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TRENCHLESS NORTH AMERICA

The Official Magazine of the North American Society for Trenchless Technology

"NASTT membership allows me to meet industry professionals and work side by side with them to contribute to the growth of trenchless technology."

– Tiffanie Mendez, Sunbelt Rentals Pump Solutions, National Sales Director

MEMBERSHIP ISSUE

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FALL 2023
Volume 13 • Issue 3

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TRENCHLESS NORTH AMERICA

The Official Magazine of the North American Society for Trenchless Technology

FALL 2023 – VOLUME 13, ISSUE No. 3

JOIN US AT THE NASTT 2024 NO-DIG SHOW IN PROVIDENCE RI!

For the first time, the heavily populated Northeast region is hosting the annual NASTT premier event – the largest trenchless technology conference and trade-show in the world. The No-Dig Show motto "Green Above, Green Below" exemplifies the position of trenchless technology as an important steward of our environment. Join us April 14 – 18 2024 and be part of the excitement as an attendee, presenter, sponsor or exhibitor! Watch for more details within.

10

APRIL 14-18 | PROVIDENCE, RI
NO-DIG SHOW 2024

FEATURES

14 Q&A: Kim Hanson PE

New to the NASTT Board of Directors, Kim Hanson PE has always wanted to build and design things. When she rode a muck cart 1000 feet into a tunnel and stood in front of a TBM, she was instantly hooked and has never looked back, forging a successful career with Hazen's tunneling and trenchless group.

18 Morty's Trenchless Academy: Bypass Evolution

New pumping equipment, advanced sensors and an increased focus on training are spurring an evolutionary phase of growth and development in the bypass pumping industry. Overcoming a technology gap, remote monitoring of bypass pumping projects is finally moving from analog to up to date digital technology.

28 NASTT 2023-2024 Corporate Membership Listings

NASTT offers special recognition to its Corporate and Government, Utility and Education members in appreciation of their ongoing promotion of NASTT and the industry. The NASTT Corporate, Government & Education Members are highlighted here, along with key contacts, websites and corporate logos – the NASTT community!

46 Emergency Trenchless Rehabilitation of Two Interceptor Sewers: Toronto ON

Selected as the Outstanding Paper – Rehabilitation at the 2023 NASTT No-Dig Show in Portland OR, this paper details the emergency trenchless rehabilitation of two large interceptor sewers located in designated ravine parks in Toronto Ontario.

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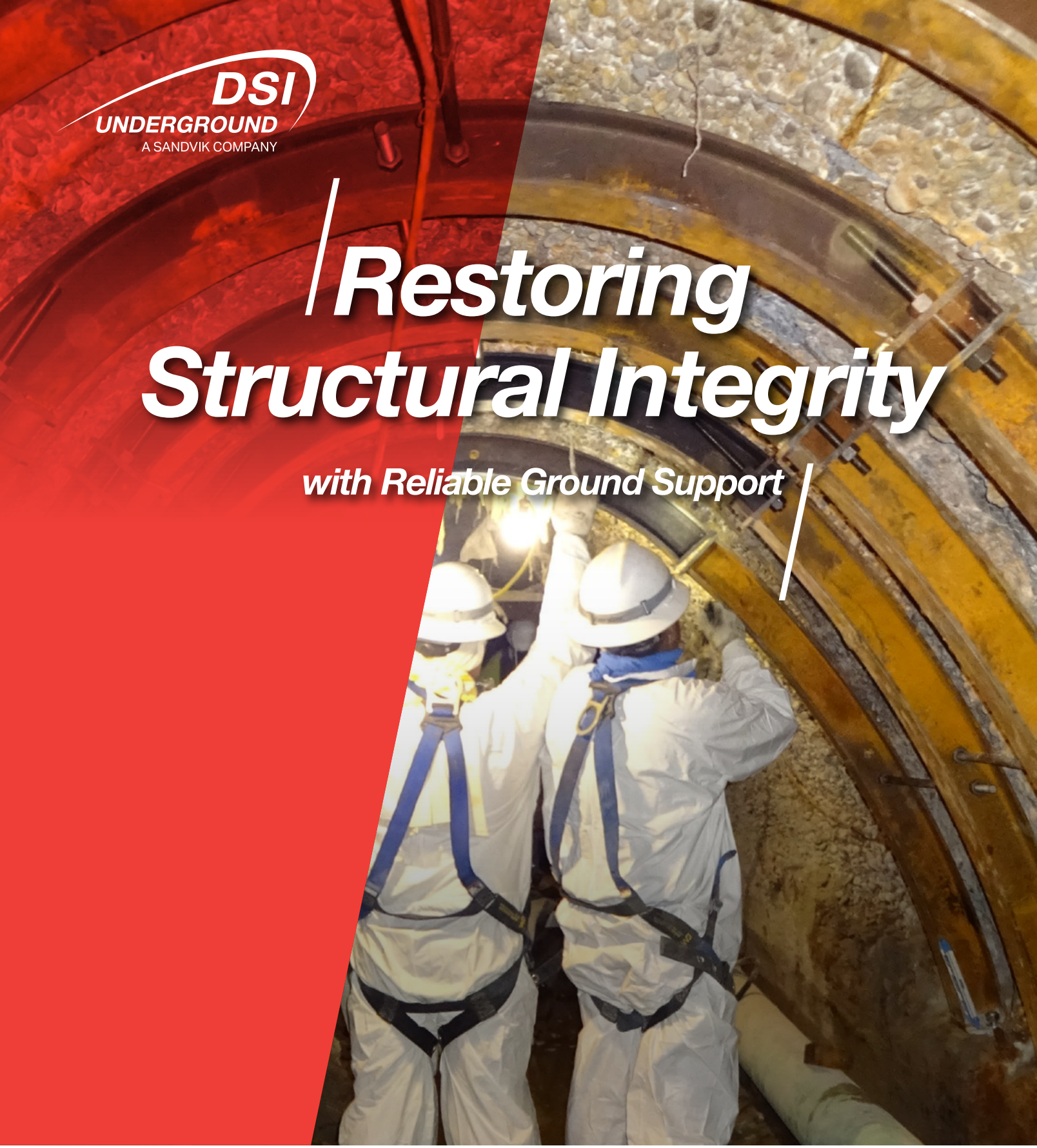

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WELCOME TO THE FALL 2023 EDITION OF
TRENCHLESS NORTH AMERICA!

This edition focuses on one of the most important aspects of NASTT – you, our members!

Thank you to all of you who replied to our industry survey on Membership and the NASTT. Written on my office wall is the Warren Buffet quote: "Delight the customer!" and at the core of the new Strategic Plan for 2024 – 2027 will be the suggestions and comments you have provided us with. This enables the Board of Directors to provide a clear direction and path to growth as an organization, guided by the latest market trends and demands. We look forward to publishing the results of these in the New Year.

As we support trenchless technology advocates to help us provide more as an organization to contractors, widen our voice in the growing renewable energy market, provide broader Good Practices Courses and expand our Student Program and work together with similar organizations, we are looking to provide further membership benefits through a range of new initiatives and programs.

The ISTT International No-Dig in Mexico recently provided a platform for success to the MEXTT Regional Chapter, so important in creating local contacts to grow the grass roots directly through our Regional Chapters. The legacy of the event and the work by our volunteers is a planned series of workshops around other major cities in the country to engage directly locally with the municipalities and owners to provide knowledge and networking related to trenchless technology.

"One of the most important aspects of NASTT – you, our members!"

No-Dig North was also a great success in Edmonton and thank you to Chris Lamont and Craig Pass (Associated Engineering) for their leadership and hard work in providing such an excellent knowledge sharing environment. Thank you also to all those who attended the courses, accepted scholarships or attended their first show. And our gratitude goes out to those of you who continue to exhibit, sponsor, present, volunteer and attend these great conferences. We appreciate you! Regional Conferences are also being held by many Chapters which are great fund raising events as well as a chance to get together and do something different. Many of these also offer NASTT Good Practices Training Courses and allow those attending to gain CEUs.

The NASTT Training Course series has reached more people than ever before and now has a structured program to update courses and publications as well as investing in new material. There are many opportunities for you to be directly involved in our association and continue to build awareness in trenchless technology.

To all of you who volunteer and contribute to making us better, thank you.

Enjoy your read!

Matthew

Matthew Izzard, Executive Director
North American Society for Trenchless Technology (NASTT)
mizzard@nastt.org

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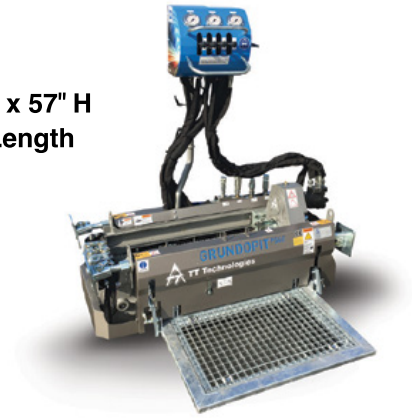

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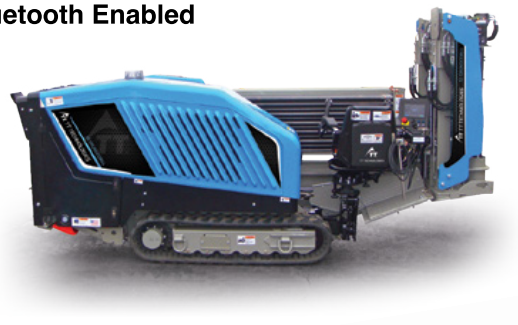

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ONGOING ADVANCEMENTS WITHIN THE TRENCHLESS INDUSTRY

As I look towards my second year as Chair of NASTT's Board of Directors, I eagerly anticipate the ongoing advancements not just within NASTT but also within the trenchless industry. Recently, the Strategic Planning Committee held a two-day workshop where we gathered and reviewed the feedback obtained from a series of surveys of the NASTT membership and trenchless industry at large. This information will be used to develop an operational plan that will steer us along the path that will foster growth of our organization and enhance the resources we offer to our membership. We are looking forward to rolling out these new and improved offerings, events, and resources, including our upcoming new website! In the coming weeks and months, we will be introducing online features based on the feedback we've received from you! NASTT strives to be the go-to hub for trenchless technical and industry news and information. Stay tuned for more details on our upcoming developments!

The Fall issue of *Trenchless North America* focuses on our membership and serves as our annual membership directory. I want to take this opportunity to thank you all for your support of our Society and the industry as a whole. We are a passionate group and that comes across in the enthusiasm we see in our volunteers and members. Please use this directory as a tool to network with your fellow trenchless colleagues and grow your businesses and opportunities. In the coming months we have many additional events planned to bring the underground infrastructure community together. Our NASTT Good Practices Courses are being held both virtually and in-person throughout the year. Visit **www.nastt.org/training/events** to find a course that fits your schedule.

"Thank you all for your support of our Society!"

If you have attended an NASTT event (national or regional) you probably left feeling excited and eager to get more involved. I ask that you consider getting engaged in one of the many NASTT committees that focus on a wide variety of topics. Some of our committees that are always looking for fresh ideas and new members are the Training and Publications Committee, the individual trenchless topic Good Practices Course Sub-Committees, the Educational Fund Auction Committee, the No-Dig Show and No-Dig North Planning Committees and Technical Program Committees. There are many opportunities for you to consider where your professional expertise can be put to use through networking with other motivated volunteers. With education as our goal and a strong drive to provide valuable, accessible learning tools to our community, we are proud of our continued growth as both an organization and as an industry. Our volunteers and committee members are what keep us moving in the right direction.

Looking ahead, we are excited about the NASTT 2024 No-Dig Show scheduled for April in Providence, RI. The Rhode Island Convention Center offers a great location within the heavily populated northeast US corridor to meet and discuss everything new in the trenchless industry. Providence is accessible directly from the Rhode Islande TF Green airport (PVD) or by a 50-mile drive or train ride from Boston-Logan airport (BOS). The conference will feature the ever-popular panel discussion forums during the technical program on a variety of trenchless topics. We are also featuring new track topics including a focus on renewable energy. As an important part of the trenchless industry, I urge you to join us in Providence in April. Interact with 200 exhibitors, explore innovative products and services, participate in technical sessions for practical solutions, and network with colleagues throughout the week at the various events designed for creating meaningful connections.

For more information on our organization, committees, and member benefits, visit our website at **www.nastt.org** and please feel free to contact us at **info@nastt.org**. We look forward to seeing you at a regional or national conference or training event soon! And we hope you are planning to join us in Providence next April.

Matthew Wallin

Matthew Wallin P.E., Chair
North American Society for Trenchless Technology (NASTT)

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NASTT 2024 No-Dig Show Preview

Welcoming North America's Underground Infrastructure Community to the Populous Northeast!

"Be a part of the excitement as a presenter, sponsor and exhibitor!"

The North American Society for Trenchless Technology looks forward to hosting the 2024 No-Dig Show in Providence, Rhode Island April 14-18. Hosting North America's premier trenchless educational and networking event in the Northeast for the first time, presents a golden opportunity for the Northeast Trenchless community to showcase the progress it has made in utilizing trenchless applications as the preferred method for underground infrastructure construction in the Northeast.

