.

The IRRR highlighted the project, explained their support of the project, and described the trenchless construction method in their Taconite Assistance Area Resource Guide 2026 writing: "The Hibbing Public Utilities Commission (HPUC) is conducting a major water infrastructure project. IRRR supported the project with $3 million in legislative revenue bond proceeds as required by the 2024 Minerals Article Legislation/Tax Omnibus Bill. Nearly one mile of water main will be fixed to ensure reliable and steady water flow to the residents of Hibbing. The current water main is 30-inch cast iron pipe that is over 100 years old. HPUC is using a technique called 'slip lining' to replace the century-old pipe; it is a trenchless repair method that can be completed during the winter months. A new, smaller diameter pipe is inserted inside the existing, damaged water main, restoring its structural integrity and repairing any leaks. The method eliminates the excavation of the entire water main and is less expensive, creating costs savings to the rate payers."[3]

It is exciting to see this funding mechanism highlight and elevate trenchless construction methods to a much wider audience through the 2025 HPU project. Local and regional media highlighted this project and the use of trenchless construction.

Trenchless Project 2 – Spring 2025

The one mile stretch of the Utilities' 30-inch water main from the South Water Treatment Plant to the City was anticipated to be replaced or rehabilitated later in the 5-year capital improvement plan. With cost and schedule savings from the 2024 project, the work was moved up and bid in December 2024. The 30-inch cast iron water main was installed in 1967 and has experienced several leaks due to exterior corrosion. Engineer Bolton & Menk designed another trenchless slipline for this pipe with a small amount of open cut at either end. The project was competitively bid and Geislinger & Sons of Watkins, MN was awarded the work. Bids for the project were significantly less than the budgeted amount, providing costs savings for HPU on top of savings from 2024 project.

Portions of the water main alignment are through a swampy, wooded area which includes a creek crossing. Therefore, winter or early spring construction in Northern Minnesota provided an opportunity to allow the contractor better access to the full alignment. Pipe fusion was completed by Core & Main in March 2025 with three separate slipline segments planned. In this project, 5,220 LF of 18-inch Fusible PVC pipe was sliplined through the existing pipe. The actual slipline installations began the first week of April 2025. Despite significant weather delays, the project was completed in less than two months from start to finish.

[2] Department of Iron Range Resources and Rehabilitation: https://mn.gov/irrrb/about-us/who-we-are/
[3] Department of Iron Range Resources and Rehabilitation, 2025, FY26 Taconite Assistance Area Resource Guide, https://mn.gov/irrrb/assets/%2726%20Resource%20Guide%20LR_tcm1047-700927.pdf

EBI Drilling completed long slipline pulls with directional drill rig

This slipline installation was completed using a directional drill rig to pull the pipe through the existing 30-inch pipe. Subcontractor EBI Drilling of Duluth, MN completed the slipline installation with their Vermeer D100x140 rig. Based on water main valve locations and site conditions, three slipline segments were completed. The two longest segments were approximately 2,100 LF. Installing the new pipe with a directional drill rig provided consistent installation force and speed, monitoring of pull forces, and overall quick installation rates. Pull forces averaged less than 30,000 lbs. throughout installation. The water main was tested and cellular grouted similar to the 2024 project.

With the long slipline segments and loose, swampy backfill at one end, restraining the ends of the fused pipe was important for pressure testing. Since pressure testing was completed prior to grouting the annular space, accounting for Poisson effects was important. The Poisson effect, which occurs in all materials, is material deformation in the direction perpendicular to applied force. In the case of a fused pipe during pressure testing before being backfilled or grouted, the internal pressure creates hoop stress expanding the pipe diameter and retracting the pipe ends. Providing restrained joints and proper backfill of adjacent open cut pipe sections was important to counteract the Poisson effects on the sliplined pipe.

Trenchless Project 3 – Summer 2025

During completion of the second project, additional failures on another section of the existing 30-inch cast iron main occurred, including at an adjacent 30-inch water valve. This led HPU to complete an emergency project to slipline another 4,905 LF of the existing 30-inch cast iron pipe. This water main was not expected to be replaced until late in their 10-year schedule. Geislinger and Sons completed this slipline project as well. Underground Solutions supplied pipe and fusion services starting in July 2025.

This section included approximately 2,400 LF of water main under a local golf course, so trenchless construction prevented disruptions to their business and customers. EBI Drilling returned with their directional drill rig to complete two slipline segments on this portion. The longest segment between an existing valve and bend fitting was over 3,200 LF. Installation of this segment saw pull forces averaging around 25,000 – 30,000 lbs. The highest pull force, less than 50,000 lbs., occurred to restart the installation after sliplining was paused to allow additional pipe fusion. Due to recurring large rain events this summer, extremely wet and muddy conditions prevented the entire pipe length from being laid out ahead of installation. Therefore, during the slipline installation, two segments were fused together to create a single pipe over 3,200 LF.

The contractor completed a segment of the project with open cut construction where numerous bend fittings were located on the existing pipe. Then the sliplined water main connections were completed, pressure tested, and annular space grouted as with previous projects. The project was wrapped up in mid-August.

Conclusion

Overall, greater than 12,000 LF of important water supply pipes were rehabilitated through sliplining. Success from trenchless construction methods was recognized by the owner and engineer, leading to further design and construction with trenchless methods. The project received local and regional media attention providing positive exposure of trenchless technologies to a wide audience.

Through these three trenchless construction projects, Hibbing Public Utilities achieved significant cost savings over other installation methods, which allowed key transmission main replacements to occur years ahead of schedule.

ABOUT THE AUTHOR:

Jason Bordewyk *supports end users, contractors, and engineers with trenchless construction pipe solutions. As a Regional Manager with Underground Solutions, Jason works in Minnesota, Iowa, and Wisconsin. Projects supported include new construction and pipe rehabilitation with directional drilling, pipe bursting, and sliplining being the primary construction methods. Jason has worked within the water and wastewater industry since 2001; prior to joining Underground Solutions, he worked as a consulting engineer.*

NORTH AMERICAN SOCIETY *FOR* TRENCHLESS TECHNOLOGY

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Seattle Public Utilities Pump Station 043 Emergency Force Main Repair, Hiram M. Chittenden Locks (the Ballard Locks) in Seattle, WA.

Pipeline construction is booming and the need for installation beneath USACE structures using trenchless technologies is increasing. Horizontal directional drilling, microtunneling, pipe ramming and pipe bursting offer positive solutions to installing pipelines with minimal disruption.

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TYPICAL CRITERIA	HDD	Direct Steereable Pipe Thrusting	Microtunneling	Pilot Tube B
Pipe Diameter	2 - 48 inches	30 - 60 inches	30 - 120 inches	4 - 48 inche
Depth Range	15 - 200 feet	25 - 130 feet	15 - 100 feet	8 - 30 feet
Length Range	200 - >10,000 feet	500 - 4,000 feet	200 - 3,000 feet	50 -300 feet
Maximum Length	>10,000 feet	>5,000 feet (7,500 feet maximum)	2,000 feet with intermediate jacking stations	+/- 400 feet
Minimum Depth of Cover	>25 feet	As low as 2X pipe diameter	As low as 2X pipe diameter	As low as 4(
Design Angles	Entry: 8 to 14 degrees / Exit: 8 to 16 degrees	Launch: 0 to 8 degrees / Reception: 2 to 10 degrees	Typically < 2.5%	Typically < 2
Entry/Launch Approach	Surface entry	Near surface launch	Shaft launch	Shaft launch
Min. Install Radii	Governed by installation & operating stresses	Governed by installation & operating stresses	Generally flat or sloped	Generally fl
Pit/Shaft Design	Shallow pit, non-engineered	Engineered shoring for shallow launch pit; shallow, non-engineered reception pit	Engineered shoring for launch & reception shaft	Engineered launch & re
Foundation	Traditional deadman	Engineered for site conditions & anticipated loads	Engineered for site conditions & anticipated loads	Engineered conditions & loads
Pipe Stringing	Typically exit side	Launch side	Pipe segment storage on launch side	Pipe segmer launch side
Installation Stresses	Tension, bending, hydrostatic buckling & combined	Compression, bending, & combined; column buckling	Compression & buckling	Compressio
Annular Pressures	Hydrostatic drilling fluid pressure & cutting transport pressure	Hydrostatic lubricating pressure & slurry over pressure	Hydrostatic lubricating pressure & slurry over pressure	Hydrostatic pressure
Gravel, Cobbles and Boulders	High risk of failure for > ~30-40% gravel	Can negotiate limited rocks up to 1/3 size of the cutterhead, and up to ~30 - 40% gravel	Can negotiate limited rocks up to 1/3 size of the cutterhead, and up to ~30 - 40% gravel	High risk of
Clay Soils	Risk of hydraulic fracture	Low risk of hydraulic fracture	Low risk of hydraulic fracture	Low risk of fracture
Relative Cost	$$	$$$$	$$$$	$$

GY OVERVIEW GUIDE: NEW INSTALLATIONS

Guided Auger oring	Auger Boring	Pipe Ramming	Pipe Jacking	Hand Mining/ Tunneling
s	12-72 inches	12 - 120 inches	42 - 144 inches	42 - 144 inches
	8 - 30 feet	5 - 25 feet	10 - 40 feet	10 - 40 feet
t	50 - 300 feet	50 - 300 feet	200 - 1,000 feet	100 - 600 feet
	+/- 500 feet w/ guidance	+/- 400 feet w/ guidance	1,500 feet with intermediate jacking stations	1,000+ feet
0-inches	As low as 2X pipe diameter	As low as 1X pipe diameter	As low as 2X pipe diameter	As low as 2X pipe diameter
2.5%	Typically < 2.5%	Typically < 2.5%	Typically < 2.5%	Typically < 2.5%
n	Shaft launch	Shaft launch	Shaft launch	Shaft launch
at or sloped	Generally flat or sloped	Generally flat or sloped	Generally flat or sloped	Generally flat or sloped
shoring for ception shaft	Engineered shoring for launch & reception shaft	Engineered shoring for launch & reception shaft	Engineered shoring for launch & reception shaft	Engineered shoring for launch & reception shaft
for site & anticipated	Engineered for site conditions & anticipated loads	Engineered for site conditions & anticipated loads	Engineered for site conditions & anticipated loads	Engineered for site conditions & anticipated loads
nt storage on	Pipe segment storage on launch side	Pipe segment storage on launch side	Pipe segment storage on launch side	Tunnel liner segment storage on launch side
n & buckling	Compression & buckling	Compression & buckling	Compression & buckling	Compression & buckling
lubricating	Hydrostatic lubricating pressure	Hydrostatic lubricating pressure	Hydrostatic lubricating pressure	Hydrostatic lubricating pressure
failure	Can negotiate up to 1/3 size of the cutterhead	Casing can be sized to swallow up cobbles & boulders	Medium risk of failure. Can access tunnel heading for removal of obstructions	Medium risk of failure. Can access tunnel heading for removal of obstructions
hydraulic	Low risk of hydraulic fracture	Low risk of hydraulic fracture	Low risk of hydraulic fracture	Low risk of hydraulic fracture
	$	$$	$$$	$$$

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WORKING THROUGH CONSTRUCTABILITY CONSTRAINTS:

Need for Precision in Maintaining Line & Grade

By: Steve Matheny, P.E., Logan Clay Products LLC

Riverview, Michigan is a suburb south of metro Detroit situated along the Detroit River with a population of approximately 12,000. Residents here expect a safe, small-town environment where community members care about each other. When neighbors living in this area experienced basement flooding from an overcharged sanitary sewer, it was a public concern.

The Huntington Meadows subdivision was built in the early 70s with footing drains connecting to the sanitary sewers. There is an enclosed drain in this low-lying subdivision with houses built over it. Heavy rain events are the most common cause of over-charged sewers in the area. The existing Reinforced Concrete sewer lines include some sections that have been lined with Cured in Place Pipe (CIPP). These sewers will stay in place and will remain a part of the collection system.

A new relief sewer main is needed in the Huntington Meadows neighborhood to expand the system's capacity during heavy rain fall events and eliminate basement flooding. There are existing utilities in the planned sewer line alignment that cause constructability constraints. Those constraints resulted in proposing the relief sewer to be constructed at a depth of 20 feet with a slope of 0.2 percent and with only 2 feet of vertical clearance at a utility crossing. Maintaining grade and clearances are paramount for the construction of the proposed overflow sewer line.

The Riverview neighborhood, built in the 70s, needs expanded sewer overflow service to eliminate basement flooding

Open cut construction at a depth of 20 feet + was ruled out as it is very disruptive to the neighborhood, not to mention the safety concerns it causes. The consulting city engineer, Souheil Sabak, P.E. and President of C.E. Raines Company, has vast experience with trenchless projects using a different pipe material and a different installation method. This project had challenges that made Sabak extra cautious when evaluating and considering

all trenchless installation options. The need for precision in maintaining grade led to considering the Pilot Tube Method of Guided Boring (PTM) with Vitrified Clay Jacking Pipe (VCP-J) as the best installation option. The stiff gray soils in the project area with an STP (Standard Penetration Test) of 4, meant the geotechnical conditions are ideal for a PTM installation.

The proposed sewer alignment and method of construction were carefully considered as the sewer will traverse residential, commercial and state right-of-way zones before it connects to the Downriver Transport Sewer System.

The design solution for the relief sanitary sewer was completed in 2022 but was stalled due to delayed funding.

The Pilot Tube Method seemed to address all of the concerns as it offered reliable, precise controls for line and grade and limited surface disruptions. Sabak became more confident in the method and the materials when Jeff Boschert, P.E. and President of National Clay Pipe Institute, shared the most recent compression tests conducted by an independent lab for the City of LA. The minimum compression strength of the five pipe tested was over 30,000 psi. The average promised by the NO-DIG Pipe company is 20,000 psi and the minimum requirement of ASTM C1208 (Standard Specification for Vitrified Clay Pipe and Joint for Use in Microtunneling, Sliplining, Pipe Bursting and Tunnels) is just 7,000 psi.

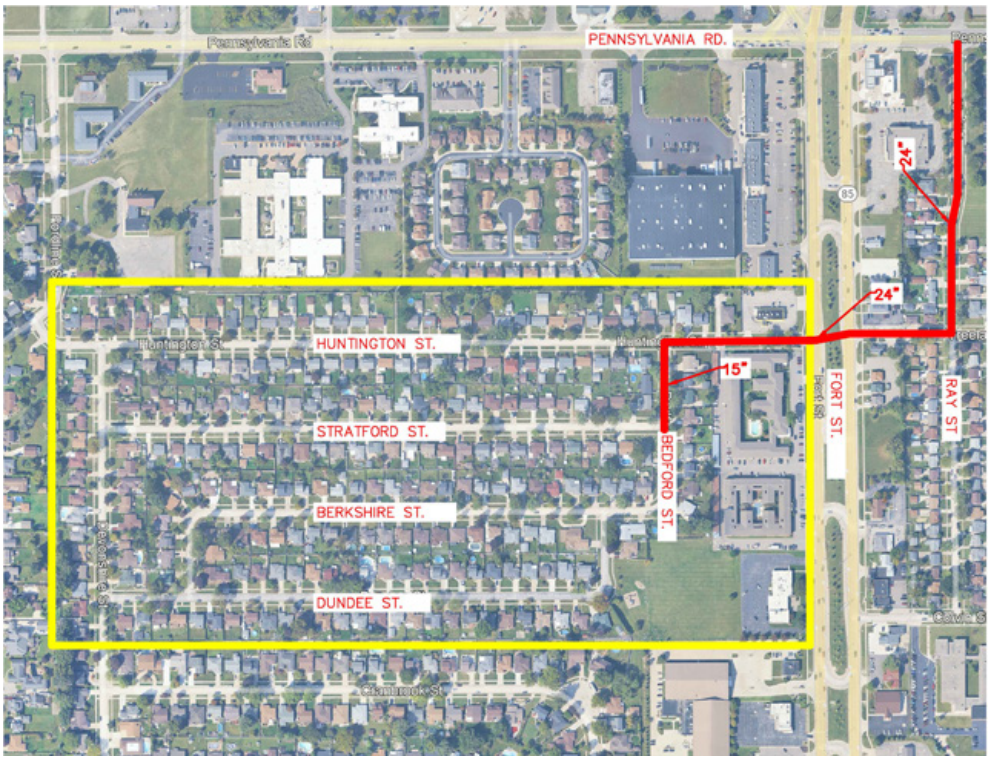
> **"The excess strength represented by recent test results was compelling."**
>
> **- Jeff Boschert, P.E., President, National Clay Pipe Institute**

The ASTM standard is used to determine Allowable Safe Jacking Loads for NO-DIG pipe. With 24-inch NO-DIG pipe, the Allowable Safe Jacking Load is 230 tons with a 2.5 Safety Factor using the ASTM standard to calculate jacking force. As a point of reference, Akkerman's 4800 series GBM (Guided Boring Machine) has a maximum jacking force of 200 tons.

The difference between the ASTM strength specification for VCP-J and the actual compressive strength of the pipe as tested, represents over a twenty-fold increase in the safety factor for the jacking forces planned. The pipe strength far-exceeds the jacking forces created by the most commonly used equipment.

"Sabak had done his research," according to Boschert, "but he was really focused on the compression

NO-DIG Vitrified Clay Jacking Pipe



The planned new sanitary sewer line will affect many in the tight-knit community

strength testing. He was open about his concerns, which meant we were able to discuss them thoroughly. The excess strength represented by recent test results was compelling."

Sabak characterized the process, saying, "Extensive work was undertaken to develop this project. Hydraulic studies, coupled with evaluation of options to resolve the basement flooding issue, led to the most feasible approach which is to construct a relief sewer that connects to the Downriver Transport Sewer System. The relief sewer layout proved to be challenging due to the landscape, proximity to existing utilities, clearances and right-of-way limitations. Obtaining permits from the various governing agencies was also a very involved process. The construction methodology became key in addressing these challenges. Again, the Pilot Tube Method seemed to address all of the concerns as it offered reliable, precise controls for line and grade and limited surface disruptions. We are excited about this project and look forward to its successful delivery."

The Huntington Meadows Relief Sewer will include 400 feet of 15-inch and 1900 feet of 24-inch VCP-J. The jacking and receiving shafts will be created where the manholes are planned with the longest drive on this project slated to be 365 feet. The drives will average 287 feet with three drives over 300 feet.

A $20 Million bond issue that included funding for this project recently passed allowing the project to move forward.

The project went to bid in May of 2025 and will break ground in the Summer of 2025 with a budget of $5.2M. As the winning bidder, DVM Utilities is an experienced trenchless installer with over nine years of trenchless installation experience. Their main office is located in Sterling Heights, MI, approximately thirty miles from Riverview. The project will benefit from their extensive experience using PTM.

"We've intentionally been very conservative as we developed this plan," said Sabak. "The accuracy of the method, the compressive strength of the pipe and the reliability of the pipe material all played their part in making PTM the best and most economical option for this community."

"The Pilot Tube Method seemed to address all of the concerns."

- Souheil Sabak, P.E, President, C.E. Raines Company

ABOUT THE AUTHOR:

Steve Matheny, P.E., *is a sales engineer for Logan Clay Products. He is a Board Member for ASCE and has authored a number of papers and articles. He is currently consulting on multiple PTM projects. His bachelor's and master's degrees in civil engineering are both from Wayne State University. Steve is the current Chair of the MSTT Chapter Board of Directors.*

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SEISMIC DESIGN CRITERIA FOR HDPE PIPE WATER MAINS

Technical Document Important for Utilities in Earthquake Prone Areas

By: Steve Cooper, SCA Communications

A pioneering report provides documentation for the required wall thickness of a fully fused, high-density polyethylene (HDPE) water main pipeline to withstand the lateral spread from an earthquake. Researched and authored by Michael O'Rourke, Ph.D., P.E., F.SEI, M.ASCE Professor Emeritus Civil Engineering at the Rensselaer Polytechnic Institute, the *Design of HDPE Water Mains for the Lateral Spread Seismic Hazard* (MAB-9) can be found at the website of the PPI Municipal Advisory Board: www.plasticpipe.org/MABpubs

"This critically important document provides the criteria for the proper design of an HDPE water main system," stated Camille George Rubeiz, P.E., F. ASCE, co-chair, HDPE Municipal Advisory Board, and senior director of engineering for the PPI Municipal & Industrial Division. "It is the first report of its kind that provides the rationale, data and formulas for determining the proper wall thickness for a fused, highly ductile and highly flexible HDPE water main in a seismically sensitive area, subjected to an induced lateral spread.