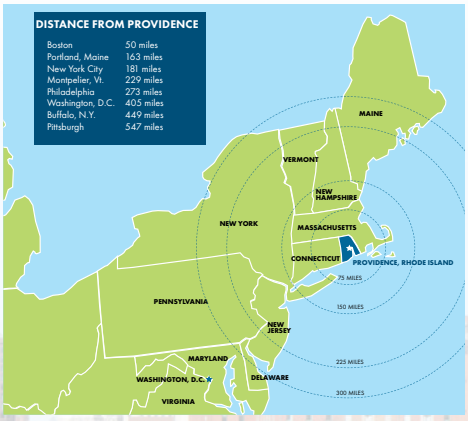
Within an easy day's drive from most cities in the populous northeast – Providence is just a few hours' drive from Portland ME, Philadelphia, PA, NY, NJ, VT and CT – the 2024 NASTT No-Dig Show promises to draw significant attention from top infrastructure decision-makers across the Northeast including municipal authorities, utilities, engineers, contractors, suppliers and policy-makers. The 2024 NASTT No-Dig Show motto "Green Above, Green Below" exemplifies the trenchless industry's position as an important steward of our environment and natural resources, utilizing approaches that have significant environmental and social benefits. Trenchless Technology is at the forefront of ongoing efforts to reduce GHG emissions.

As our planning kicks into high gear, check the website www.nodigshow.com for updates and further information. Additional details are provided in future editions of Trenchless North America as we get closer to the event.

The excitement and anticipation is building – be a part of the excitement as a presenter, sponsor and exhibitor!

Babs Marquis CCM
Delve Underground
2024 No-Dig Show Planning Committee Chair
Secretary, NASTT Board of Directors
Past Chair, NASTT-NE Chapter

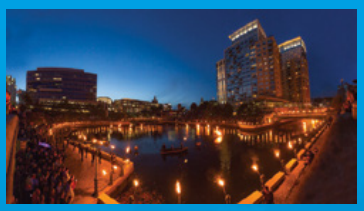
The NASTT No-Dig Show is being hosted in the Northeast for the first time

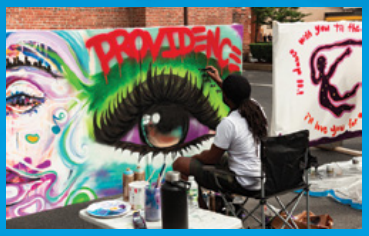


Providence is an easy day's drive from most cities in the Northeast

APRIL 14-18 | PROVIDENCE, RI

NASTT NO-DIG SHOW 2024





See You Next Year in PROVIDENCE

2024

SCAN THE QR CODE TO VIEW A VIDEO AND LEARN MORE ABOUT PROVIDENCE!

NASTT 2024 No-Dig Show Scholarships Provided to Municipal & Public Utilities

Municipal and public utility scholarships cover registration and accommodations costs for over 150 delegates attending the 2024 No-Dig Show, April 14 – 18 in Providence, Rhode Island!

In 2013, NASTT established the No-Dig Show Municipal & Public Utility Scholarship Award Program to provide education and training for employees of North American municipalities, government agencies and utility owners who have limited or no training funds due to economic challenges. At least 100 applicants are awarded the scholarship annually, with a total of over 1500 scholarships since the inception of the program.

At least 100 applicants are awarded the scholarship annually, with a total of over 1500 scholarships since the inception of the program.

Register today to secure these future customers! Join us at the Rhode Island Convention Center, April 14 – 18, 2024. Visit www.nodigshow.com to register today!

Who Do You Want to Meet at No-Dig 2024?

Doing business with municipal agencies and public utilities is crucial to the trenchless industry. NASTT's Municipal & Public Utility Scholarship brings hundreds of decision-maker agency representatives in-person to the No-Dig Show. Nearly 2,000 delegates have been onsite looking for solutions to their infrastructure challenges that you can provide.

"The show provided many opportunities to network with contractors, consultants, and decision makers within municipalities and utilities across the United States and Canada."

– Joseph Barnes, Johnson County Wastewater

"I found the sessions interesting and gained a lot of useful information to bring back to my community. I had such a narrow view of Trenchless Technology before the show, and now see it in a clearer fashion and in a larger light. The exhibits were interesting and I found many products or ideas that directly related to what I deal with on a day to day basis."

– Matt Overeem, Village of Wilmette

Each year NASTT hosts a reception for the Municipal Scholarship recipients to network with each other and kick off the conference

APRIL 14-18 | PROVIDENCE, RI

NO-DIG SHOW 2024

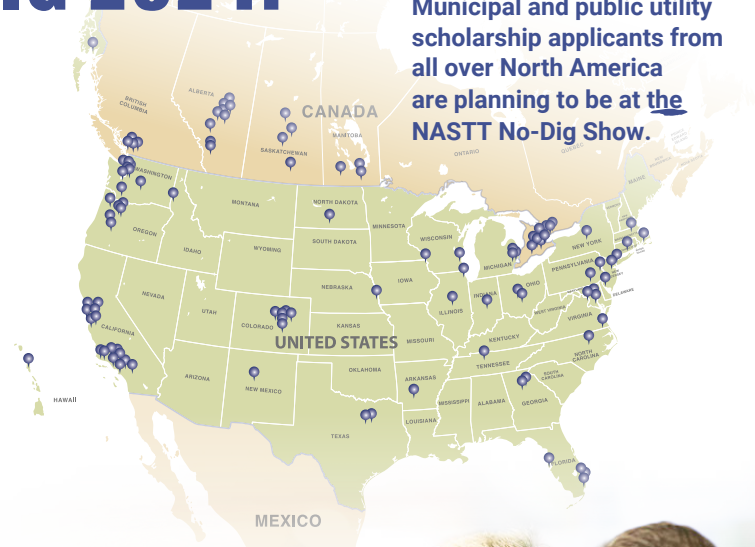
GREEN ABOVE.
GREEN BELOW.

NASTT 2024 NO-DIG SHOW | APRIL 14-18 | PROVIDENCE, RI

ATTENTION TRENCHLESS CONTRACTORS....

Municipal & Public Utility Decision Makers will be at NO-DIG 2024!

Doing business with municipal agencies and public utilities is crucial to the trenchless industry. NASTT's Municipal & Public Utility Scholarship brings hundreds of decision maker agency representatives in-person to the No-Dig Show. Since its inception, over 2,000 delegates have been onsite looking for solutions to their infrastructure challenges that you can provide.



Municipal and public utility scholarship applicants from all over North America are planning to be at the NASTT No-Dig Show.

CONNECT WITH THEM AT NO-DIG!

- **Networking Events**
- **Exhibit Hall**
- **Technical Education Session**

Visit nodigshow.com to register!

Register today to secure these future customers!
Join us at the Rhode Island Convention Center, April 14-18.

with

Kim Hanson, PE

After her service in the Navy, Kim joined Hazen and Sawyer in 2015 and now works in their tunnel and trenchless design and construction management group. Joining the NASTT Board of Directors this year, Kim currently serves on the No-Dig Technical Program Committee, as a No-Dig Show Track Leader, and as the Vice Chair of the Educational Fund Auction Committee. She is also an active member of the American Water Works Association (AWWA) and has volunteered with Water for People since 2015, organizing the North Carolina Committee's annual 5k Race and Silent Auction fundraisers.

Hazen

What first inspired you to become interested in the construction & engineering field, particularly underground construction?

I can't remember when I first decided I wanted to be an engineer; it feels like I've always known that's what I wanted to do. I love to build things and was always curious about how things were designed. I didn't know what I wanted to design, just that I wanted to design and build something.

My dad owned his own sign company and growing up he always inspired me as we drove around town and would point out the signs that he built. I think seeing his pride helped me on my path to becoming an engineer. After graduating college with a Bachelor of Science degree in Ocean Engineering, I served in the Navy on a surface ship and then as a hydrographic surveyor. I deployed worldwide and experienced first-hand how important water and sewer services are to a community. It's not flashy, but it's something I'm really passionate about, and I'm grateful to have found a place in the water and wastewater industry. I went to graduate school when I left the Navy and decided to focus on environmental engineering because of my past experiences. I joined Hazen and Sawyer out of grad school, and my path here over the past eight years took me to construction management and trenchless design.

Unfortunately, I don't get many opportunities to brag about what I built to my family though. It's not that exciting to drive down a road and say "Did you know there's a 96-inch sewer under this road? I designed the tunnel it's installed in"! Even though it's not noticeable, I still have pride in what I help build.

Outline your experience of first being introduced to trenchless technology methods and applications.

Several years ago, I helped a coworker who was performing construction observation for a project that included some CIPP lining. I had never seen or even heard of CIPP and I found it really interesting. While there, I was asked to fill in on a nearby tunnel project when the project field engineer was out. I went down into a shaft, rode a muck cart over 1,000 feet into a tunnel, and stood behind a TBM machine during excavation. I was hooked!

I didn't truly join Hazen's tunnel and trenchless group until about a year later. I was working as a field engineer on another project and still filling in when needed on the tunnel construction job. After spending about a year and a half in the field, I went back to the office and was looking for design work again. They told me our tunnel group was looking for help, and I jumped at the chance. I've been there ever since! These last 6 years have been great, and I have been given the opportunity to find my own path and passion and encouraged to get involved.

How did you first get involved with NASTT?

In 2019 I was asked to assist in presenting one of our tunnel projects at No Dig. I wrote a paper and put a presentation together, but unfortunately, Covid canceled the 2020 show and scaled back the educational and volunteer opportunities in the industry. I got back to NASTT after attending the microtunneling short course post-Covid and I reached out to NASTT staff about volunteering. I started on the No-Dig Planning Committee and Technical Program Committee and now I am a Board Member and the Chair for the Educational Fund Auction (we are currently looking for donations for the 2024 auction at No-Dig!).

"I rode a muck cart over 1,000 feet into a tunnel and stood behind a TBM machine during excavation. I was hooked!!"

What are your thoughts on the current state of the trenchless industry? What are some of the goals and initiatives you would like to see NASTT pursue?

From the design side of things, I see trenchless alternatives being pursued more and more, especially in urban areas. However, trenchless methods are still new in many areas where I work, and I'd love to expand our educational opportunities to teach owners and engineers about the different technologies available for new installation and rehabilitation. I would love to see NASTT continue to develop additional educational opportunities and material targeted toward people who are newer to the industry. I'd also like to see more young professionals at our events and as members.

What do you think can be done to better engage young professionals in NASTT and the trenchless industry?

I think we need to be more purposeful about encouraging our young professionals to submit abstracts and volunteer for committees and attend conferences. NASTT offers great volunteering and networking opportunities to get involved and meet new people. We all need to start somewhere, and you don't need to be a subject matter expert to get involved. I was initially hesitant to volunteer for committees in NASTT because I was new to trenchless. I jumped in anyway and felt like I learned a lot just by being in the room and meeting new people. When I was nominated for a Board of Director position, I was interested but felt way underqualified. There is a staggering amount of experience on our National Board, and I didn't feel like I had anything valuable to contribute. NASTT staff and other volunteers were great and convinced me that having a new perspective would be valuable to the organization, and thankfully I listened!

"You don't need to know everything. It's ok to ask questions."

"I love getting to be a part of developing solutions to unique and complex problems!"

Do you have any advice for YPs or others who are new to the industry?

A couple of years ago I attended a presentation by Dave Sackett (Brierley). He finished his presentation with advice to young professionals, explaining how he built his career on saying "yes". I couldn't agree more with that sentiment and echo that advice wherever I can. I got the opportunity to get into construction management by saying yes when we needed someone to cover a job out of state for a few months. Because I said yes to that, I was able to see my first CIPP installation, and then my first tunnel job. When asked if I wanted to learn something completely new and join the tunnel design group (before joining the construction management group I was a wastewater process engineer), I said yes. Volunteering with NASTT? Yes. Board position? Yes. This interview? Yes! I couldn't have imagined two years ago that I'd be here, and in this magazine, where so many experienced and respected trenchless professionals have been before me.

My advice would be, you don't need to know everything. It's ok to ask questions. At a construction site, observe and talk to people. We have an industry full of hard-working and knowledgeable people who want to share what they know. Take advantage of it and don't be afraid to admit you don't know something.

Biggest challenges facing the trenchless industry today? Has acceptance and understanding of trenchless technology improved?

I think the biggest challenge facing the industry is it is growing so quickly. More and more utilities are looking to trenchless technology to install their new infrastructure or rehabilitate aging lines as a way to minimize public impacts. Everyone I know in the trenchless industry is extremely busy, and we are all fighting for more resources (people, equipment, etc.) to complete new projects.

I think acceptance of trenchless technology has improved, but we need to continue pushing education. People hear trenchless and think "no trench". It's important we communicate with and educate owners and engineers on the applicability of different methods and what construction looks like. There are a lot of tools in the trenchless toolbox, and knowing more about each method helps us select and recommend the appropriate methodology.

What do you personally enjoy most about working in the trenchless technology field?

I work with clients across the nation, and I love the challenges and diversity of these projects. No two projects are the same and each one has its unique challenges and solutions. In the past couple of years, I've helped design and/or manage the construction of a large drill and blast tunnel under a river in Virginia, a TBM tunnel below a water body in New Jersey, microtunnels with wet retrievals in Tennessee and North Carolina, and several complex HDD jobs across the country. I love getting to be a part of developing solutions to unique and complex problems. I also love being involved in the construction side of things. I lead the construction management side of our trenchless group and love doing site visits early in design to assess constructability, and of course, seeing our projects being built! The people in the trenchless industry, and in NASTT, are a big part of why I enjoy what I do. Being a part of NASTT has introduced me to so many experienced and knowledgeable people. I now have a network of contractors, engineers, and manufacturers to call to ask questions, and I'm constantly learning from them how to be a better engineer and better advocate for trenchless technology.

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Bypass Evolution

New Pumping Equipment, Advanced Sensors, Increased Training Focus

By: Ladd Gould, Sunbelt Rentals

In the past 23 years, the bypass pumping industry has grown significantly in parallel with the growth of CIPP lining and the wastewater pipeline rehabilitation industry. Bypass evolution has seen new pumping equipment, advanced level sensors, and increased focus and training on how to address and mitigate sanitary sewer overflows and spills. Most modern electronic devices, from kitchen appliances to vacuum cleaners have incorporated IoT (Internet of Things) technology into their capabilities. In the age of digital and application-based "right-now" everything; pump and bypass monitoring has remained analog. This has resulted in a technology gap in the remote monitoring of sewer bypass and other pumping projects.

PumpSentri standalone units

> *"A game-changer for the pipeline rehabilitation industry"*

Background

To create a better understanding of the technological gap as it pertains to the bypass industry it's best to start with a complete understanding of what is being deployed. Currently, the industry standard for monitoring the performance of a sewer bypass is to physically watch the pump. This requires one or two skilled technicians depending on the scope and specification and a service truck with tools. Technician(s) remain on site monitoring the performance of the deployed assets.

Physical pump watch models have both advantages and disadvantages. The biggest advantage is in person pump watch can respond immediately to system performance incidents and anomalies on a project in real-time, thereby reducing the response time should flow conditions, adjacent operations, or mechanical challenges with pumps or other control devices compromise the bypass operation. A major disadvantage is on-site technicians monitoring is subject to human error, which can happen when the bypass system performance verification is based solely on the visual operations of pumps, gauges, and system surcharge levels. Visual observations alone make it difficult to troubleshoot system issues that cannot be seen. Another disadvantage is the use of manual paper logs. Recording observations and sharing the paper trail of system performance can be inefficient, prone to handwritten error, and not readily accessible by all stakeholders on the project. Communication gaps can develop; causing delays in proactive services and/or system diagnostics; all of which can contribute to system performance errors.

In addition to onsite technicians performing pump watch, remote auto-dialer call boxes became standard as a secondary backup alert system for the owner or contractor. The call box interface is limited to a few features, e.g., elevated liquid level, or pump running. Portable call boxes cannot share pumping system performance in real time, especially during non-alert events. Over the past 23 years, manufacturers have made few technological advancements to portable call boxes.

Solution

Since 2018, Sunbelt Rentals' goal has been to develop a more advanced tool to remotely monitor bypass pumping system performance. Sunbelt Rentals' primary focus in developing this tool has been to reduce the risk of sanitary overflows, coupled with an additional benefit of increased operational efficiencies, and a reduction in maintenance cost.

One of the biggest challenges Sunbelt faced in developing new monitoring technology is that IoT is still in its relative infancy in the construction industry with many different platforms and

Figure 1 - 100 MGD Wet Weather Bypass

Figure 2 - 800hp - Electric Drive Pump

interfaces, depending on the make and model of the machinery. Sunbelt found many different telematics platforms for the pumps, however, nothing offered a multi-platform tool that worked with any make and model of pumping equipment. Most of the technology identified was engine-based, which did not provide the interface for fluid sensors to collect the data of the complete pumping system.

PumpSentri

With no solutions available, Sunbelt Rentals took matters into their own hands and created PumpSentri, a cloud-based tool that allows stakeholders to monitor and control the actual bypass performance. PumpSentri fills the gap by providing real-time system performance data that visual operations alone

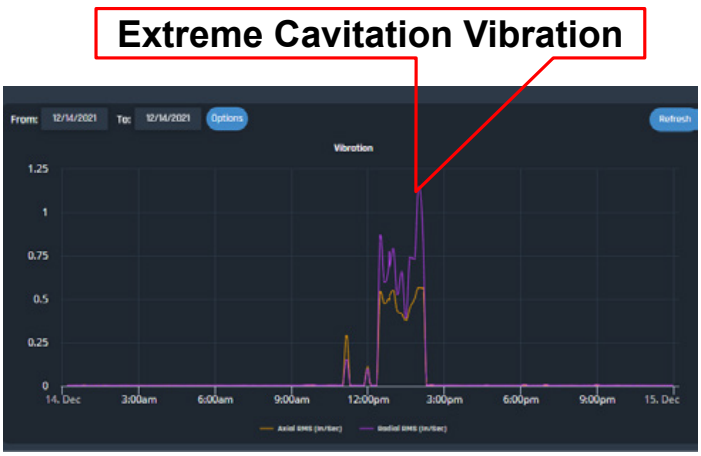


Figure 3 – PumpSentri Vibration Data log from the 100 MGD Bypass project where a significant manufacturing issue was determined. This graph shows the axial and radial vibration, with concern that the radial vibration is more than 1-inch per second

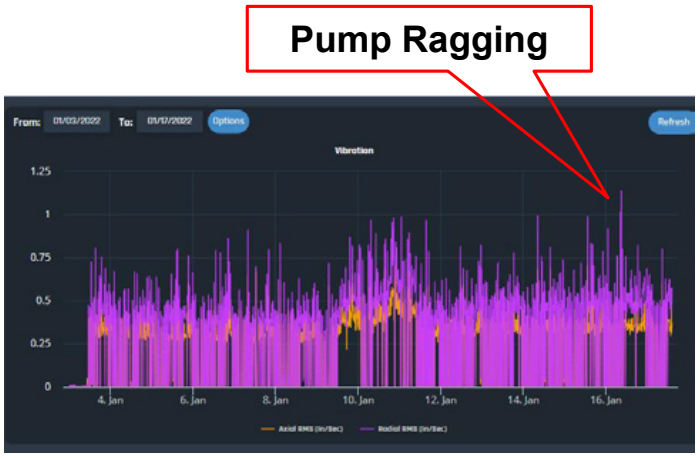


Figure 4 – Another snapshot in time where the customer had ragging issues and alerts were sent out for incidents greater than 1-inch per second

cannot provide. PumpSentri Remote Monitor allows for continuous real-time pumping system information to be sent to a cloud-based platform for data logging of the complete system. PumpSentri offers a platform to interface with a variety of sensors to monitor system pressure, suction vacuum, wet well surcharge, flow, pump wet end vibration, and all pump engine telematics. This modern technology allows for remote monitoring, and the ability to see what cannot be seen in a bypass system. PumpSentri is a tool for system technicians and operators to precisely calibrate the operation of a bypass and proactively mitigate potential issues before they occur. Remote digital monitoring is not a replacement for on-site pump watch, but PumpSentri is an additional tool to provide useful data to the pump operations team, contractors, and owners on the performance of the complete bypass system.

Currently, PumpSentri is deployed in two packages. The first is via a resolute monitoring unit installed on each unique pump asset. The other option is a remote, standalone unit for integration into remote sensors anywhere in a pumping system. Both options provide the ability to view a pumping system's health and performance online; with additional options of system alerts that can be set up per stakeholder, per alert with customized parameters. PumpSentri is a 3D version of a call box where not only does the user receive alerts but can also remotely view the data points from the pumping system in real time, and pull historical data leading up to the alert event. This information can be utilized to diagnose the actual alert, and corrective measures can be deployed to prevent future alerts.

When PumpSentri is installed on a pump asset; it provides the health of the actual pump beyond basic engine telematics. Providing:

1.) Proactive Event Alerts: Engine data, low fuel Levels, high or low water levels, pressure, temperature, and pump vibration.
2.) Location, and Runtime
3.) Additional Sensor Inputs: Flow, Pressure, Liquid Levels
4.) Remote Operational Operation: Start/Stop & Engine RPM

The standalone version can be incorporated remotely anywhere in the bypass system and allow the interface of different fluid sensors to provide real-time updates, or alerts on:
1.) Flow
2.) System Pressure
3.) Utility access surcharge levels
4.) Sewer Plug Pressures

Case Studies – Saving Time and Money

One of the first PumpSentri deployments was on a large project where a one hundred million Gallons per Day bypass system was only operating during wet weather events. The bypass was installed to support the replacement of a 90-inch parallel interceptor, which added capacity to the original interceptor during wet weather events. Therefore, the bypass system only became operational during wet weather events. To reduce cost and avoid the deployment of pump watch personnel for the entire duration of the project Sunbelt utilized PumpSentri on six of the primary pumps set in automation with liquid level transducers which monitored data and logged the surcharge levels. Even during non-rain events the team could remotely view the surcharge levels in the sewer. When the sewer level rose during a weather event, the system would automatically start and send out an alert to the standby pump watch team to deploy. Even during the initial startup, before the pump watch team was deployed, the stakeholders could view the bypass performance

remotely. With the integration of PumpSentri technology, the owner of the system saved hundreds of thousands of dollars during the duration of the project by not having pump watch technicians onsite for the entire duration of the project. The project pump watch team was only deployed when needed. In this next case study PumpSentri saved time and operational costs. A custom-built eight hundred horsepower, electric drive pump was deployed to bypass a lift station with an excessive duty point of four thousand Gallons Per minute at 440 feet of head pressure. It was noticed during startup there was extreme vibration from the pump. The calculations for the system were per the hydraulic and performance data for the specified pump, but the pump did not function correctly in the application. With the radial shaft vibration data collected from a PumpSentri mounted on the pump, the team was able to share information in real-time with the pump manufacturer who determined there was a balance issue, and another wet end was rapidly deployed from the manufacturer to the job site to fix the issue.

By being able to remotely share critical pump performance information with the manufacturer, a tremendous amount of downtime was saved. Additionally, during the operation of the bypass, the PumpSentri assisted the customer who was self-performing pump watch by providing vibration alerts when the pump had ragging issues so the customer could quickly mitigate the issues. This allowed for avoiding costly repairs of seal failures and/or a potential sanitary sewer overflow.

Conclusion

Incorporating IOT (Internet of Things) into bypass operations is a game-changer for the pipeline rehabilitation industry and for temporary pumping applications. By deploying this modern technology on bypass systems, not only is risk mitigated for the project stakeholders, but the chance of pumping system downtime is reduced. Now all stakeholders can view the performance data of the temporary bypass system in real-time, not just the pump watch team.

Ladd Gould *is the Strategic Customer Manager for Sunbelt Rentals Pump Solutions supporting the trenchless sewer rehab industry. Ladd began his career in the pumping industry in 1991, and in 2002 Ladd Joined the Sunbelt team. With over thirty years of temporary pumping experience Ladd has been involved in some of the largest bypasses in North America. With notable bypasses on the Saskatoon Interceptor 2012 Northwest Trenchless Project of the year, and the West Palm Beach Force Main Rehabilitation 2017 Trenchless Project of the year.*

Meet NASTT's Newest Staff Member!

VICTORIA COX

Regional Chapter and Events Coordinator

Victoria joined the NASTT Staff in April of 2023 as the Regional Chapter and Events Coordinator. Victoria has a B.A. in Communication Studies from Central Washington University and spent 7 years in the Real Estate industry prior to joining NASTT. Victoria is a skilled communicator with a personable demeanor.

When she's not busy helping our Regional Chapters or setting up event registration, Victoria loves to indulge her passion for travel and spending time with friends. She's always on the lookout for new experiences and opportunities for personal growth. Her furry companion, Kai, provides much-needed breaks from her busy schedule for cuddles and playtime.

Tori works closely with our Regional Chapters and is expanding the services NASTT is able to offer our volunteers on the regional and local level. Tori can be reach via email at vcox@nastt.org.

MEMBERSHIP

Bring more to your career. Save time and money.

Empower the world of trenchless technology.

Be part of the premier network of trenchless professionals.

NASTT members have worked through challenges, celebrated success and are ready to share their know-how at events, volunteer activities and online.

Be a solution provider.

Whether you're just starting out or are in the C-suite, NASTT's exclusive education and training supports your certification goals, grows your skillset and brings answers to your project, job site, team meeting and KPIs.

Be on the front lines of trenchless issues and products.

NASTT brings you emerging trends, innovative technologies, and who's who in the profession so you can keep up to date on the information you need to stay on the cutting edge of the industry.

Be the best with support from the best.

With members at every stage of their career, NASTT gives you access to a wide spectrum of members to give or receive support, advice and mentorship wherever you are in your career journey.