"According to the latest United States Geological Survey, nearly 75 percent of the United States could experience an earthquake during the next 100 years that would cause significant damage to underground water mains. Professor O'Rourke's analysis of possible seismic events, lateral spreads and wave propagation hazards with formulas and charts provides the much needed data to help design a resilient water system."

The MAB serves as an independent, non-commercial adviser to the Municipal & Industrial Division of PPI, the major North American trade association representing the plastic pipe industry

> **"Experience suggests that HDPE pipe does very well in earthquakes."**
>
> **- Michael O'Rourke, Ph.D., P.E., F.SEI, M.ASCE**
> **Professor Emeritus Civil Engineering,**
> **Rensselaer Polytechnic Institute**

The two primary seismic hazards to buried pipelines are wave propagation and permanent ground deformation. Because earthquakes are caused by movement at a fault, the resulting movement results in waves traveling away from the fault. These waves stretch and bend pipeline infrastructure at or near the ground surface and is referred to as the wave propagation (WP) hazard.

"The WP hazard occurs in all earthquakes and is most commonly quantified by the resulting ground strain," O'Rourke explained. "The WP hazard is also transitory in that after the shaking ends, the ground returns to its original pre-quake position. If the earthquake is large, it can also result in permanent offsets at the surface or movements of the ground (lateral spread hazard) both referred to as permanent ground deformation (PGD). The report addresses the lateral spread hazard and the strains due to PGD which are larger and hence more important than those due to WP."

O'Rourke's document contains formulas, calculations, empirical data, and illustrations plus nomenclature and definitions, all of which can be used in designing the HDPE water piping system.

"Experience suggests that high-density polyethylene pipe does very well in earthquakes," O'Rourke said, "but engineers like to have ways to calculate and substantiate their design. Listening to what somebody else says that, 'Oh yes, the pipe is great', but they still are faced with the question of 'what wall thickness do I

The ductility of HDPE pipe provides high resistance to earthquakes and is also an important factor for ease of installation

Heat fusing HDPE pipe sections provides a leak-free joint plus heightened security and protection from seismic events

need?' 'I have this particular diameter pipe and it's going to be buried this far underneath the ground so what wall thickness do I need for some expected seismic event?' The goal is to have HDPE pipe that will be able to withstand the expected earthquake loads on this inherently ductile material. With that in mind, MAB thought it would be useful to develop a document that provides designers with some relationships, tables, formulas, et cetera, that they can use to figure out how thick the wall would need to be for an expected lateral spread. And that's the purpose of the MAB-9.

"HDPE is known as a continuous pipe, which means the pipe segments, which are 40 feet to 50 feet long, are fused together," he continued. "The ductile iron or cast iron pipe has joints every 15 or 20 feet, and the damage from a seismic event frequently occurs at those joints. Continuous pipe, whether it's welded steel or high-density polyethylene, usually does better than segmented pipe in earthquakes. HDPE has the added advantage over steel (and all other materials) in that it is highly ductile, flexible and corrosion resistant and so it can move with the earth as opposed to trying to resist the deformations that the earth is imposing on it."

Rubeiz elaborated, "MAB-9 is essential for many reasons. Proper wall thickness is very important, especially with earthquakes, and ground movement. Plus, there continues to be a dire need to replace the aging infrastructure, especially pipes that are older and brittle that many seismic events will cause them to crack.

"Nearly 75 percent of the United States could experience an earthquake during the next 100 years."

- Camille George Rubeiz, P.E., F. ASCE, Co-chair, HDPE Municipal Advisory Board

RIDGECREST, Calif. - A formerly straight section of pipe broken by shifting earth during a 7.1 earthquake that shook Southern California in July 2019, cracking buildings, breaking roads and causing power outages. The quake, centered 11 miles from the Ridgecrest area, is the largest quake to hit Southern California in at least 20 years. It was followed by a series of large and small aftershocks, including a handful above magnitude 5.0. (Credit: Gene Blevins/ZUMA Wire/Alamy Live News)

HDPE pipe and the information contained in MAB-9 will help in those replacement programs to provide a proper and resilient water main system.

"Being intrinsically able to withstand seismic shifts along with corrosion resistance, leak-proof fused joints creating a monolithic HDPE piping system, having a high degree of flexibility, and high ductility, are among the many reasons HDPE pipe is recognized to be the best product used for seismic installations and, of course, trenchless and open cut installations," Rubeiz stated.

"We would also like to thank the other MAB members and supporting engineers who provided their time and expertise to the project - Robert Diamond, P.E., City of Palo Alto, CA; Casey Haynes, P.E., City Utilities, Springfield, MO; Bill Heubach, P.E., M. ASCE, Seattle Public Utilities, WA; Harvey Svetlik, P.E., GPPC, TX; and Gerry Groen, P.Eng., Infra Pipe Solutions, ON."

Additional information can be found at www.plasticpipe.org/mabpubs or www.plasticpipe.org/municipalindustrial

ABOUT PPI:

The Plastics Pipe Institute, Inc. (PPI) *is the major North American trade association representing the plastic pipe industry and is dedicated to promoting plastic as the materials of choice for pipe and conduit applications. PPI is the premier technical, engineering and industry knowledge resource publishing data for use in the development and design of plastic pipe and conduit systems. Additionally, PPI collaborates with industry organizations that set standards for manufacturing practices and installation methods.*

SPIRALINE uPVC LINER FOR REHABILITATING STORM LINES

A Future-Focused Solution in Columbia MO

By: Ryan Poertner, Ace Pipe Cleaning, Inc.

The City of Columbia, MO was recently awarded an ARPA grant to rehabilitate some of their storm sewer system. With aging infrastructure and corrugated metal pipes that were causing sinkholes the city decided to rehabilitate these sewers trenchlessly. By choosing a trenchless rehabilitation method the City was looking to repair the sewers while reducing the impact on their citizens and the environment. The City elected to award this project to Ace Pipe Cleaning, Inc., headquartered in Kansas City, MO performing Cleaning & Televising, CIPP Rehab, and MH/Structural Rehab throughout the Midwest. As a part of the Carylon Corporation, Ace Pipe Cleaning is one of 14 companies who can perform this type of work throughout the United States. Nate Runyan (City of Columbia Sewer Engineer) said "hiring Ace Pipe Cleaning for this scope of work was easy. They perform great work and we knew they would take the appropriate precautions working around our storm sewer system."

Based on environmental concerns with using resins and chemicals typically used in CIPP (Cured-In-Place-Pipe) storm sewer rehabilitation, Ace elected to partner with IJTECH and use Spiraline to rehabilitate the storm sewers. Spiraline is an advanced spiral wound uPVC liner. The only environmental concern would be capturing the PVC shavings after trimming the ends to prevent them from getting into the storm sewer system. There are no resins involved related to the curing of the liner as it is already processed at the manufacturing plant.

"Spiraline is engineered for rapid deployment."

What is Spiraline?

Spiraline is an expandable, spiral wound lining system made from uPVC, designed specifically for gravity stormwater and sewer pipes ranging from 6 to 80 inches. Its installation utilizes a trenchless, mechanical approach that renovates deteriorated pipelines with minimal disruption and high durability.

Spiraline is engineered for rapid deployment. Recent innovations have simplified and automated the winding process, reducing manual adjustments – a common source of errors in other methods. The compact and mobile equipment can be easily transported and operated within confined spaces, making it ideal for urban storm sewer networks.

A unique feature of Spiraline is its ability to be installed in live flow conditions. Most rehabilitation systems require the flow to be fully diverted or bypassed, which adds complexity and cost. With Spiraline, the liner and installation equipment are unaffected by typical storm sewer flows, meaning that there is no need for expensive or risky bypass systems, operations can continue during some wet weather events and the risk of overflow during installation is minimized.

Smooth, circular internal bore enhances hydraulic efficiency

Spiraline creates a structural, stand-alone pipe within the original sewer. The finished liner matches or exceeds the strength of new uPVC pipes, offering full restoration of structural integrity to deteriorated sewers, resistance to corrosion, root intrusion, and chemical attack, and a design life of at least 100 years, comparable to traditional PVC pipes that have demonstrated decades of reliable performance.

The smooth, circular internal bore provided by Spiraline enhances hydraulic

"Low material and installation costs make Spiraline a cost-effective option."

"Hiring Ace Pipe Cleaning for this scope of work was easy, they perform great work."

- Nate Runyan, Sewer Engineer, City of Columbia

A structural, stand-alone pipe within the original sewer

A unique feature of Spiraline is its ability to be installed in live flow conditions

efficiency. Since the liner is expanded into close contact with the host pipe, it eliminates the risk of "fins" and wrinkles which can increase flow resistance – a common issue in cured-in-place pipe (CIPP) and other trenchless rehabilitation technologies.

Low material and installation costs, combined with reduced labor and time requirements, make Spiraline a cost-effective option. The installation footprint is minimal, increasing worksite safety and reducing liability. Additionally, the need for fewer workers and shorter project durations further lowers the costs.

Since no excavation are typically required or no hazardous chemicals are used and the process generates minimal waste, Spiraline aligns with sustainable infrastructure practices. The technology helps preserve the surrounding environment – an essential consideration in urban and ecologically sensitive areas. Mr. Runyan stated, "We decided to utilize Spiraline on some of our storm sewers to eliminate the potential for chemical contamination of our storm system and waterways."

Spiraline has proven highly effective for urban storm sewers susceptible to infiltration, exfiltration, and deformation, projects requiring rapid, non-intrusive rehabilitation with minimal service interruption, locations where excavation is impractical or prohibited due to sensitive environments or dense urban settings, or locations where access is limited for large equipment. Spiraline equipment easily is able to maneuver offroad and down banks to gain access to inlet and outlet structures. A small path could be required, but no need to get large equipment to the structure to perform the work.

In Conclusion

Using Spiraline for storm sewer rehabilitation delivers a suite of benefits – minimal disruption, live flow installation, structural longevity, cost efficiency, safety, and environmental responsibility. As cities continue to face the challenges of aging infrastructure, Spiraline stands out as a future-focused solution, ensuring storm sewers remain efficient, resilient, and sustainable for generations to come.

If you have any projects where Spiraline sounds like an ideal solution, please reach out to Ryan Poertner (rpoertner@acepipe.com).