NASTT™

nastt.org/membership

membership@nastt.org
888-388-2554

NASTT membership equips and empowers you to thrive in your career.

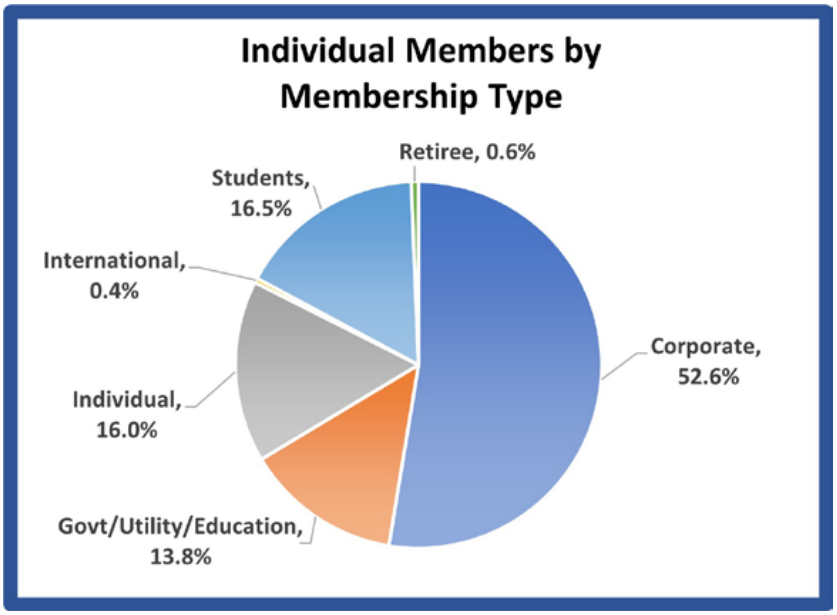
Join as an individual or get group savings as an organization with a corporate or government/education/utility membership.

NASTT Membership

Whether you're a sales professional, engineer, skilled laborer, business development expert, business owner or executive, or project manager who works in contracting, construction, manufacturing, gas, water, planning and development or transportation, NASTT is the platform you can build your career upon.

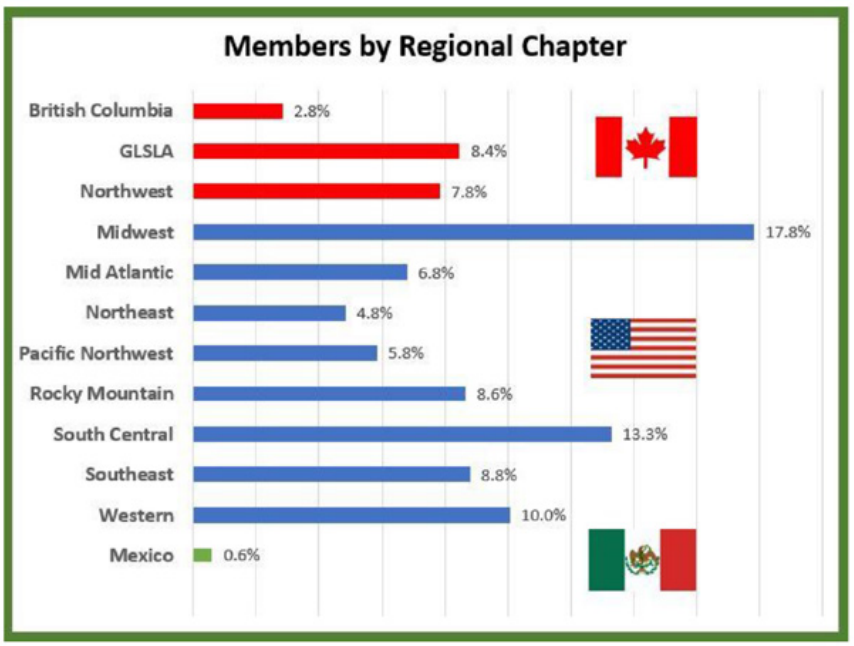
NASTT has something for everyone connected to the trenchless profession: from small businesses to global enterprises and entry-level, young and future professionals to CEOS and presidents. Across Canada, the United States and Mexico, NASTT members are connecting over trenchless technology and its related industries.

Who are NASTT Members?



Get Involved in your Regional Chapter!

- Build a power network of trenchless professionals in your area.
- Find local business resources.
- Learn about projects and solutions near you.
- Grow your expertise at regular meetings with your peers.
- Be a recognized leader in the chapter trenchless community.
- Share your expertise at local seminars and conferences.
- Write articles for the regional chapter magazine.
- Serve on a committee or the chapter board.
- Be a mentor to students at local colleges and university.
- Help get the word out on local projects and trenchless news.



Top 5 Member Roles By Position/Title

ENGINEER / EIT
Civil Engineer
Project Engineer
Engineer/Director of Engineering

MANAGER/DIRECTOR
Operations Manager
General Manager
Regional Manager
Construction Manager

EXECUTIVE / C-SUITE
President/CEO
Vice President
Principal
COO

PROJECT MANAGER/ TEAM LEADER
Project Manager
Sr. Project Manager
Team Lead

PROJECT MANAGER/ TEAM LEADER
Project Manager
Sr. Project Manager
Team Lead

NASTT is stronger than ever with new and improved programs, services and tools to help expand your know-how, career connections and opportunities. A dynamic range of career content, online member interaction, job resources, educational courses, expertise-building publications, give-back opportunities, career building recognition and networking events are designed to support your specialty area, role and career stage.

NASTT Group Membership

NASTT Group Membership Promotes Peak Performance!

"Being a NASTT group Corporate member gives us credibility in the industry. NASTT is the best trenchless forum in the world to learn trenchless methods and connect with clients and teaming partners and the best way for our younger staff to get training and experience, and build presentation skills."

– Kenneth G. Sorensen, Sr. Principal Engineer, Kleinfelder, Inc.

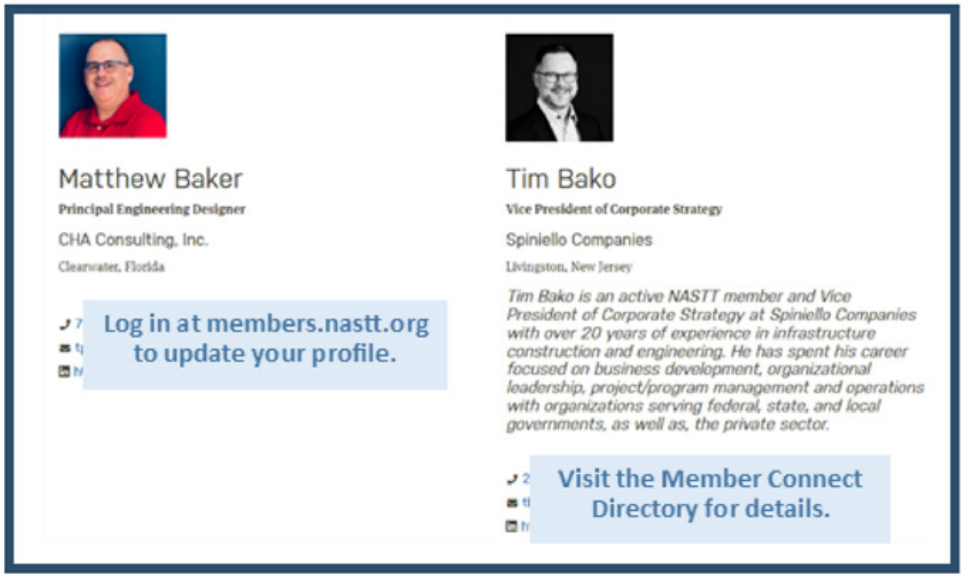
Corporations, government organizations, utilities, colleges, universities, and training centers can join as a group and be recognized as premier supporters of NASTT and for their commitment to advancing trenchless technology.

- **Develop your employees** with team technical training.
- **Increase your bottom line** with group membership rates and simplified membership management.
- **Find industry insights** in NASTT Elite.
- **Access trenchless ideas**, knowledge and solutions from founders, innovators and front-runners.
- **Let potential customers and clients find you** in the Trenchless Industry Directory of NASTT Organizations.
- **Promote your business** with member-only exhibitor rates at the NASTT No-Dig Show.
- **Be recognized as a leader** of the trenchless industry.
- **Strengthen your employee benefits package** to attract and keep the best trenchless professionals.
- **Build your employee library** with bulk purchase rates on NASTT books and member-level access to the *NASTT Knowledge Hub – coming soon!*

NASTT Online Directories

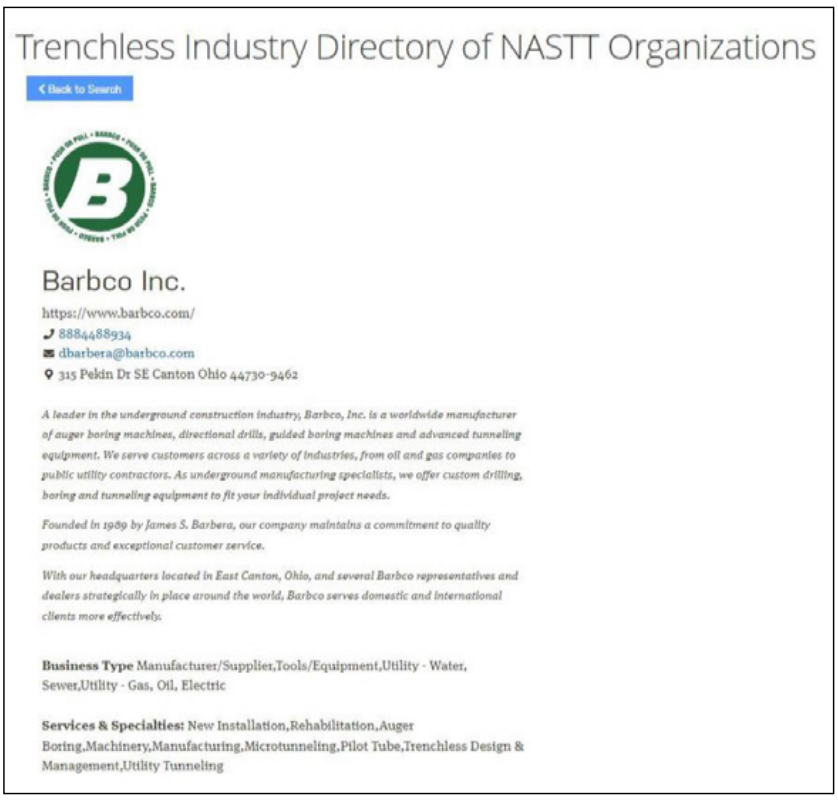
NASTT member directories make it easier for members to connect, find referrals, identify leads for partnerships, find a mentor, contact technical paper authors and presenters or reconnect with former colleagues.

Member Connect Directory – Members Only!
www.members.nastt.org/member-directory



Trenchless Industry Directory of NASTT Organizations – Open for Public Search

NEW! Launching Soon!



The Trenchless Industry Directory of NASTT Organizations will be accessible to the public and can include the company logo, industry/business type, services and specialties, website and brief company description.

Primary Contacts of group corporate and government/utility/education memberships can update their organization's profile by logging in to their *individual* profile. Click the Organization's tab and then the blue manage button.

If you have any questions or need assistance logging in, please contact Carolyn Hook at 440-534-9463.

NASTT Celebrates Trenchless Awards

CELEBRATE TRENCHLESS AWARDS

NASTT Celebrate Trenchless Awards recognize the multitude of ways that individuals and companies contribute significant time, energy and intellect to developing trenchless technology and fostering its success. The awards celebrate innovators, champions, volunteers and emerging leaders who have made a substantial impact in the industry.

Two Ways to Recognize Outstanding Young Professionals

Ralston Young Trenchless Achievement Award

Applauding savvy NASTT members under 36 with at least 5 years in the trenchless industry who have demonstrated excellence early in their career by making valuable contributions to the trenchless technology industry, the Ralston Young Trenchless Achievement Award recognizes members whose talent and ability are the future of trenchless. You do not have to be a NASTT member to nominate; but, only NASTT members are eligible for the award. Self-nominations are allowed. Student members are not eligible.

Submit Your Nomination by November 30: tinyurl.com/YoungTrenchless24

NEW! Trenchless Rising Stars

NASTT is looking to discover early career professionals with fewer than 5 years work experience who are already making impressive strides in the trenchless industry and have great potential to impact the future of the profession.
The Trenchless Rising Stars program works with members to identify, engage and promote young professionals whose record reflects ongoing and exceptional growth in their contributions to the profession and increasing levels of leadership, responsibility and sphere of impact. These early career professionals have a track record that reflects a strong career trajectory and the potential to reach the highest levels of achievement in the profession. Undergraduate student members are not eligible.

Recommend your colleagues, co-workers and connections by November 30: tinyurl.com/TrenchlessRisingStar.

About the NASTT Member List

NASTT offers special recognition to its Corporate and Government, Utility and Education members in appreciation of their ongoing promotion of NASTT and the industry. Primary contacts are included in the listing. The member lists are as of October 2023.
Do not use this list for purposes such as advertising, solicitations, and mass communications.