ABOUT THE AUTHOR:

***Ryan Poertner** is General Manager of Ace Pipe Cleaning, Inc. (a member of the Carylon Corporation) a Midwest contractor specializing in Lateral Connection Repair, CIPP Lining, MH/Structural Rehabilitation with Cement & Epoxy, Laser/Sonar/HDCCTV Profiling, Sewer Cleaning, among other things. Ryan serves on the MSTT Board of Directors.*

CASE STUDY: HOW TO COOPERATIVELY RESOLVE DIFFERING SITE CONDITION CLAIMS ON TRENCHLESS PROJECTS

By: Tom Olson, Olson Construction Law

1. Introduction

Differing Site Conditions ("DSC") are a common feature in trenchless projects. They can affect cost, time and constructability. It is consequently critical that trenchless subcontractors as well as engineers understand how they can cooperatively and fairly resolve DSC claims on the jobsite, not in the courtroom. The purpose of this article is to provide a roadmap to accomplish this based on past trenchless projects on which I have successfully assisted contractors.

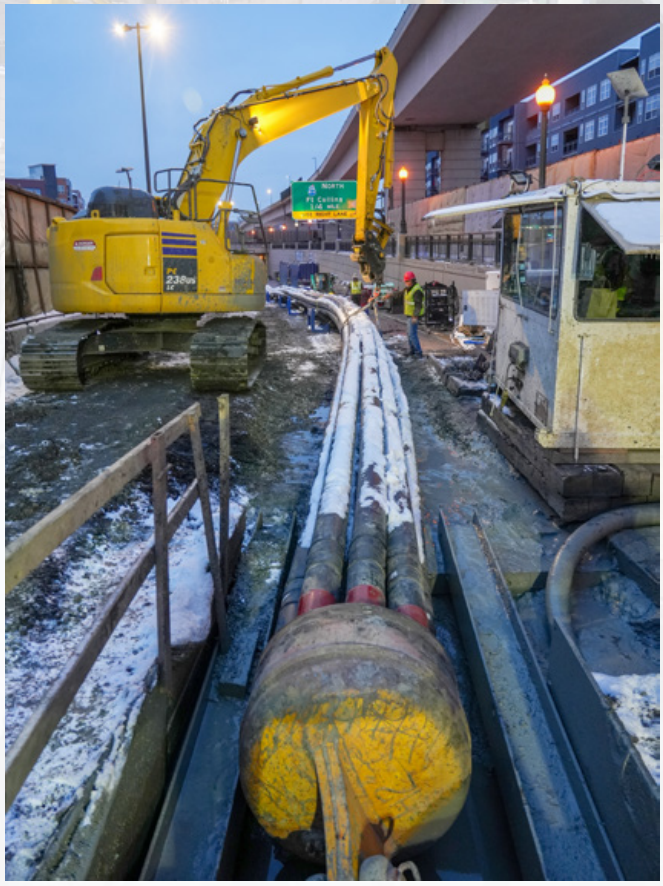
2. Why Do Contractors Encounter Dsc So Frequently?

Before we address 'how' to cooperatively and fairly resolve DSC claims on the jobsite, it is first important to emphasize 'why' contractors have and will continue to encounter DSC.

Based on my experience, there are four main reasons why contractors encounter DSC:

- First, some engineers believe 'the less they say about the anticipated subgrade conditions, the less exposure owners have to pay for DSC.' This belief causes engineers to *inadequately investigate the subgrade.*
- Second, some engineers have told me they like to minimize the 'cost' of a subgrade investigation to 'save money' for the project design. This too causes engineers to *inadequately investigate the subgrade.*
- Third, some design engineers lack the requisite formal education to know 'what' an adequate subgrade investigation should require and 'whether' they received one.
- Fourth, soil borings do not allow for two of the most problematic subgrade conditions (i.e. cobbles/nested cobbles and boulders) to be visually examined: they are too big for the boring tube. As a consequence, geotechnical engineers can only attempt to ascertain from the 'drill chatter' whether they have encountered such conditions.

The net effect of these factors is the subgrade is *inadequately investigated*, which in turn, increases the likelihood of encountering DSC[1]. That is why this topic is so important.



3. How To Contractually Address A Potential Dsc As A Subcontractor

While public projects do not allow general contractors to negotiate the language of their contracts with the owner, you still have this right if you are the subcontractor on the project. Your subcontract between you and the general contractor defines and allocates the risk between the parties. While it is common to have a flow-down provision which limits a subcontractors compensation to that which is recovered from the owner, it is not mandatory.

First, trenchless subcontractors need to *expressly include language in their bid* re: the 'anticipated subgrade conditions' as well as the 'right to payment' if *unanticipated conditions are encountered*. This right should also include payment for 'idle resources.'

Second, subcontractors need to ensure that their 'bid' (or at least the language above) is *expressly incorporated into the subcontract*. In the event a contractor refuses, you need to make clear that your pricing is based on the exclusions included in your bid, and if they refuse to incorporate those exclusions your pricing will change.

Third, subcontractors need to determine if there is 'pay-if-paid' language or a 'no damage for delay' clause which would limit their rights to compensation and revise those if necessary. This is all about allocating the risk on the project.

4. How Do Contractors Cooperatively And Fairly Resolve Dsc Claims On The Jobsite?

Based on our experience representing trenchless contractors around the country, we have successfully developed and implemented strategies to cooperatively and fairly resolve DSC claims on the jobsite. Set forth below is a condensed list of successful strategies.[2]

Insofar as most trenchless projects include a DSC clause, it is critical that contractors address a potential DSC both 'when' and 'how' contractually required. Per the standard DSC clause[3], when a contractor believes it has encountered DSC, it is *procedurally required to:*

- Immediately give WRITTEN NOTICE to the engineer[4] before a subcontractor proceeds with its work.

"You should be able to fairly and cooperatively resolve your DSC claim on the jobsite."

  - o Identify 'what' subgrade conditions have been encountered and 'why' they were 'not anticipated' (i.e. why the conditions are properly treated as DSC).
  - o Expressly cite to the DSC clause and explain 'what' that clause requires of both the contractor and the engineer.
  - o This includes explaining that the engineer is IMMEDIATELY required to conduct its own subgrade investigation of the alleged DSC, determine if there is a DSC, and report the engineer's findings IN WRITING to the contractor.
  - o NOTE: Often the best subgrade investigation can/should occur when a trenchless contractor *excavates the pit(s).* This allows, for example, a contractor to 'actually see' the existence of cobbles and boulders. Mindful of this, contractors should track what they encounter as well as measure 'size' of materials. If the subgrade conditions of the pit are 'different' than anticipated, contractors should provide immediate written notice of a DSC. Contractors should also take pictures of what encountered and 'save actual evidence' of the DSC (e.g. pile the cobbles and boulders in a location where they can be easily examined later). Sometimes an engineer may think 'what's the big deal' when they hear there are cobbles and boulders. When they see a large pile of the material which has been pulled out it can be a powerful visual.
- STOP WORK. If a contractor *fails* to do so, it may be held to have WAIVED its rights for additional compensation and time.
  - o For some trenchless projects, it may be impractical or a non-starter to 'stop' given how it could affect the work.
  - o Mindful of this, at the same time you give written notice, request the right to continue working while the engineer investigates the DSC claim and explain why that is practical (i.e. will minimize related extra costs by eliminating 'idle' costs) and necessary (e.g. pipe may become 'unmovable' because of skin friction).

o Ensure that the engineer confirms in writing that you can proceed with the work.

- Ensure the engineer conducts the contract-required subgrade investigation, which includes providing written results of investigation.

Fourth, if the engineer AGREES that there is a DSC, immediately ask 'how you should proceed.'

- This includes the crossing construction itself (e.g. will a change in equipment and/or method be required).
- As to 'pricing' the DSC, if the trenchless contractor has successfully completed one or more crossings prior to encountering the DSC, the most effective way to truly capture the financial/time impact of the DSC is to compare actual production from these other crossings rather than with the bid. Not only is this a more accurate means to measure extra costs and time delay it also provides a stronger basis for an engineer to agree on the impact. Use of the 'bid' production rate can cause engineers to disagree on what production should have been since it is an 'anticipated' rate.
- If the engineer alleges that the trenchless contractor has caused the extra costs/time (in whole or in part), you should seek and obtain a short WRITTEN analysis from the equipment supplier re: why you used the 'proper' equipment in an 'proper' way. Share that analysis with the engineer. And, of course, you should additionally explain that you successfully used the same equipment in the same manner for the other crossing(s), and 'why' consequently you did not cause any of the extra costs. If you have not completed additional crossing(s) on this project, cite to other project examples where you utilized the same means and methods for the *anticipated* conditions successfully (upon which the 'planned' production rates in your bid were based on).

Fifth, if the engineer DISAGREES that you have encountered a DSC:

- Ask the engineer to explain IN WRITING the 'basis' of that disagreement.
- Take pictures/videos of DSC. If you have encountered cobbles and/or boulders, make sure the pictures include 'measurements' since both obstacles are defined by 'size.' Then share this with the engineer.
- If the engineer disputes 'what' you claim to have encountered, hire a geotechnical engineer to investigate on your behalf and report the findings in WRITTEN FORM. Then share this with engineer.
- NOTE: Besides providing actual evidence of the DSC, a trenchless contractor can also show the 'existence' of a DSC through the 'adverse impact to contractor's operations.' This can include:
  - o Difficulty moving/supporting equipment;
  - o Unusual amount of effort required;
  - o Anticipated equipment insufficient;
  - o Material departure from work procedures; and

"Differing Site Conditions can affect cost, time and constructability."

o Equipment breakdowns, repairs and erratic production.[5]

- If you can access the 'face' of where you have encountered the DSC, invite the engineer to inspect that.
- NOTE: If a contractor encounters the anticipated 'type' of material which 'reacts' in an unanticipated manner, the contractor should still be able to successfully assert a DSC claim.[6]

Sixth, if the engineer DISAGREES that you have a contractual 'right' to assert a DSC claim:

- If the engineer's basis for a denial is that you did not have the 'right to rely' upon the soils information set forth as part of the contract documents because of a 'disclaimer' (e.g. "Soils data is for Information Only," "The owner does not warrant or guarantee the accuracy of the soils data," "Site conditions may vary," "The contractor is responsible for conclusions to be drawn from the soils data), you should then:
  - o Ask the engineer if it relied upon the soils data when it designed the project. Invariably, the answer will be that the engineer did rely upon the data. In response, ask how the same information became unreliable when the engineer provided this data to contractors when bidding.
  - o Ask the engineer if its opinion is that the DSC clause is invalid due to the disclaimer. Explain that this clause was developed to help contractors make more accurate bids, and thus keep costs down for the owner. If the engineer's position is this disclaimer overrules the DSC clause, contractors would again be forced to add contingencies to bids for conditions they may never encounter (and hence require owners to pay for extra costs not incurred).
  - o Contract an attorney for him/her to provide a written analysis on why such disclaimers should be treated as unenforceable.[7] Provide this analysis to the engineer.
  - o Recognize that even if such disclaimers are/may be enforceable for a *Type I* DSC claim (i.e. encountered DSC different than indicated in the contract documents), the same soils data still provides the best evidence of the anticipated subgrade conditions. As such, the data can be relied upon to sustain a *Type II* DSC claim (i.e. different than "what would be anticipated for the work at the project location").
- If the engineer's basis is that you did not have the right to rely upon the soils data because the borings were not at either the 'vertical' and/or 'horizontal' location of the crossing, you should then:
  - o Ask the engineer if they relied upon those borings when they designed the project. Insofar as the engineer presumably did so rely, ask why you could not similarly rely upon when bidding the project.
  - o NOTE: Another powerful way to prove your right to rely is to ask for the 'engineer's design cost estimate.' If the engineer's estimate was lower than yours, and you did not include dollars for the actual conditions encountered, then this shows that the engineer did *rely upon the borings* (and consequently you too had the same right when bidding the project).
- If the engineer's basis is that you cannot assert a DSC claim because the soil borings disclosed that the subgrade conditions could have been "anticipated to a degree," you should consult an attorney.
  - o Based on my research and successful use of it, "although conditions may have been anticipated *to a degree*, this will not preclude recovery when actual conditions were in a *higher proportion or more difficult than expected*."
  - o Provide the legal analysis to the engineer.[8]
- If the engineer's basis is that you *should have anticipated the worst-case scenario*, you should consult an attorney.

- o Based on my research and successful use of it, "the Government's 'worst case' interpretation of the contractual indications is *invalid*."
- o "The purpose of a 'differing site conditions' clause is to deter a contractor from bidding on a *worst-case scenario* and adding a contingency factor to its bid."
- o Provide the legal analysis to the engineer.[9]

• If the engineer's basis is that you could have and should have discovered the subgrade conditions per the contractual duty to "examine the site" and "become familiarized with local conditions affecting the work:"

- o Based on my research and successful use of it, "where the Government makes a positive assertion as to subgrade conditions, it is not relieved of liability by general contractual provisions requiring the bidder to investigate the site."
- o The contractual requirement for a contractor to perform a site investigation should not shift the subsurface risks to the contractor.
- o Even if the contract expressly provide that a contractor *could* conduct a below-grade investigation, unless the contract expressly *requires* a contractor to do so, the contractor is not required.
- o As a matter of law, the contractor's "site" investigation requirement should be limited to a "sight" investigation.
- o Provide the legal analysis to the engineer.[10]

5. Conclusion

There are many reasons why an engineer may decide to deny a DSC claim. And, based on my experience, part of that is simply a function of dollars: the engineer does not want the owner to have to pay for *unanticipated costs*. It is critical to recognize this. Because receiving a DSC claim denial does not mean the contractor has not encountered a DSC or does *not* have the right to assert a DSC claim. The good news is based on my experience of 40 years, if you follow the roadmap I have provided above, you should be able to fairly and cooperatively resolve your DSC claim on the jobsite, not in the courtroom.

6. Footnotes

[1]For what an 'adequate subgrade investigation' should include, see article I wrote for the 2018 NASTT No-Dig show entitled "Differing Site Conditions are Here to Stay: A Roadmap to Manage." *See also* my 2022 NASTT No-Dig article entitled "Inaccurate Utility Information: How to Protect Against the Largest Problem on Highway Construction Projects with Subgrade Utility Engineering (SUE)."

[2]If you are the subcontractor, you need to ensure you are following your subcontract claim requirements in addition to the project specifications. And, you should be working with the general contractor to prove the DSC to the engineer. Even if your subcontract has been negotiated so the risk of a DSC is on the general contractor, the ideal outcome would still be to have the owner pay for the conditions encountered through a valid DSC claim.

[3]Make sure that you carefully review the project specifications, as well as an special or supplemental conditions to determine the exact requirements for your project.

[4]Unless you are working on a 'federal' project, literally all states require 'written' notice. Even if a contractor provides the 'same' notice information 'verbally' that it would through 'written' notice, state law provides that a contractor's DSC claim is WAIVED.

[5]For a collection of cases which support this, see the article I wrote for the 2023 NASTT No-Dig Show entitled "Differing Site Conditions: When a Contractor Encounters Anticipated Conditions Which React in an Unanticipated Manner."

[6]While most of our work is 'behind the scenes' on a contractor's behalf, sometimes it is appropriate/necessary to have an attorney step forward. For us, that normally takes the form of sharing our legal analysis of the issue. We successfully did exactly that in sharing the referenced legal argument for the first time on a large federal project. Although this was the first time we developed and asserted this legal argument, we fairly and cooperatively resolved the matter *without litigation*. For the factual background of that project, we can provide the PowerPoint presentation we gave for the 2023 NASTT No-Dig Show. For the legal support, *see* Footnote 3.

[7]You can also reference an article which I wrote for the2024 NASTT No-Dig Show. See "Project Soil Borings and Contract Disclaimers: Contractors' Right to Rely Upon."

[8]For cases which support this proposition, *see* Footnote 3.

[9]For cases which support this proposition, *see* Footnote 3.

[10]For cases which support this proposition, *see* Footnote 5.

ABOUT THE AUTHOR:

***Tom Olson** has helped utility contractors around the country for decades resolve issues on the jobsite, not in the courtroom. He recently helped edit and author a national trenchless manual.*

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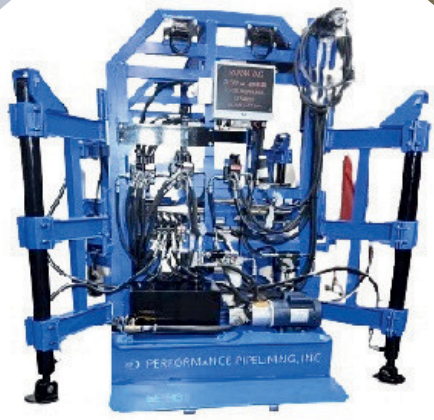

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GOING ALL THE WAY: SANITARY SEWER LATERAL TEE-LINING

An evaluation of a pilot project focused on the results of a full-length lateral tee-lining program

By: Maxwell McAvoy, Robinson Engineering, Ltd.
Mark Lammers, Village of Romeoville
Jeff Dilley, Performance Pipelining, Inc.

1. Introduction

In an effort to modernize their sanitary sewer collection system and minimize the amount of excess stormwater flow entering the sewer, the Village of Romeoville piloted a sanitary sewer rehabilitation program that focused on rehabilitation of residential sewer service laterals. The Village theorized that a significant portion of the stormwater entering the system was through the privately owned portion of the collection system, rather than the already rehabilitated publicly owned system.

To test this theory, the Village of Romeoville and Robinson Engineering, Ltd. (REL) embarked on a project to install cured-in-place pipeliners (CIPP) from the mainline sewers located in the backyards of a residential subdivision, extending all the way to the building foundations of 50 homes in the oldest neighborhood of the Village. The project utilized T-Liners™ as trademarked by LMK and were installed by Performance Pipelining, Inc. (PPI). These T-Liners™ allow for the sanitary sewer service laterals to be lined from the mainline sewer, while also rehabilitating the connection point with a full wrap tee. T-Liners™ have greatly increased in popularity over the years (*since 1998 when PPI and REL worked together to install the very 1st T-Liner™*), with PPI being recognized as one of the industry leading installers of the product. To date, they have installed 75,000+ T-Liners™ over the past 27 years and are experts on this style of CIPP installation.

2. Background

The Village of Romeoville has an ongoing sanitary sewer rehabilitation program, initiated in the early 2000s that has consisted of sanitary sewer point repairs, cured-in-place pipelining (CIPP) and manhole rehabilitation. The oldest parts of the system were constructed of vitrified clay pipe (VCP), but after approximately 220,000 linear feet of CIPP installation, nearly all Village owned VCP had been rehabilitated. In 2017, The Village began to shift focus to investigate other potential sources of infiltration and inflow (I/I) entering the sewer system. The Village recognized that one of their lift stations, the Spangler lift station, was struggling to keep up with flow increases during wet weather periods. To fix this problem, Romeoville concluded that they could pursue a different type of sewer rehabilitation project to shore up their system and reduce wet weather flows entering the lift station.

> "Installed as one homogenous, continual liner that extends up the lateral."

The oldest subdivision in the Village had sanitary sewers and watermains located in the backyards. While both the rear yard sanitary sewers and water mains were located within Village utility easements, access to residential backyards was an issue due to fences and other improvements that had been constructed by the homeowners over the last 70 years. These sewers were subject to tree root intrusions and were a huge challenge for the Village to maintain. In 2017, the Village disconnected and abandoned the rear yard watermains, and rather than remove the old 6-inch watermain, they found a way to repurpose the abandoned rear yard water main to improve rear yard drainage. While this helped alleviate some issues for the Village, they still noticed high wet weather sanitary sewer flows entering the Spangler Lift Station and ultimately the wastewater treatment plant (WWTP), making this area a great location for the new sewer rehabilitation project they were considering.

Figure 1. Mainline T-Liner w/Insignia Hydrophilic Connection Hat at service

Since all the sewer mains in this area were lined in 2007 and the sanitary manholes had been through a couple rounds of repairs, the only thing left to do was to rehabilitate the private sanitary sewer service laterals. Where previously the excess storm water in the neighborhood would seek a path to the sanitary sewer laterals, full length lateral tee-lining was now an option since the retrofitted old watermain was serving as a makeshift storm sewer. After thorough evaluation, Romeoville opted for a lateral tee-lining project that would reduce the frequency of pumping at the lift station, reduce lift station maintenance, and reduce maintenance in the backyard easements.

Thus, in 2023 the Village of Romeoville embarked on a pilot project to install 50 full length T-Liners™, with the goal of utilizing pre- and post- rehabilitation flow monitoring to measure the flow reduction realized and determine the feasibility of extending this program into other neighborhoods. The study area was chosen so that the outlet of the sanitary sewer could be flow monitored before and after the lateral rehabilitation while isolating the flow from these 50 residences.