Corporate Members

Any North American corporation, partnership or individual doing business as a sole proprietorship. Subsidiaries with their own US Federal Employer Identification Number (EIN) or Canadian Business Number (BN) are required to maintain separate corporate memberships.

Aaron Enterprises, Inc.
Tom Rice, Territory Manager
aaronenterprises.com

Ace Pipe Cleaning, Inc.
A Carylon Company
Steve Hontz, President
acepipe.com

Acoustical Control, LLC
Clayton Cox,
Regional Account Manager
acousticalcontrol-llc.com

AECOM
Paul Nicholas, Trenchless Market Sector Manager
aecom.com
See ad on pg. 29

Aegion Corporation - HQ
Robert Moorhead,
Chief Commercial Officer
aegion.com

Akkerman
Jason Holden, VP,
Chief Revenue Officer
akkerman.com

Alliance for PE Pipe
Peter Dyke, Executive Director
pepipe.org

American West Construction
Paul Snyder, Manager
trustawc.com

Am-Liner East
Mel Willett, Vice President
amlinereast.com

Applied Felts
Gil Carroll, Director of Business Development
appliedfelts.com
See ad on Outside Back Cover

AOC
Mike Diehl,
Director of Marketing, Americas
aocresins.com

Aqua Tech Solutions Inc.
Devin Ricalis, Project Manager
aquatech.com

Aries Industries, Inc.
Jim Kraschinsky, Vice President - Sales & Marketing
ariesindustries.com

Arup
William Howlett, Senior Tunnelling Engineer
arup.com

Associated Engineering
Jason Lueke, P.Eng., National Practice Leader - Trenchless
ae.ca

Atlas Trenchless, LLC
Jim Lagios,
President/General Manager
atlas-trenchless.com
See ad on pg. 16

Avanti International
Britt Babcock, PE, President
avantigrout.com

Avertex Utility Solutions Inc.
Jason Kottelenberg, President
avertex.ca

Barbco Inc.
David Barbera, Vice President
barbco.com

Benjamin Media Inc.
Bernard Krzys, CEO & Publisher
benjaminmedia.com

Bennett Trenchless Engineers
Kathryn Wallin, Senior Scientist
bennetttrenchless.com
See ad on pg. 40

Binnie
Karen Duve,
Marketing Coordinator
binnie.com
See ad on pg. 53

Bit Brokers International
Chester Thomas, In House Counsel And Sales Rep
bitbrokers.com

Black Diamond Oilfield Rentals
Paco McLaughlin, Vice President
bdoilfield.com

Bolton & Menk, Inc.
Brian Simmons, PE,
Principal Engineer
bolton-menk.com

Bond Civil & Utility Construction, Inc.
Tara Canavan, Business Development Associate
bondbrothers.com

Bore Master Inc.
Ryan Haubenschild,
Vice President
globecontractors.com

Bothar Inc.
Jonathan Barrie, VP Preconstruction Services NA
bothargroup.com

Bradshaw Construction Corporation
Lester Bradshaw, President
bradshawcc.com

Brierley Associates Corporation
Nick Strater, PG, Sr. Project Manager
brierleyassociates.com

Brown and Caldwell
Christopher Garrett,
National Practice Leader
brownandcaldwell.com

Brownline Canada
Chris Frisch,
Operations Manager
www.drillguide.com
See ad on pg. 17

Brownline USA
James Cloud, President
drillguide.com/en/
See ad on pg. 17

BTrenchless
Chris Knott,
Director Of Business Development/Estimator
btrenchless.com

C&L Water Solutions Inc.
Chris Larson, COO
clwsi.com

Campos EPC, LLC - HQ
Michael McSchaefer, PE, PMP,
Engineering Manager
camposepc.com

Capital Infrastructure Group
David Beswick, President
capitalinfrastructuregroup.ca

Carollo Engineers, Inc.
Tim Taylor,
Infrastructure Practice Director
carollo.com

Carylon Corporation
Lewis Klein,
Director of Marketing
caryloncorp.com

CCI & Associates, Inc.
Justin Taylor, P.Eng., PE,
VP of Engineering / General Manager
cciandassociates.com

CETCO | Minerals Technologies
Debra Bac,
Technical Sales Manager
cetco.comdpg

Claude H. Nix Construction
Stephanie Nix-Thomas,
President
chnix.com

"The bottom line is that active membership benefits me professionally and, in turn, my company can provide unique and cost-effective solutions to challenging projects."

– George Ragula, CEO, Ragula Tech

Consor Engineers
Brendan O'Sullivan, PE,
Technical Practice Leader, Trenchless Technologies | Principal Engineer
consoreng.com

Contech Engineered Solutions LLC
Gaelyn S. Cunningham,
Senior Marketing Manager - Pipe Solutions
conteches.com
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Coppola Services, Inc.
Michael Coppola, CEO
coppolaservices.com

Core & Main
Russell Reeves, National Director of Fusible
coreandmain.com

Cretex Specialty Products
Timothy North, General Manager
cretexseals.com
See ad on pg. 22

CUES, Inc.
Terri Mooney,
Senior Sales Administrator
cuesinc.com
See ad on pg. 51

D.V.M. Utilities, Inc
Daniel DiLegge, President
dvmutilities.com

Delve Underground
Glenn Boyce, Ph.D., PE, P.Eng, Ir, Principal
delveunderground.com

Derrick Equipment Company
Ben Clark, Global Sales Manager - Construction Technologies
derrick.com

Direct Horizontal Drilling
Dave Fisher,
Contracts & Project Manager
directhorizontal.com

DitchWitch
Scott Pevey,
Director of Marketing
ditchwitch.com

Doetsch Environmental Services
Joe Schotthoefer,
Vice President
doetschenv.com

Drillworx, LLC
Dave Helgeson, Salesman
drillworx.us

DSI Tunneling LLC
David Harvanek, General Manager
dsitunneling.com
See ad on pg. 5

Earth View LLC
Allison Murrell, President
evllc.com

Electro Scan, Inc.
Chuck Hansen, Chairman & Chief Executive Officer
electroscan.com

Emagineered Solutions, Inc.
Steve Waring, Chairman and CEO
emagineered.com

ENZ USA Inc
Lance Pusey, North American Sales Director
enz.comen/home/

Faction Fusion
Robert Morrow, President
factionfusion.com

FER-PAL Infrastructure
Shaun McKaigue, President/CEO
ferpalinfrastructure.com

GeoEngineers
Jon Robison, Principal
geoengineers.com

Gemini Pipeline Rehabilitation Solutions, LLC
Sean Borris, President
geminipiperehab.com
See ad on pg. 52

Geotree Solutions
John Hepfinger, President
geotreesolutions.com

GHD
Bradley Marin, C.E.T., Technical Director
ghd.com

Global Underground Corporation
Robert Powilleit, Vice President
globalug.com

GM BluePlan Engineering Limited
Jayne Harris, Project Manager
gmblueplan.ca

Granite Inliner
Mike Green, Business Development Manager
graniteconstruction.com

Haley & Aldrich Inc.
Abhinav Huli, Trenchless Practice Leader
haleyaldrich.com

HammerHead Trenchless Equipment
Jeff Gabrielse, GM/President
hammerheadtrenchless.com
See ad on Inside Front Cover

HardRock Infrastructure Services
Donna Kurz, Manager
hardrockis.com

HB Trenchless, LLC
Timothy McQueary, Vice President
hbtrenchless.com

Herrenknecht Tunnelling Systems
Gerhard Lang, Ing., Business Development Manager
herrenknecht.com/en/

HOBAS Pipe USA
Kimberly Paggioli, Vice President, Marketing and Quality Control
hobaspipe.com

Holly Pipe Corp
Jerry Nugent II, President
hollypipe.com

Horizontal Boring & Tunneling Co.
Brent Moore, President
hbttrenchless.com

HTS Pipe Consultants Inc.
Tom Schultz, President
htspipeconsultants.com

Huxted Trenchless
John Langford, Operations Manager
huxtedtunneling.com

Imerys
Joseph Talley, Americas Area Infrastructure Manager
imerys.com

iMPREG LLC
Jennifer Sherman, General Manager - North America
impreg.com

Innovacion en Bombeo y Desazolve, S.A. de C.V. (INBODE)
Milton Gabriel Chavez Gasca, Country Manager
inbode.com.mx

Innovations Amplified
Susan Kay Watkins, Marketing & Brand Development
innovationsam.com

Interplastic Corp.
Jason Schiro, Business Manager-Pipeline Remediation Polymers
interplastic.com

Interstate Engineering, Inc.
Lonni Fleck, President
interstateeng.com

Iowa Trenchless
Jason Clark, President/Owner
iowatrenchless.com
See ad on pg. 31

IPEX, Inc.
Nicholas Hooper, Market Development Manager, US, Novaform
ipexna.com

IVIS Inc.
Dolores Eaton, President
ivisinc.com

J.W. Fowler
John Fowler, Chief Operations Officer
jwfowler.com

Jacobs Engineering Group - World HQ
Marya Jetten, Project Manager
jacobs.com

JD Brule Inc.
John Brule, President
jdbrule.com

Kennedy/Jenks Consultants Inc.
Sarah King, PE, PMP, LEED AP, Principal Civil Engineer
kennedyjenks.com

Kiewit Engineering Group Inc.
Forest Rong, Vice President, Power Delivery
kiewit.com
See ad on pg. 57

Kiewit Infrastructure Co.
Matt Roberts,
Trenchless Manager
kiewit.com
See ad on pg. 57

Kimley-Horn and Associates, Inc.
Marty Paris,
Senior Vice President
kimley-horn.com

Kleinfelder
Gus O'Leary,
Principal Professional
kleinfelder.com

KOBUS, Inc.
Keren Wilkinson,
Project Manager
kobus-inc.com

"Several NASTT connections provided valuable information which led to numerous project successes! NASTT allowed me to share my experiences with others bringing rewards and learning to the trenchless community at large."

– Kevin Bainbridge, Vice President, Robinson Consultants

Kondex Corporation
Diane Riley, Marketing
kondex.com
See ad on pg. 34

Laney Directional Drilling Co.
Andrew Sparks,
Director of Engineering
laneydrilling.com

LaValley Industries
Jorge Prince,
Chief Financial Officer
lavalleyindustries.com

Lithos Engineering
Benny Siljenberg, PE, MBA,
Vice President
lithoseng.com

Logan Clay Products
Steve Matheny, Business Development Manager
loganclaypipe.com

M.E. Andrews and Associates Limited o/a Andrews.Engineer
Diane McLean, CPM,
Office Manager
andrews.engineer

Madewell Products Corp.
Don Rigby,
Business Development
madewell.net

Mears Group, Inc. - Corporate HQ
Gregory Bosch,
Director Business Development
mears.net

"I stumbled into the trenchless industry through my role in the public sector where there is a constant pursuit of minimizing disruption to the public and improving customer service levels. Anyone entering the trenchless industry can keep abreast of advancements through NASTT resources such as publications and conferences."

– Kristy Gibson, Project Coordinator, City of Toronto, Toronto Water - Laboratory Services

Michael Byrne Manufacturing
Jim Weist, President
byrnegroup.com

Michels Canada
Jason Squires, Chief Operating Officer
michelscanada.com
See ad on pg. 35

Michels Corporation
Holly Luehring, MBA, Director of Marketing and Communications
michels.us
See ad on pg. 35

Midwest Mole, Inc.
David Howell, Director of Rail & Consulting Services
midwestmole.com
See ad on pg. 55

Miller Pipeline Corporation
Chris Schuler, General Manager, Mun. Serv.
millerpipeline.com

Minger Construction Co., Inc.
Luke Minger, Vice President
mingerconstruction.com

Mladen Buntich Construction Co., Inc.
Lee Roesner, PE, Vice President
buntich.com

Mott MacDonald
David Field, NASA Tunnel Practice Leader, Senior Vice President
mottmac.com

National Liner
Scott Roth, Director
nationalliner.com

Neptune Coring
Ben Campbell, General Manager
neptunecoring.com

NO-DIGTEC, LLC
John Newell, President
pipeburster.com

Northeast Remsco Construction Inc.
Richard Palmer, Vice President, Trenchless
northeastremsco.com

NorthStar Fluid Solutions
Jon Todd, Supply Chain Manager/Co-Owner
northstarfluids.com

Novinfra
Alexandre Bouchard, VP operations / Co-Founder
novinfra.com

Nu Flow Technologies
Marissa Melanese, Projects Coordinator
nuflowtechnologies.com

OBIC
Dustin Schlachter, Owner
obicproducts.com
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Ok Bit Service Inc.
Jay Foster, Sales Manager
okbit.com

Omega Liner Company, Inc.
Mark Hallett, Director of Sales
omegauvpipe.com

On Point HDD
Timothy Kelty, President
onpointhdd.miami

Pacific Boring Inc.
Steve Gallyer, President
pacificboring.com

ParklandGEO Ltd.
Monique Tenszen, Geo-Environmental Engineer
parklandgeo.com

PICA Corporation
Dave Russell, President
picacorp.com

Picote Solutions Inc.
Katja Lindy-Wilkinson, Ceo
picotesolutions.com

Pipe Bursting of New England
Jon D'Allessandro, Owner/President
pipeburstingne.com

Plastics Pipe Institute
Camille Rubeiz, PE, F. ASCE, Senior Director Of Engineering
plasticpipe.org
See ad on pgs. 9, 42

Pretec Directional Drilling, LLC
Bill Colson, General Manager
pretecdd.com

Prime Resins, Inc.
Michael Vargo, Technical Support
primeresins.com
See ad on pg. 56

Progressive Pipeline Management
David Wickersham, President & CEO
progressivepipe.com

ProKASRO Services USA, Inc.
Teresa Jahn, Marketing
prokasrousa.com

Protective Liner Systems, Inc.
Jerry Trevino, President
protectivelinersystems.com

PSILAB, Inc.
Danny Villarreal, Program Manager
psilab.net

Pure Technologies
Hayley Stratford, Business Development Administrator, Assessment Services
puretechltd.com

QuakeWrap Inc.
Firat Sever, Ph.D., PE, BCEE, F. ASCE, Pipeline Division Manager
quakewrap.com

Rain for Rent
Charlotte Storms, Marketing Specialist
rainforrent.com

Ranger Contracting Inc
Robert Porter, HDD Project Manager
ranger-contracting.com

Rausch Electronics USA, LLC
Gregory Hall, President
rauschusa.com

"I joined because with municipalities' underground infrastructure coming to its end of design life during a time when municipalities are consolidating and have limited capital budgets, the only solution to keep things flowing is via trenchless methodologies. NASTT is the place to be – the place to obtain the knowledge necessary to support our municipalities into the future."