By selecting this area, the Village effectively gave the residents a fresh start with their sanitary sewer lateral, since this area was prone to tree roots coming through the old VCP joints/cracks and causing blockages. Before this project, residents with tree root intrusions would need to hire a plumber to rod the line to clear a path for flow. This method is usually a temporary fix, as it simply pokes a hole in the blockage. The lateral tee-lining method contains a more thorough method of cleaning the line, using a combination of a high-pressure water jet nozzle to clear out most of the debris/blockages, and a root cutter to handle any large blockages that the jet doesn't clear. It is also a continuous liner that seals the joints of the existing pipes and prohibits future roots from growing into the service.

The pilot project consisted of 50 full-length lateral tee-liners, which included a 5-foot base T-Liner™ with approximately 45 feet of additional liner. Upon completion, the Village, REL, and PPI added 36 new Vac-A-Tee (VAT) cleanouts, one mainline cleanout for access and three spot liners also known by the LMK brand name as a Cap-A-Connection (CAC).

3. Project Implementation

Funding for this project was covered entirely by an American Rescue Plan Act (ARPA) grant, which is an act that was signed into law on April 1, 2022, to provide recovery funds for governments in response to the economic and public health impacts of COVID-19. The grant allowed the Village to perform the entire project without the need for any financial contribution by the homeowners. While some municipalities cover the cost of a tee-liner installation for the first 5-10 feet from the sewer main, the remainder of the lateral to the house would be the homeowner's responsibility. In those cases, the residents would have to cover either the partial or full cost of this extension piece. Romeoville, however, due to the nature of the grant received, as well as the fact that this was a pilot project, opted to cover 100 percent of the total cost of this liner's extension to the VAT.

Figure 2. PPI Crew prepares the lateral liner w/ resin saturation

Figure 3. Use of a shop-vac to pull resin through the entire length of the T-Liner™ as part of resin saturation

As the first step of the implementation of this project, each resident in the area was informed of the project beforehand and was asked to opt-in to the project, at no cost to them. This elicited positive reactions from the homeowners. Performing full-length lateral tee-lining with no financial contribution from the homeowner is a great way to get residents onboard with the program, thereby maximizing participation and ensuring the neighborhood is fully rehabilitated. After speaking with each resident in this project area and explaining to them that they would be receiving a rehabilitated sewer line at no cost, the Village of Romeoville's Mark Lammers received many grateful responses. The residents provided stories to Mr. Lammers about their experience with their sewer laterals in the past, emphasizing the frequency that they would have to hire plumbers to break through root blockages. Some residents even responded emotionally, adding that they would often delay any sewer repairs needed until emergencies arose, due to financial restraints. This project therefore provided them with a new sewer line that, in theory, eliminates the need for any expensive maintenance for the foreseeable future.

The Lateral T-Liner™ used in this project is designed to reconstruct a sewer service lateral pipe without excavation, creating a water-tight seal both in the main and up the lateral, and is installed as one homogenous, continual liner that extends up the lateral. The liner makes use of a single molded hydrophilic gasket or "InsigniaTM Hydrophilic Connection Hat" to ensure a water-tight connection between the mainline and the service lateral.

To be installed, the lateral liner is inverted, saturated with resin (the resin is poured into the lateral liner, pulled throughout the liner by a vacuum, and then the resin is evened out using rollers), and then inserted into the host pipe and expanded to press against the host pipe using a pressurized bladder. The liner is then held in place by the bladder while the resin is steam cured. The finished product is a non-leaking structural connection that fits tightly into the original host pipe and seals the system from I/I.

In some cases, the T-Liner™ extends approximately 5-10 feet up the lateral, by way of a blind install. This installation, often called a "Shorty", is a common repair that many municipalities choose as it covers the connection between the mainline and the service lateral, which is often where a lot of breaks in the sewer service occur due to punch-in connections. However, PPI's Brendan Mahaney remarked that "On this type of job, there is no way for the crew to know if the liner expands to the host pipe sufficiently until they are on cooldown… after installation is complete". The Village of Romeoville wanted to avoid this uncertainty, as well as take their installations a step further than the Shorty.

So, the Village opted to include VAT cleanouts and extend the lateral liners to reach these cleanouts, further prohibiting stormwater from entering the sanitary sewer system. PPI's crews

Figure 4. Coring of existing service lateral as part of Vac-A-Tee installation process

Figure 5. Hydrostatic Test performed on installed Vac-A-Tee to ensure the cleanout is properly sealed from any potential infiltration

"The Lateral T-Liner™ is designed to reconstruct a sewer service lateral pipe without excavation."

would core a hole into the top of the sewer lateral and install a saddle connection with a pipe riser to the surface, as well as perform a hydrostatic test. A hydrostatic test is a test of the cleanout riser and the saddle connection to the service prior to coring into the service, where the saddle and riser are glued onto the existing service, and then filled with water to surface level. The water level is then observed over time for any bubbling or reduction of level to verify a watertight installation. The water levels in the cleanouts never bubbled or dropped at any location, indicating that PPI had successfully installed a secure and water-tight connection that would prohibit any groundwater infiltration. The inclusion of these VAT cleanouts to the project not only allowed for more footage of sewer to be rehabilitated, but also made the installation process a lot easier for the contractor, as they were able to put a camera down this access point and follow

Figure 6. Feeding of Lateral Tee-Liner into manhole – Liner installation process

Figure 7. Push Camera setup – allows PPI to follow liner as it is extended into lateral during installation – crew uses to ensure liner is sticking to host pipe correctly prior to beginning curing

the T-Liner™ during installation to verify the liner was securely fit to the host pipe. Additionally, the cleanouts provided ventilation for the liner curing process by releasing styrene gases from the sewer before they could enter the homes. They also allowed crews to vacuum out any excess resin and gave homeowners an access point for any future maintenance that they may need. After this installation was completed, PPI would send a camera down each cleanout again and inspect the newly installed liner all the way to the mainline connection, ensuring that there are no fins, creases, or other discrepancies.

4. Results And Impact

As a result of this project, both the residents and the Village have noticed large benefits in terms of various maintenance cost reductions and an extension of sewer life.

In 2019, REL was tasked with performing a flow monitoring study of this area in advance of the installations of the T-Liners™. REL partnered with its sub-consultant ADS Environmental Services (ADS) to install a flow monitor and analyze the data received. Upon completion of the lateral lining project, a flow monitor was again installed in the same location so that the pre- and post-installation data could be compared and the flow reduction realized by the T-Liner™ installations could be calculated. By tabulating the wet weather responses gathered at this site during various storm events for both periods, it is estimated that, for rainfall events ranging from 1 inch to 5 inches, approximately 74 – 81 percent of the volume of I/I has been eliminated from entering the sanitary sewer system in the project area. Over time, this reduction will save the Village money that would have otherwise been spent treating this wet weather flow at the WWTP and will also reduce the likelihood of basement backups and sanitary sewer overflows in the area. Going a step further, we can take the volume of reduced flow over the study period, extrapolate it to estimate the total volume of reduced flow for the year, and multiply that by an industry standard value for the cost of treatment at the WWTP to determine the estimated yearly treatment costs saved by these installations. Therefore, it is estimated that the Village of Romeoville is saving approximately $19,760 per year in treatment costs as a result of the flow reduced by this lateral tee-lining pilot project.

However, these estimated savings only consider the I/I flow reduction and corresponding treatment cost savings, whereas the actual savings of this project extend far beyond what can be calculated. We have already mentioned the impact the liners have on the homeowners, saving them costs of future rehabilitation and/or emergency maintenance they would have otherwise had to perform on their laterals, but the liners also provide extensive savings for the Village. For example, lowering the flows entering the lift station lowers the frequency and duration of pump time, in turn extending the life of the pumps and minimizing electricity costs. Providing a noticeable reduction of I/I on the existing infrastructure in the Village also helps free up capacity at the WWTP.

With this project having been completed, the Village is now working on upgrading the lift station and performing improvements at the WWTP. However, instead of the focus being to add capacity to address existing infrastructure problems, this tee-lining project has allowed the Village to focus on the future of the Village, making upgrades with the goal of modernizing their system and allowing for new development and growth within the community.

When asked how he believes the project turned out,

Figure 8. Steam Curing Process – upstream volatile organic compound relief at Vac-A-Tee

Romeoville's Mark Lammers was pleasantly surprised with the flow reduction observed during the post-installation flow monitoring, stating that "the amount of flow in a rain event that was cut down is higher than I thought". He also had nothing but praise for how PPI executed this project, calling them "the consummate professional to deal with". He elaborated by recalling how PPI explained their techniques and how they were going to perform the installations at every step of the project, as well as extending that courtesy and professionalism to every homeowner on the project, both by way of door notice and by face-to-face contact. Because of the rear yard sewers, the Village also worried about any ground surface impacts the contractor would leave in the yards during their installation process. But again, PPI was praised for their "small footprint in people's backyards", as well as their coordination with homeowners having pets, letting them know exact timeframes of work so the residents could plan and respond accordingly.

Presently, the Village of Romeoville is further evaluating the results of this project and is considering renewing this type of project in another area. Funding for these types of projects can be a challenge, especially when it comes to spending public dollars on private property. Since this pilot project was entirely funded by an ARPA grant, the Village is considering various options for the funding of the next phase of this important program. Possible options could include a cost-sharing program with the homeowners, or the pursuance of external funding sources similar to the ARPA grant.

ABOUT THE AUTHORS:

***Mark Lammers**, is Assistant Superintendent of Public Works, Village of Romeoville*

***Max McAvoy, PEI**, is a Project Engineer with Robinson Engineering*

***Jeff Dilley** is a Project Foreman with Performance Pipelining, Inc.*

PIGGING A 64-INCH RAW WATER LINE

By: American Pipeline Solutions (APS)

American Pipeline Solutions (APS) and Wichita Water Partners pigged a complex, large diameter raw water line at the state-of-the-art water treatment plant launching in 2025. Multiple pigs cleared the debris and silt from the pipe before it was converted into a potable water line.

Background & Situation

The Northwest Water Facility is a major water infrastructure project to provide clean drinking water to over 500,000 Wichita residents. The City of Wichita partnered with Wichita Water Partners to build the state-of-the-art water treatment plant, replacing the city's 80-year-old facility. With the capacity to treat up to 120 million gallons of clean drinking water daily, the project represents the largest capital investment in the city's history at $500 million.

The four-mile stretch of a 64-inch diameter raw water pipeline required thorough cleaning before being converted into a potable water line. The large-diameter pipeline had accumulated significant silt buildup, necessitating a specialized pigging process. Wichita Water Partners enlisted American Pipeline Solutions (APS) for their decades of expertise in pigging large-diameter pipelines.

An external pump was used to launch the pig into the pipeline until the point that it was propelled by the system water flow

Scope Of Work

The pipeline segment requiring cleaning included approximately 20,000 feet (four miles) of 64-inch ductile iron and 66-inch pre-stressed concrete cylinder pipe (ECP & PCCP). In the early stages of the project, APS assessed the pipeline's condition, the type and thickness of deposits, and its geometry including bends, turns and restrictions. They proposed a series of progressive pig runs using different types of pigs to remove the debris and safely clean the pipe without causing any damage.

Preparations And Equipment

With a tight timeline of just ten weeks, APS faced immediate logistical challenges. Specialized launchers and receivers to accommodate the oversized pigs - critical to the project- had lead times of up to twenty weeks. To meet the shortened timeline, APS fabricated a launcher and receiver and made adjustments to the design.

A key preparatory step involved identifying and preparing the launch and retrieval sites. After reviewing the proposed launch point, APS agreed that it had enough space and access for the crews and equipment. Site preparations included the pipeline being brought to the surface at the launch site and attached to the modified launcher. An external pump ensured adequate flow for inserting the pig, while a snubber held the pig in place to prevent it from slipping backward.

The proposed retrieval point lacked adequate space for the receiver, equipment or filters to capture debris. The search for a new retrieval point led to an area that would require diverting the pigs from the main pipeline into a section of newly constructed pipe.

Pigging Process

APS implemented progressive pigging, a technique requiring a deep understanding of pig types and their sequential application to effectively loosen silt, flush debris, and clear the pipeline. Pigs were selected based on their size, material and aggressiveness. A series of pig runs were performed, with each run using a slightly larger and more aggressive pig than the previous one. The process involved the following steps:

Debris pushed out from the medium density bare pig (left) included 5-gallon drums, an extension cord and grout

The 90-degree turn through a tee that led to the newly constructed section of pipeline towards the retrieval point

- **Initial Cleaning with Soft Foam Swabs**
  The first pigs used were LB Light-Density Bare Swabs, designed to dislodge initial silt buildup gently. These soft foam pigs ensured safe passage through the pipeline without causing damage.
- **Medium-Density Bare Pig with Bullet Nose**
  Next, a medium-density bare pig was deployed to remove tougher accumulations. This flexible foam pig adapted to the pipeline's contours and effectively removed construction debris, including chunks of concrete, extension cords, five-gallon drums, and excess grout.
- **Medium-Density Criss-Cross Foam Pigs**
  The final pigging runs utilized medium-density criss-cross foam pigs with bullet noses. These pigs provided a more aggressive cleaning action to remove any remaining loose debris while preserving the integrity of the internal lining. The durable polyurethane elastomer crisscross coating enhanced abrasion resistance and scraping efficiency.

Each pig was inserted and secured before the system's flow rate was activated to propel it through the pipeline. Traveling

at approximately 1–2 feet per second, each pig run took four to six hours. Most of the silt and buildup was removed within the first three runs.

The pigs navigated around sharp bends, underneath the Arkansas river and maneuvered through a complex manifold system before making a final 90-degree turn at the retrieval point. Using a transmitter, pig locations were tracked to ensure pig progress. APS stationed crew members at five separate locations to monitor the progress and report on any anomalies.

Challenges And Solutions

Modifying the Retrieval Point

The proposed retrieval site in a residential neighborhood, lacked sufficient space for the equipment and crews. APS identified an alternate location that required diverting pigs into a newly constructed 2,000-foot section of pipeline that was not yet operational. The custom-built receiver was installed and the site prepared for receiving the pigs.

Flow rates were skillfully controlled for each pig to turn at a 90-degree angle through a tee into the last section of pipe. There were also 48-inch butterfly valves at the retrieval point that had to be shut to divert the pigs towards the receiver.

Pipeline Complexity

Drastic elevation changes and multiple 90-degree bends added further complications. APS stationed personnel at critical junctions to monitor the pigs' progress and ensure they successfully navigated each turn. At approximately 2,000 feet before the final retrieval point, a crew member confirmed each pig's passage through a critical turn. Water was diverted into a filter to slow the pig's movement and control its final approach.

Handling Large-Diameter Pigs

Specialized equipment and expertise were needed to manage the project. Securing suitable launchers, receivers, and the process of ensuring sufficient flow rate for pig propulsion required extensive planning and expert project leadership.

Mitch Howe, Senior Project Manager at APS with over 20 years of pigging experience, played a crucial role in guiding the project and anticipating potential obstacles. He recommended the use of an external pump to effectively launch the pig into the pipeline beyond the point the system water flow could take over and push the pig through.

Mitch's expertise was relied on to maintain optimal flow rates that ensured the pigs moved efficiently, without risk of too much pressure or excessive flow. If a pig moves too quickly, its cleaning abilities may be compromised. After each pig run, Mitch evaluated the collected debris and the pig's condition to determine the next pig type and the need for further runs.

Debris and silt were captured in filters at the retrieval point

Results

Five complex pig runs were successfully executed within the ten-week deadline on the largest-diameter pipeline APS has pigged. Careful selection and sequencing of pigs, with precision management of water pressure and flow, achieved thorough cleaning and removal of debris without compromising the pipeline's integrity.

Following pigging operations, Wichita Water Partners proceeded with final pipeline preparations, including sanitizing and reinstalling butterfly valves. The pipeline was then treated and tested to meet potable water standards.

The Northwest Water Facility is currently undergoing performance testing, startup, and commissioning. It is expected to be fully operational in summer 2025, delivering clean drinking water to Wichita and surrounding areas.

ABOUT THE AUTHORS:

American Pipeline Solutions (APS) *is a leading provider of pipeline and pigging services based in New Milford, PA. With decades of experience, APS specializes in cleaning and maintaining pipelines across the water, oil, and gas industries. Utilizing state-of-the-art technology and global partnerships, APS delivers pipeline pre-commissioning, Ice Pigging™, inspection, condition assessments, and cleaning services.*

Wichita Water Partners *is a joint venture led by Burns & McDonnell, Alberici Construction, and regional partners, spearheading the development of Wichita's most ambitious water infrastructure project. Wichita Water Partners team members have worked on nearly every major water infrastructure project in Wichita over the past 30 years.*

INNOVATING CULVERT REHABILITATION:

From Arch Geometries to Tunnel Relines

By: Robert G (Bob) Moore, Contech ES

Across North America, infrastructure owners are confronting the same challenge: aging culverts and tunnels reaching the end of their design life under mounting pressures from deterioration, traffic demands, and budget constraints. Traditional dig-and-replace methods often prove too disruptive, costly, or impractical – particularly when utilities, roadways, or waterways complicate access.

Fortunately, trenchless rehabilitation techniques now provide proven alternatives, extending service life with less disruption and greater cost efficiency. This article will focus on the unique challenges of arch culvert rehabilitation while highlighting a specific project – Buckingham Creek Tunnel Reline – to demonstrate how tailored approaches can deliver structural integrity, hydraulic efficiency, and community benefits while preserving historic infrastructure.

Arch-shaped culverts present unique obstacles for engineers

The Challenge of Arch Culvert Rehabilitation

Arch-shaped culverts, single radius and "horseshoe shaped" profiles, are common in legacy infrastructure but present unique obstacles for engineers. Their non-circular geometry, often coupled with integrated parapet walls, makes traditional sliplining impractical.

To address this, Contech offers HEL-COR® half-round and Tunnel Liner Plate corrugated steel liners. These liners are custom fabricated to conform precisely to the arch profile, creating a snug fit with minimal annular space.

Key Benefits of the Approach

- Structural Performance: Once installed and grouted, the liner and host structure work together as a composite system, providing robust load-carrying capacity.
- Custom Fit: Half-round liners can be fabricated to match the existing arch geometry, making efficient use of available space.
- Efficient Installation: Reduced excavation minimizes construction time, traffic disruption, and restoration costs.
- Durability: With proper protective coatings and grouting, HEL-COR® liners deliver decades of reliable service.

Designed for Strength

Stiffness and corrugation depth are critical design factors. HEL-COR® is available in ½-inch and 1-inch corrugation depths, while larger structural plate liners can reach 5½-inch corrugations for greater efficiency. Deeper corrugations allow for wider spans with thinner steel gages, reducing both material costs and complexity. HEL-COR® arches have been successfully applied in spans up to 50 feet, underscoring the system's versatility for large-scale rehabilitation projects.

"This approach preserves the aesthetic and historic character of legacy structures."

Non-circular geometry makes traditional sliplining impractical

Preserving Historic Structures

Many arch culverts constructed of brick, stone, or concrete still retain partial structural integrity. In such cases, these materials can be stabilized and repurposed as permanent formwork for HEL-COR® liners. This approach preserves the aesthetic and historic character of legacy structures while delivering a fully structural, modernized system.

Buckingham Creek Tunnel Reline: A Case in Point

The City of Duluth, Minnesota, faced a unique challenge when it set out to improve Buckingham Creek, the coldest of the city's sixteen trout streams. Flowing through Enger Park Golf Course, the stream had long been constrained by artificial ditches, perched culverts, and warming ponds that degraded aquatic habitat. Working with the Minnesota Department of Natural Resources (DNR), the consulting engineer (LHB), and local resource agencies, the city launched a comprehensive restoration effort to enhance both stream ecology and the golf course itself.

As part of the project, over 3,000 feet of stream channel were realigned to restore natural flows. Ponds introducing warmer water were bypassed, perched culverts blocking fish passage were replaced with bridges, and the overall water quality and habitat were significantly improved.

Rehabilitation Over Replacement

During the work, an aging brick arch culvert crossing the creek was identified as deteriorating. While replacement was an option, its historic character and the desire to minimize environmental disturbance led the city to pursue rehabilitation.

A 42-inch-span half-round HEL-COR® corrugated steel arch, manufactured by Contech, was selected to reline the 71-foot-long brick structure. The liner was field-assembled by bolting sections together, with factory-welded grout plugs at the crown for efficient back-grouting. To further streamline the process, Contech customized the liner to match the contractor's preferred installation method, minimizing downtime and cost.