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RedZone Robotics Inc. - HQ
John DePasquale, Sales Operations Manager
redzone.com

Reline America LLC
Jeff van Huet, Technical Advisor
relineamerica.com

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Zachary Matyja, PE, Vice President of Client Services
rjn.com

Robert B. Somerville Co. Limited - Western Head Office
Tyler Calvert, HDD Operations Manager Western Division
rbsomerville.com

SAK Construction LLC
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sakcon.com

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Blair Seeley, Principal
scsconsultinggroup.com

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Pam Sawatzke, Sales/Marketing
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sekisuispra.com

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Danmeng Qian, Engineer
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Richard Lovett, President
groutscouts.com

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Anthony Hughes, PE, Senior Sales Engineer
sprayroq.com

SSC Underground
Arvid Veidmark, President
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Staheli Trenchless Consultants
Kimberlie Staheli, PE, Ph.D., President
stahelitrenchless.com
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Stantec
Dave Krywiak, P.Eng., Principal
stantec.com

Subsite Electronics
Sean Hubbard, Marketing Communications Manager
subsite.com

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Tiffanie Mendez, National Sales Director
sunbeltrentals.com
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Louis Bouffard, Business Unit Manager
texel.ca

The Crossing Company | The Crossing Group
Ryan Maclean, President
crossinggroup.com/the-crossing-company

The Hallen Construction Company, Inc.
Pascale Ambrosio, Executive Vice President
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The Strong Company, Inc.
Tim DeJarnette, President
strongseal.com

The Tunneling Company | The Crossing Group
Nick Hyde, Project Manager
crossinggroup.com/the-tunneling-company

Thompson Pipe Group
Carl Pitzer, PE, Trenchless Manager
thompsonpipegroup.com

TRGH Vylon Pipe
Matthew Holl, Sales Manager
vylonpipe.com
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TRI/Environmental
Mario Paredes, PE, Senior Research Engineer
tri-env.com

Trinity Products LLC
Tim Ransom, Business Development
https://trinityproducts.com
See ad on pg. 15

Tri-State Utilities
John Saintsing, usiness Development Manager
tristateutilities.com

TRUVAC by Vactor Manufacturing, Inc.
Kristy Gussarson, Marketing
truvac.com

TRY TEK Machine Works Inc.
Dennis Burger, Vice President
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Al Chancellor, Marketing/Sales
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Ryan Slagerman,
Operations Manager
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VECTOR MAGNETICS

Vector Magnetics
Jed Sheckler,
Director of Marketing
vectormagnetics.com
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Vermeer Corporation
Amy Olsen,
Product Marketing Lead - Utility & Pipeline
VermeerMVS.com

Victoria Drain Services Ltd.
Dave Lloyd, President
victoriadrains.com

Vortex Companies
Kit Jones, VP,
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vortexcompanies.com

Wade Trim
Donna Jakubowicz, FSMPS, CPSM, Vice President, Director of Brand
wadetrim.com

Warren Environmental Inc.
Victoria Messina,
Marketing Manager
warrenenviro.com

Waterline Renewal Technologies, Inc. - Corporate HQ
Aaron Kaplan,
Director of Product Management
waterlinerenewal technologies.com

Westlake Pipe & Fittings
Keith Moggach,
National Manager - Specification Engineering
westlakepipe.com

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Justin Messner,
Director of Municipal Operations
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John Lamerton, VP Marketing
wyoben.com

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Technical Manager
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awwd.com

Aurora Water Department
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auroragov.org

Central Contra Costa Sanitary District
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centralsan.org

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abbotsford.ca

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publicworks.baltimorecity.gov

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bendoregon.gov

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City of Fort Lauderdale
Sayd Hussain, Project Manager II
fortlauderdale.gov

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Jeff Loftin, Engineer 2
greshamoregon.gov

City of Los Angeles, Dept of Public Works - Bureau of Engineering
Edward Arrington, Principal Civil Engineer
dpw.lacity.org

City of Loveland Water and Power Department
Tanner Randall, Senior Civil Engineer
cityofloveland.org/home

City of Medicine Hat
Brian Graham, Manager Of Field Operations
medicinehat.ca

City of Moscow
Nathan Suhr, Staff Engineer
ci.moscow.id.us

City of New Bedford
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newbedford-ma.gov

City of Omaha Public Works
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publicworks.cityofomaha.org

City of Ottawa
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ottawa.caen

City of Pacifica
Rey Mendez, Collection System Assistant Superintendent
cityofpacifica.org

City of Portland Environmental Services Bureau
Jeremiah Hess, Supervisor
portlandoregon.gov

City of Regina
Allison Hahn,
regina.ca

City of Richmond
Roger Keating, Project Manager
richmond.ca

City of Rochester Hills
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rochesterhills.org

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Brian Brost, Manager of Utilities | Public Operations
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Parwinder Athwal, Wastewater and Construction Operations Superintendent
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wenatcheewa.gov

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cleanwaterservices.org

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epcor.com

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Metropolitan Water Reclamation District of Greater Chicago (MWRDGC)
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transports.gouv.qc.caen/Pages/Home.aspx

Mohawk Valley Water Authority
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Director, Water & Wastewater Services
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Northeast Ohio Regional Sewer District
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Supervising Civil Engineer
seattle.gov/utilities

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Town of Normal Public Works
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normalil.gov/115/Engineering-Public-Works

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Upper Trinity Regional Water District
Kurt Staller,
Project Manager -Sr. Engineer
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~ Eric Schuler, PE, Onondaga County Department Water Environment Protection

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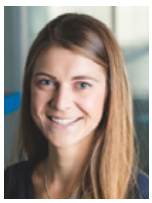
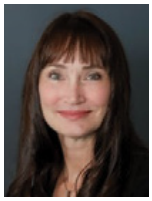
~ Joe Lane, Aegion Corp.



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, Jacobs Engineering Group



Amazing Network

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~ Cindy Preuss, PE, CDM Smith

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~ Jim Murphy, UniversalPegasus International

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WARREN ENVIRONMENTAL

Warren Environmental Establishes Roots in Georgia with Relocation

Warren Environmental and Coatings, LLC (Warren Environmental), a leading manufacturer of proprietary epoxy products and patented application technologies, is excited to announce its strategic relocation from Massachusetts to Georgia this fall. This move reflects the company's commitment to enhancing operational efficiency, expanding its presence, and better serving its Approved Applicator Network.

The new 15,000-square-foot manufacturing facility in Gainesville, Georgia, offers numerous advantages for Warren Environmental. The decision to relocate was driven by several factors, including improved logistical capabilities and enhanced operational efficiency. The location in Georgia will facilitate faster shipments of products, enabling Warren Environmental to better serve its expanding Approved Applicator Network. In addition, the new facility will provide operational efficiencies regarding optimized layout and design, up-to-

date infrastructure, and additional space to accommodate the increased production and storage needs.

Company President Brian Brandstetter expressed his enthusiasm about the move, saying, "This relocation represents a significant milestone in our company's growth. Our new location in Georgia aligns with our long-term goals and enables us to provide our applicators and their clients with quality and readily available epoxy products."

As Warren Environmental relocates its manufacturing facility, it remains committed to providing the same high-quality epoxy coating system and excellent service that its applicators have come to expect. The company assures all existing and prospective applicators, as well as their customers, that this relocation will have little to no impact on their current operations. The relocation process has been thoroughly planned to ensure a seamless transition without disrupting operations.

About Warren Environmental
Warren Environmental is a leading manufacturer of proprietary epoxy products and patented application technologies. Since 1996, Warren has protected or rehabilitated private and municipal clients' water and wastewater infrastructure throughout the U.S., with safe and effective epoxy coatings for all environments.

For more information about Warren Environmental and its relocation, please visit our website at **www.warrenenviro.com** or contact **info@warrenenviro.com**.

Akkerman Revolutionizes Operator Training with State-of-the-Art Facility

Akkerman, a renowned producer of high-grade tunneling and boring equipment, has recently taken a groundbreaking step in enhancing operator training for construction firms specializing in trenchless underground construction. You will find the highlights of the company's remarkable journey of success, attributing it not only to their sophisticated equipment but also to the skilled operators using them.

However, the construction industry is facing challenges, including increased turnover and a growing need for faster and more effective equipment training on a larger scale. Akkerman has traditionally relied on its model of providing on-site training through traveling technicians to customers before they handle new equipment. Nonetheless, President Justin Akkerman acknowledges that conducting training at active work sites is far from ideal, as it can lead to losses due to delayed work and increased costs.

In a bold move, Akkerman embarked on the construction of a cutting-edge training center in early July, with an investment of a quarter million dollars. This innovative facility is designed like a raised garden bed, featuring three 40-foot-long channels standing approximately six feet tall and filled with varying materials, from soil to rocks.

The new approach invites customers to send their teams to Akkerman for training upon hiring or during downtime, significantly reducing losses caused by work delays. While Akkerman will still dispatch technicians on-site to assist with new equipment as required, a substantial portion of the training can now take place at the Brownsdale training center. This shift provides operators with access to abundant resources, without the pressures of tight schedules and deadlines.

Notably, this state-of-the-art facility will not only benefit the customers but also enhance the company's own research and development efforts. Akkerman previously collaborated with clients to test new and prototype equipment at active project sites, but this approach had its limitations. Real-world testing, though informative, could sometimes disrupt the client's work and strain relationships. The new training center allows Akkerman to privately assess prototypes without the risk of public failures.

Another significant advantage of the training center is its potential to boost customer product awareness. When clients visit Akkerman HQ, they will witness a wide array of equipment in action with minimal setup required. Justin Akkerman believes this first-hand experience will significantly enhance customer appreciation of the company's offerings.

Enterprise Minnesota's Business Growth Consultant Abbey Hellickson praises the innovative concept, recognizing how it fosters a more profound level of engagement between Akkerman and its customers. The facility's interactive nature encourages a closer bond and better understanding, elevating customer experience to new heights.

In conclusion, Akkerman's forward-thinking approach to operator training sets a new standard in the construction industry. By investing in a dedicated training center, the company addresses challenges, improves customer relationships, and amplifies its commitment to excellence. This move proves that innovation and customer-centric strategies are the pillars of Akkerman's continued success and growth. Learn more at **www.akkerman.com**.

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45 INJECTION GROUT AUTHORITY

Avanti International Celebrates 45th Anniversary In 2023

This year marks a milestone for Texas-based Avanti International, as the injection grout manufacturer celebrates its 45th anniversary as an industry leader.

Pioneered by industry icon David Magill in 1978, Avanti started with just one product – AV-100® Chemical Grout – which was primarily used to seal leaking sewer lines. Today, Avanti's injection grouts include a comprehensive line of acrylamide, acrylics, US Grout Ultrafine cements, polyurethanes, epoxies, pumps accessories, and more.

"Through hard work and dedication by our team, we are honored and grateful to be celebrating 45 years of success and a future that is just as bright thanks to the support of our industry friends and clients!" says Britt N. Babcock, PE, President of Avanti. "David Magill paved the way for decades and was an integral leader who aided in developing industry wide standards and practices that are still in use today". Since 1978, Avanti has upheld its dedication to providing injection grouting education by offering a comprehensive range of educational resources including grout schools, webinars, technical presentations, and onsite training that serves the municipal, industrial, and geotechnical sectors. Avanti's injection grouts have contributed to the success of critical infrastructure projects in diverse environments throughout the United States, and across the globe in countries such as Australia, Nigeria, Abu Dhabi, Mexico, Canada, Puerto Rico, and the United Kingdom.

To stay up to date with Avanti's latest developments, industry insights, company announcements, and product news, visit the Avanti website and subscribe to their newsletter.

About Avanti
Avanti International is a leading producer of injection grouts for municipal, industrial, and geotechnical applications used worldwide to stop water leaks, stabilize soil and rock, and control groundwater permanently. Since its founding in 1978, Avanti has continually demonstrated its commitment to innovation by conducting ongoing product research to refine and expand its range of injection grouting solutions, all designed to cater to the unique needs of the industries it serves. For further information, visit **avantigrout.com**

PPI
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Compression Fit HDPE Pipe – Another Proven Pipeline Replacement Method

ASTM Standard Codifies Method for Gravity and Pressure Pipe for Both Water and Force Main Projects

It wasn't a typical sliplining job to replace a failing force main line in Sioux Falls, S.D. The original ductile iron pipe was corroded and had severe ovality due to sulfuric acid from the sewage destroying it. Pulling through a new pipe, it was thought, wouldn't be possible because the old pipe was deformed. Reducing the diameter was not possible – that needed to be as close to the old one to maintain the rate of flow. The solution provided by Murphy Pipeline Contractors (Jacksonville, FL) was to insert high-density polyethylene (HDPE) pipe and compress it to fit, knowing that the thermoplastic pipe would naturally reform itself.

"This is one of the inherent attributes of HDPE pipe," stated Camille George Rubeiz, P.E., F. ASCE, co-chair, HDPE Municipal Advisory Board, and senior director of engineering for the Plastics Pipe Institute's (PPI) Municipal & Industrial Division. "As well as being corrosion proof, it is flexible and ductile. It can go through a special die on the job site that makes it possible to be pulled inside a host pipe even when the pipe is not round, and form a tight compression fit within the old ductile iron pipe." PPI is the major North American association representing the plastic pipe industry.

More than 8,700 feet of 36-inch ductile iron sewer force main was replaced with HDPE PE 4710, DR 21 pipe using Murphy's CompressionFit™ method, patent pending. The new pipe has a 100-psi operating and a 200-psi surge pressure rating, and is rated as a Class 6 solution in accordance with ASTM F3508. The sewer force main traversed under three city parks, along Covell Lake, through major commercial districts and under state highway SD 115. The pipe was made by WL Plastics (Fort Worth, TX), a member company of PPI.

Opened in 1985, the Sioux Falls system treats some 18 million gallons of wastewater daily. There are 900 miles of pipe in the system that conveys the wastewater to the city's treatment plant.

"We were asked 'Can a 36-inch ductile iron sewer force main with severe ovality be replaced with HDPE pipe using CompressionFit?'", said HDPE pipe industry expert and consultant Harvey Svetlik, P.E. "The answer was an unequivocal 'yes'. Matter of fact, other recent projects saw 54-inch diameter pipe with

a three-inch wall thickness installed using the CompressionFit method. This technology preserves the flow rate of the existing host pipeline and seals over holes and leaks, so you have a dual-wall composite pipeline. And the thicker HDPE pipe provides structural integrity."

Svetlik has more than 40 years of experience specializing in polyethylene pipes and fittings. He is the inventor of the MJ Adapter, also known as the Harvey Adapter. An active member of PPI for 30 years, he is the author of numerous PPI technical notes, developer of ASTM/AWWA standards, and an inventor who holds 16 patents.

One of the most recent ASTM standards authored by Svetlik is ASTM F3508 for the installation of compressed fit shape memory polymer pipe. "ASTM F3508 codifies the specification of the material to use and deals with the shape memory characteristics of the material such as high-density polyethylene."

"Most cities cannot afford to replace a 16-inch diameter or larger pipeline," said Todd Grafenauer, education director for Murphy. "The result of the CompressionFit HDPE pipe lining technology is that a new HDPE pipe will be 'compressive fit' inside the existing host pipe. This offers remarkable value over other methods." Murphy is a member company of PPI and part of the association's Municipal Advisory Board (MAB).
Governed by ASTM F3508, the CompressionFit HDPE pipe lining technology specifies an HDPE pipe with an outside diameter larger in size than the inside of the host pipe to be renewed. "ASTM F3508," Svetlik explained, "can be utilized not only for municipalities for gravity flow, but also for pressure pipes for water pipeline replacement, or force main replacement."

A Home Run for Bigfork: Community Impact Project Transforms Local Baseball Field

The American Rental Association (ARA) Foundation, in partnership with The Toro Company Foundation, Flathead County Parks and Bigfork Baseball Association, completed a Community Impact project in Bigfork, Montana to benefit Aero Lane Park, a local baseball field.

On September 27, volunteers from all four organizations worked together to enhance and upgrade the baseball diamond and park amenities. This included creating a new infield, new backstop fencing, refurbished bleachers and dugout benches as well as beautification updates throughout the park.

"Creating high-quality playing fields is crucial to the ballplayers' experience. ARA members from the local community and across the northwest region stepped up to the challenge, using their professional talents and equipment to transform the field and beautify the park," said Judson McNeil, ARA Foundation director of programs and fundraising.

To complete the work at the field, volunteers from ARA, The Toro Company Foundation and representatives from seven northwest regional and local rental operations turned out. The volunteers moved grass, replaced and stained bleachers, installed new gravel in the dugouts and parking areas, aerated the field and much more. All projects required the use of different equipment provided by local rental stores.

"Having an outdoor space for our community's youth to recreate, create memories, develop friendships and build character is an important aspect of our department," said Chris Maestas, Flathead County Park director. "The generous monetary donation by ARA and Toro as well as the time and effort from their volunteers to improve a little league baseball field that is used heavily by the Bigfork community will have a lasting impact on the ball players and the community as a whole. Flathead County is fortunate to have the support of the groups and individuals who have stepped up to the plate to support our youth through parks and recreation."

The Bigfork project is the third Community Impact project the ARA Foundation has completed in partnership with The Toro Company Foundation in 2023. Planning is underway for the 2024 projects, visit the ARA Foundation website to learn more and submit an application.

About ARA Foundation: (www.ARArental.org) The American Rental Association (ARA) Foundation, Moline, Ill., is a 501(c)(3) organization dedicated to supporting the equipment and event rental industry. It is affiliated with the ARA, an international trade association for owners of equipment and event rental businesses and the manufacturers and suppliers of construction/industrial, general tool and party/event rental equipment. The ARA Foundation offers scholarships, mentoring opportunities, employee training assistance and disaster relief to the industry.

About The Toro Company

The Toro Company (NYSE: TTC) is a leading worldwide provider of innovative solutions for the outdoor environment including turf and landscape maintenance, snow and ice management, underground utility construction, rental and specialty construction, and irrigation and outdoor lighting solutions. With net sales of $4.5 billion in fiscal 2022, The Toro Company's global presence extends to more than 125 countries through a family of brands that includes Toro, Ditch Witch, Exmark, Spartan Mowers, BOSS Snowplow, Ventrac, American Augers, Trencor, Pope, Subsite Electronics, HammerHead, Radius HDD, Perrot, Hayter, Unique Lighting Systems, Irritrol, and Lawn-Boy. Through constant innovation and caring relationships built on trust and integrity, The Toro Company and its family of brands have built a legacy of excellence by helping customers work on golf courses, sports fields, construction sites, public green spaces, commercial and residential properties and agricultural operations. For more information, visit **thetorocompany.com**.

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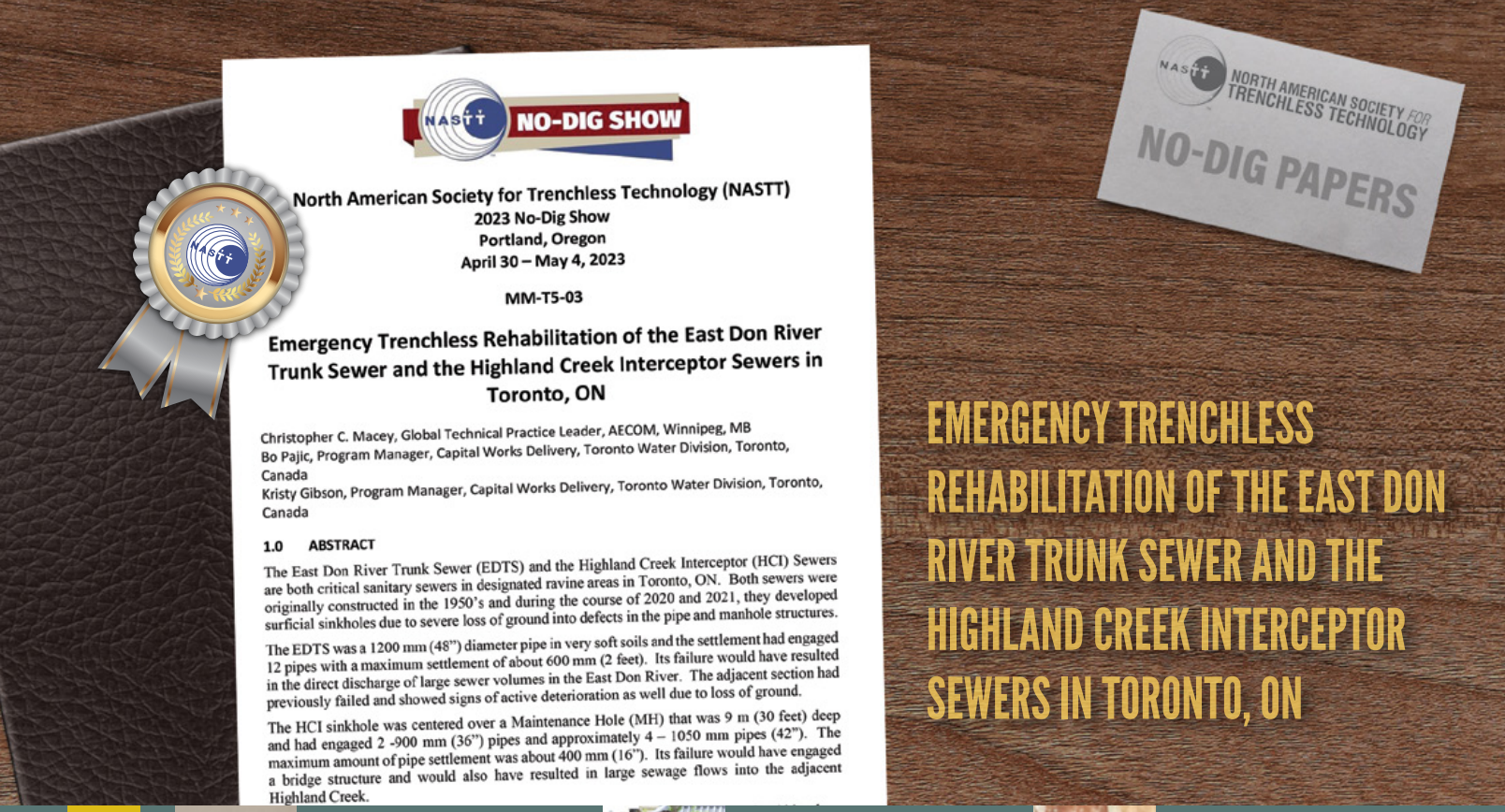

EMERGENCY TRENCHLESS REHABILITATION OF THE EAST DON RIVER TRUNK SEWER AND THE HIGHLAND CREEK INTERCEPTOR SEWERS IN TORONTO, ON

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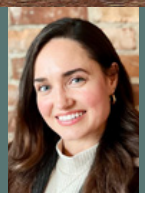

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1. ABSTRACT

The East Don River Trunk Sewer (EDTS) and the Highland Creek Interceptor (HCI) Sewers are both critical sanitary sewers in designated ravine areas in Toronto, ON. Both sewers were originally constructed in the 1950s and during the course of 2020 and 2021, they developed surficial sinkholes due to severe loss of ground into defects in the pipe and manhole structures.

The EDTS was a 1200 mm (48-inch) diameter pipe in very soft soils and the settlement had engaged 12 pipes with a maximum settlement of about 600 mm (2 feet). Its failure would have resulted in the direct discharge of large sewer volumes in the East Don River. The adjacent section had previously failed and showed signs of active deterioration as well due to loss of ground.

The HCI sinkhole was centered over a Maintenance Hole (MH) that was 9 m (30 feet) deep and had engaged 2 -900 mm (36-inch) pipes and approximately 4 – 1050 mm pipes (42-inch). The maximum amount of pipe settlement was about 400 mm (16 inches). Its failure would have engaged a bridge structure and would also have resulted in large sewage flows into the adjacent Highland Creek.

This paper captures the two separate emergency response efforts in 2021 and early 2022, where both locations were uniquely repaired using a balance of external ground stabilization techniques and CIPP lining with minimal ground disturbance. The HCI repair included MH lining and a single tapered CIPP tube shot with 4 different design sections (varying wall thickness and tube circumference).