Results

The outcome was a fully structural rehabilitation solution that preserved the historic culvert while supporting the broader stream restoration goals. The reline extended the service life of the structure, maintained the visual integrity of Enger Park, and enhanced habitat for native trout populations—all with limited disturbance to the golf course and surrounding environment.

Custom-fabricated half-round liners create a snug fit with minimal annular space

Non-circular geometry makes traditional sliplining impractical

When Rehabilitation Beats Replacement

Both the Buckingham Creek project and arch culvert rehabilitation methods illustrate the broader advantages of trenchless relining over full replacement:

- ***Cost-Effectiveness & Time Savings:*** Trenchless methods minimize excavation, traffic impacts, and restoration, reducing both construction time and costs.
- ***Retained Functionality:*** Existing structures are preserved and strengthened, respecting site constraints and historical value.
- ***Safety & Community Impact:*** Limited excavation improves worker safety and reduces inconvenience to the public.
- ***Environmental Stewardship:*** Minimizing disturbance to waterways and habitats aligns with sustainability and regulatory goals.

Contech's portfolio supports a wide range of scenarios, from smaller culverts relined with plastic or corrugated steel to large-span rehabilitations using LINER PLATE and structural plate systems. This scalability ensures owners and engineers have tools for virtually any condition.

Best Practices for Successful Rehabilitation

To maximize project outcomes, several best practices should guide rehabilitation strategies:

1. ***Thorough Assessment*** – Begin with detailed inspection of the host structure, documenting geometry, material, degradation, hydraulics, and site constraints.
2. ***Tailored Design Solutions*** – Match liner type to application: half-round HEL-COR® for arch profiles, structural plate or DuroMaxx® SRPE for tunnels and large diameters.
3. ***Structural & Hydraulic Optimization*** – Select appropriate corrugation depth and gauge to meet load demands and hydraulic performance.
4. ***Efficient Installation*** – Use field-assembly methods and minimize excavation wherever possible. Custom fabrication to contractor needs can streamline projects.
5. ***Long-Term Performance*** – Incorporate protective coatings and grouting to guard against corrosion, buoyancy, and movement.
6. ***Safety & Sustainability*** – Emphasize construction methods that protect workers, communities, and the environment.

What Infrastructure Owners Gain

- Decades of Extended Service Life: Properly designed liners can add 50 years or more to a culvert's life.
- Preservation of Legacy Structures: Historic bridges and culverts can be retained and celebrated.
- Minimal Disruption: Roads, waterways, and recreational spaces remain open during most of the work.
- Reduced Costs: Avoiding large-scale excavation and restoration yields significant financial savings.
- Scalable, Proven Solutions: From small county roads to major highway tunnels, trenchless rehabilitation adapts across scales and geographies

Conclusion

Not every aging culvert or tunnel demands full replacement. As the Buckingham Creek case and arch rehabilitation methods demonstrate, trenchless relining solutions provide a forward-looking path to extending service life, preserving history, and protecting the environment – all while staying on budget.

For infrastructure owners and engineers, the takeaway is clear: with careful assessment, tailored design, and modern relining technologies, rehabilitation is no longer a second-best option. It is the smart, sustainable choice for resilient infrastructure.

ABOUT THE AUTHOR:

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SUCCESS, YOU BETCHA!

EBI Drilling Services tackles the Tough Conditions of Northern MN with GEONEX

By: Richard Revolinsky, Geonex Inc, (GEO)

In 1991 when Terry Anderson, President of EBI Drilling Services (EBI) in Duluth MN began operations, they provided a variety of services pertaining to removal, disposal and treatment of contaminated soils and underground storage tank demolition, remediation and installation. In 2000 when Terry was on a jobsite, he came across a Horizontal Directional Drill (HDD) rig and Terry thought to himself "I bet I could do that and even better". That year EBI purchased their 1st HDD rig and they haven't looked back since. Today, 34 years later, and with the help of his sons Dexter Anderson and Kaz Anderson, EBI maintains a fleet of trenchless equipment to handle the wide variety of challenging ground conditions in the Upper Midwest.

As their reputation grew, and demand for trenchless projects, so did EBI's trenchless capabilities. Today EBI can install pipes ranging from 1 to 36 inches in diameter and up to 2,000 feet in length. Their fleet now contains three directional drills, three GEONEX Horizontal Hammer Boring Units as well as trenchers, hydro-excavators, and many more underground solutions.

OPE! Rock

Minnesota (MN), along with Northern Wisconsin (WI) and Northern Michigan (MI), have a wide range of challenging geological conditions that make it extremely difficult, if not impossible, for HDD installations. Ground conditions can change on contractors in no time at all. Terry Anderson describes that being successful in this region means not giving up, which has led to their continued success. "It's a continuous learning curve. What tools work and where, and what doesn't. We were always trying new tooling on our rigs, but the ground was always different. We used downhole hammers on our HDD rigs which worked

> "Ground conditions can change on contractors in no time at all."

"I saw a GEONEX Machine that could bust through the solid rock and other subsurface conditions without issues."

- Terry Anderson, President, EBI Drilling Services

best to get through solid rock, but we did not, nor did anyone else, have a solution for mixed subsurface conditions or for large diameter rock drilling. When I saw a GEONEX Machine that could bust through the solid rock and other subsurface conditions without issues, I immediately knew these were the rigs for us."

GEONEX Horizontal boring equipment is a fully integrated boring system specifically designed to not only withstand the forces of the pneumatic hammers to break rock upwards of 50,000 psi strength but also provide a means for maintaining the precise operating parameters necessary for the down hole hammer in the horizontal position. The umbilical system which includes an in-pit drill rig and on-grade power pack utilizes hydraulic pressures to adjust and control the installations while making it able to conform to a variety of project constraints and varying geological conditions.

By utilizing a hammer to accelerate a breaking assembly at the leading edge of the installation, the rock is fragmented and able to be conveyed back to the launch pit via rotating auger. Horizontal

EBI Drilling installs 2 parallel 16-inch casings below HWY 29 in Marachon City WI, 2023

"You have to be willing to accept and plan for a lot of risk in the trenchless industry."

- Kaz Anderson, Vice- President, EBI Drilling Services

EBI Drilling utilizes their GEONEX HZR220 to install 100 feet of 6-inch steel casing below railroad tracks in less than 8 hours. Before an additional 160 feet the next day

From the Launch Pit: EBI's operator uses the GEONEX wireless remote control to operate their HZR610 Drill machine for a 320-foot installation below the highway

Hammer Boring equipment is thus uniquely capable of quickly penetrating high strength rock at average rates of 10 to 15 feet per hour.

Success, You Betcha!

In 2017, EBI Drilling was contracted to perform over 10,000 feet of rock drilling in International Falls MN. Having researched GEONEX and their line of Horizontal Hammer Boring equipment, EBI purchased their first PP90 Power Pack and HZR220 Drill Rig capable of 5-1/2- to 10-inch Diameter installations. Later in 2019 shortly after completing the first project and having experienced the significant advantages of the GEONEX equipment, EBI purchased their second GEONEX drill Rig, only this time, it was the larger HZR400 capable of 10- and 20-foot lengths of casing installation and ranges from 8-5/8 inches diameter up to 16 inches diameter and lengths of 300+ feet.

EBI utilizes their GEONEX HZR610 drill machine and power pack, complete with front extension frame to install 40-foot lengths of casing through sand and cobbles in July 2024

News travelled fast and soon EBI began receiving calls from beyond their typical footprint around Lake Superior. With the unbridled success EBI was enjoying through the first two complete GEONEX Systems, and increased demand for their services, in 2020 EBI purchased their third GEONEX system. The HZR610 drill machine and PP180 Power-Pack, which provided EBI with the ability to install 24-inch casing through solid rock at lengths upwards of 320 feet as well as shorter distances of 30-inch casing.

To date, EBI has performed installations in more than 5 states, from Colorado to New York, and at times providing their services to the handful of other GEONEX clients in North America. Most recently, in June 2025 EBI completed the successful installation of two 150-foot 6-inch Steel Casings through solid rock (Syenite) with random fracture zones filled with gravel. EBI followed that up a month later in July 2025 with the completion of six 24-inch Steel Casings at an FAA controlled airport in Reedsburg WI. Four 100-foot bores under taxiways and two 160-foot bores under the main runway. Subsurface conditions at the airport contained Sand, Weakly Cemented Sandstone, and Sandstone. EBI completed this feat in just 6 days, minimizing the impact to the airport operations.

Kaz Anderson said "You have to be willing to accept and plan for a lot of risk in the trenchless industry. My dad did this when he first started the company, and we continue to do this today with the help of GEONEX".

ABOUT THE AUTHOR:

Richard Revolinsky *is the North American Operations Manager for Geonex Inc. He has served the trenchless industry for the past 10 years in various roles as Project Manager for Auger Boring and HDD projects and material sales. He is committed to furthering the Trenchless Construction industry with viable innovative solutions.*

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Achieve • Influence

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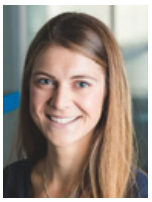
"Because of NASTT, I have a pretty stacked tool belt that helps me bring innovative approaches to infrastructure concerns. My experiences with trenchless technologies gives me a 'leg-up' over others."

~ Eric Schuler, PE, Onondaga County Department Water Environment Protection

Education Second to None

"NASTT is far and away the leading educator and networking pool in the trenchless industry. If your company plays a part in the trenchless industry, you will benefit from NASTT membership much more than you realize."

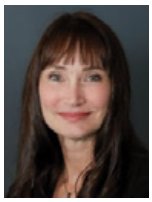
~ Joe Lane, Azuria Water Solutions



Tops at Staying on Top of the Industry

"I first joined NASTT to stay current on technological developments, best practices and market trends. Participating in NASTT committees and events and accessing its expert mentors and professionals is essential to the success of almost any project."

~ Marya Jetten, AECOM



Amazing Network

"NASTT has been the most significant vehicle relative to the industry-specific connections I've made and cultivated throughout my career."

~ Cindy Preuss, PE, CDM Smith

Membership Helps Me Strut My Stuff

"I would not be doing what I love to do without the presence and impact of NASTT. I wanted the industry to know about a record HDD project and NASTT gave me the access and opportunity to tell to the industry."

~ Jim Murphy, UniversalPegasus International

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