This paper was selected as the 2023 Outstanding Paper - Rehabilitation, from all the presentation at the 2023 NASTT No-Dig Show in Portland OR. NASTT No-Dig Papers are available for download, free to members, at www.nastt.org

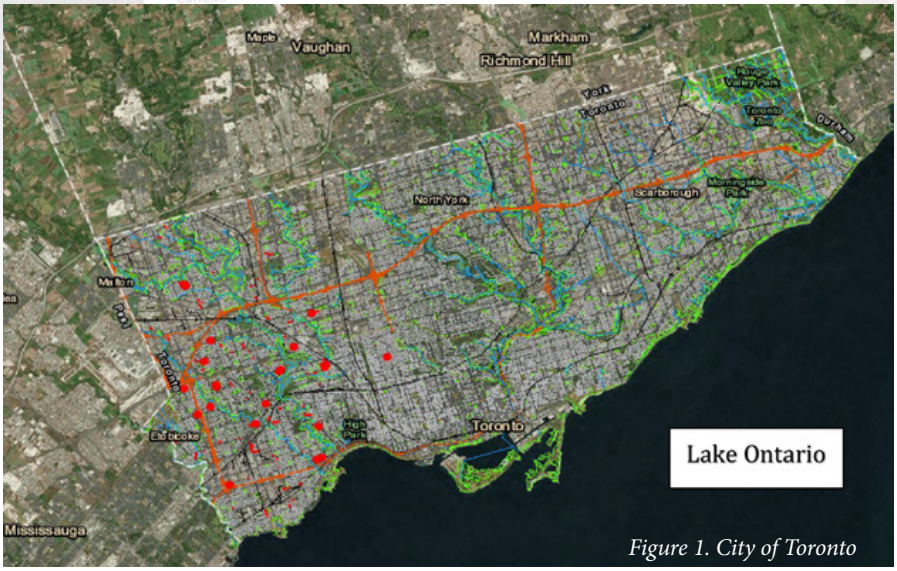

Figure 1. City of Toronto

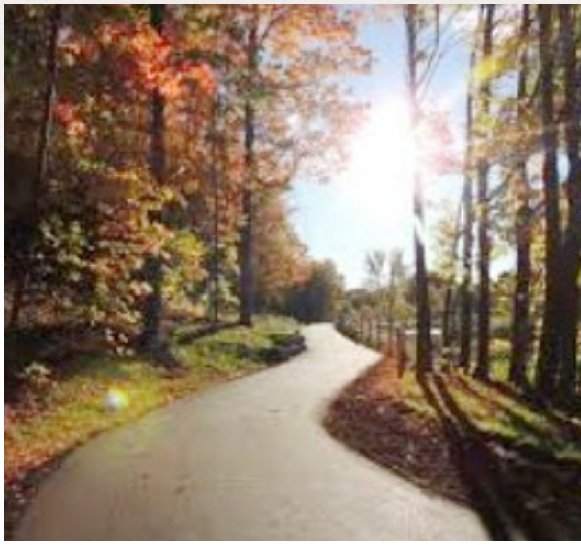
Figure 3. GTA Ravine Area – Nature Trail


Figure 2. GTA Ravine Area - Typical Setting


Figure 4. GTA Ravine Area – Sensitive Habitat

2. INTRODUCTION

The City of Toronto is the largest City in Canada with a direct service area of 2.89 million people extending to the shores of Lake Ontario (Figure 1). The Greater Toronto Area (GTA) was over 6.3 million in population in 2022 and with about 44 million people visiting the City annually it is a very complex area to maintain buried sewer assets (or assets of any kind for that matter). The sewer inventory includes over 10,500 km (6500 miles) of pipe from 100 mm to 5500 mm (4 inches to 18 feet) in diameter that is largely trying to make its way back to Lake Ontario through the original core of the City. Many of the GTA's Trunk and Interceptor Sewers are also located in a complex environmental setting characterized as Ravine Areas. These are lands regulated under the City's ravine by-law or the Toronto and Region Conservation Area (TRCA). As noted in Figure 2 through Figure 4, the ravine areas are comprised of smaller streams, developed nature trails and are home to a host of protected species. Work in these areas is complex and requires considerable planning and environmental controls. The East Don River Trunk Sewer and the Highland Creek Interceptor Sewers both flow through ravine areas.

3. THE PROBLEM

Common subsurface features in the Ravine Areas in Toronto include soft to very soft coarser grained soils with a phreatic groundwater surface. In the context of pipes that develop infiltration and exfiltration defects, these are not only very complex places to build and/or rehabilitate pipes, but they are also areas that are very susceptible to rapid and extreme loss of ground and pipe level under adverse groundwater or higher flow conditions, as depicted in Figure 5. This form of deterioration has been widely reported by a variety of researchers (Cullen) and is characterized in both the WRc SRM and ASCE MOP 62.

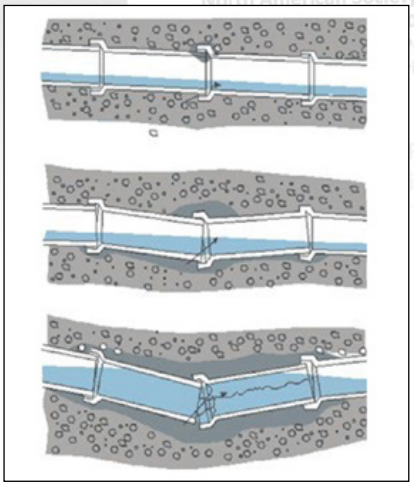

Figure 5. Loss of Ground Due to Infiltration/Exfiltration

For 4 of the 5 years in the GTA in the 2017-2021 time period, annual precipitation was above normal, and both of the sewers covered in this paper developed severe settlement issues leading to pronounced pipe settlement and in the case of the HCI, a surficial sinkhole. They were similar vintages of sewers (concrete pipes from the 1950s) with very similar subsurface conditions and presenting equally challenging Emergency Repair problems. The EDTS Emergency Repair was carried out in fall to early winter of 2021, while the HCI Emergency had its repair completed in April 2022.

3.1 East Don River Trunk Sewer (EDTS)

At the EDTS site, the host pipe was a 1200 mm (48-inch) nominal pipe size (NPS) reinforced concrete pipe (RCP), reported to be a non-cylinder type pressure pipe installed in 1959. Based on the observed pipe lengths and joint configuration, the pipe was an ASTM C361 style of concrete pipe with gasketed joints but with the bell and spigot constructed entirely of concrete. This was common in manufacture in the GTA at the subject time and would likely have been manufactured in an identical manner to ASTM C76 pipe but with the intent of having a joint with superior hydrostatic integrity.

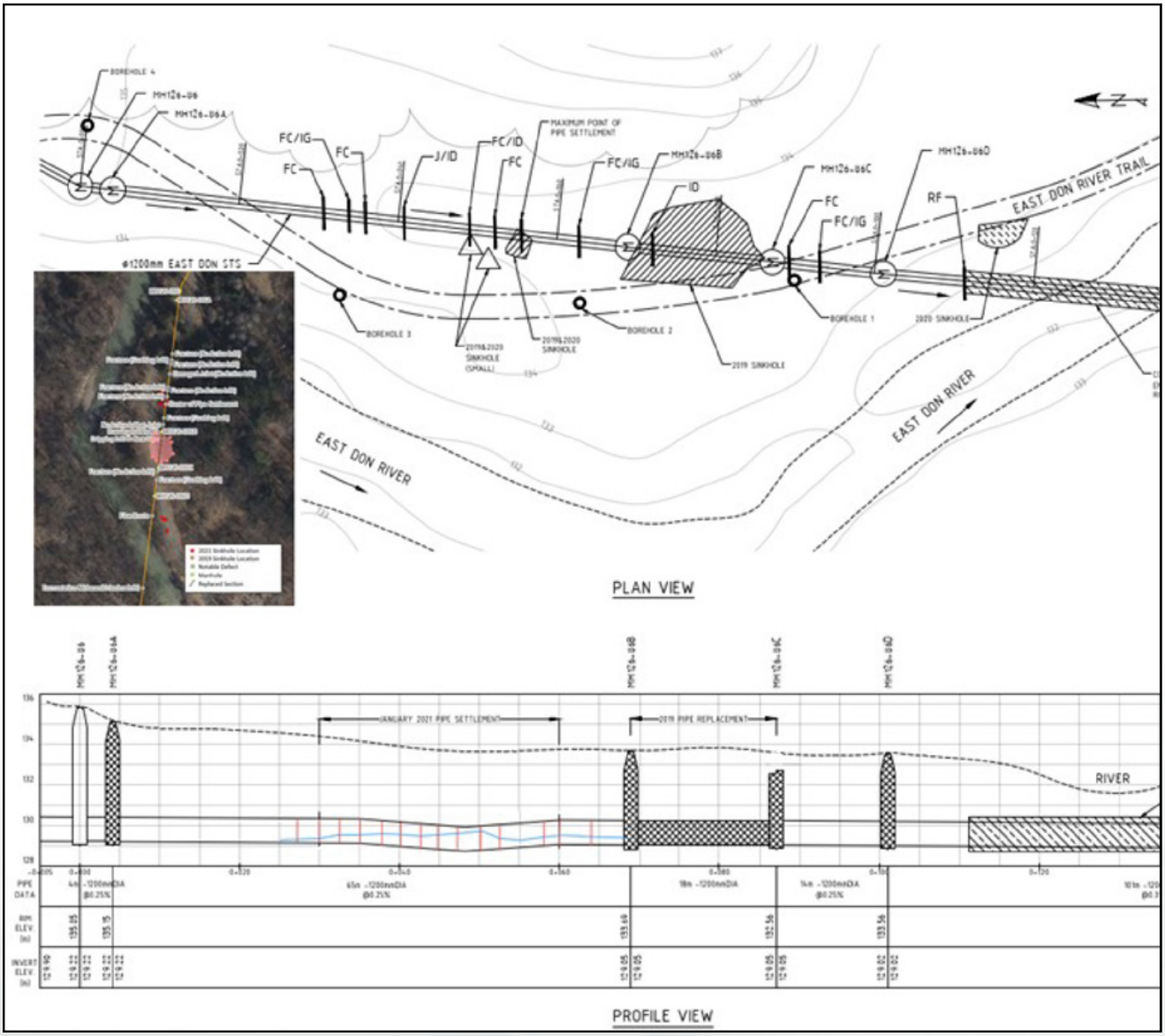

Figure 6. EDTS Plan-Profile of Pipes Engaged in Settlement Trough

The section immediately downstream of the 2021 emergency (as noted in Figure 6) had developed into a sinkhole in 2019 and was repaired with great difficultly and at considerable expense by open cut methods. That section was also showing initial signs of infiltration again and needed further remedial work in conjunction with the 2021 emergency repair.

Figure 7. HCI Location Plan and Surficial Settlement/Sinkhole

The section from MH126-86A to MH126-86B, which was not replaced in 2019, had numerous severe infiltration defects (e.g. gushers and runners), joint separations, circumferential cracks and fractures and was settling in a select area due to classic infiltration-related loss of ground phenomena as noted above. The 2021 primary repair target was driven by loss of ground settlement which was occurring over about 10-12 pipe lengths (a length of ~26 m or 85 feet). It had developed an extreme sag of about 500-600 mm (20-24 inches) with a pronounced increase in magnitude over about 4 pipes (~10 m or 32 feet). There were no longitudinal cracks or fractures in the pipe, however, if left unaddressed, the settlement would have increased due to the loss of ground from the circumferential defects and would have eventually presented itself as a large sinkhole at the surface, in much the same manner as the 2019 sinkhole. It also ran the risk of initiating a large uncontrolled spill to the East Don River.

The presence of the settlement trough and potential sinkhole development was picked up in follow up inspections by the GTA after the 2019 repair. The first signs of considerable pipe settlement as noted in Figure 6 were picked up in late 2020 inspections and were elevated to emergency repair status by May 2021.

Figure 8. HCI GPR at Sinkhole Location

3.2 Highland Creek Interceptor (HCI)

At the Highland Creek Interceptor site, a road depression/sinkhole development became evident in late June/early July 2021. As noted in Figure 7 and Figure 8, the surficial sinkhole was at a MH immediately adjacent a bridge structure over the Highland Creek.

CCTV and MH inspections were initiated as well as a subsurface investigation. While the flow levels were very high in the pipe, it was clear that:

- Both the 1050 mm (42-inch) from MH105-104 and 900 mm (36-inch) from MH104-103 pipes were precast reinforced concrete pipe (RCP), likely ASTM C76 pipe (based on the use of 1.2m/4ft long pipe lengths).
- The 1050 mm pipe entering MH220-104 had a severe fracture at the crown (Figure 9) and appeared to be articulating at the connection to the MH in a manner consistent with settlement of the MH structure. Approximately 4 pipes over 4.8 m (16 feet) were engaged in a settlement trough and at the MH had settled from 300-400 mm (12-14 inches). The remainder of the pipe back to MH105 had no cracks, fractures, or active infiltration, but had pronounced H2S corrosion from 10:00-2:00 throughout.
- The 900 mm pipe exiting MH220-104 also had a pronounced crown fracture and appeared to be articulating, as well, in a manner consistent with

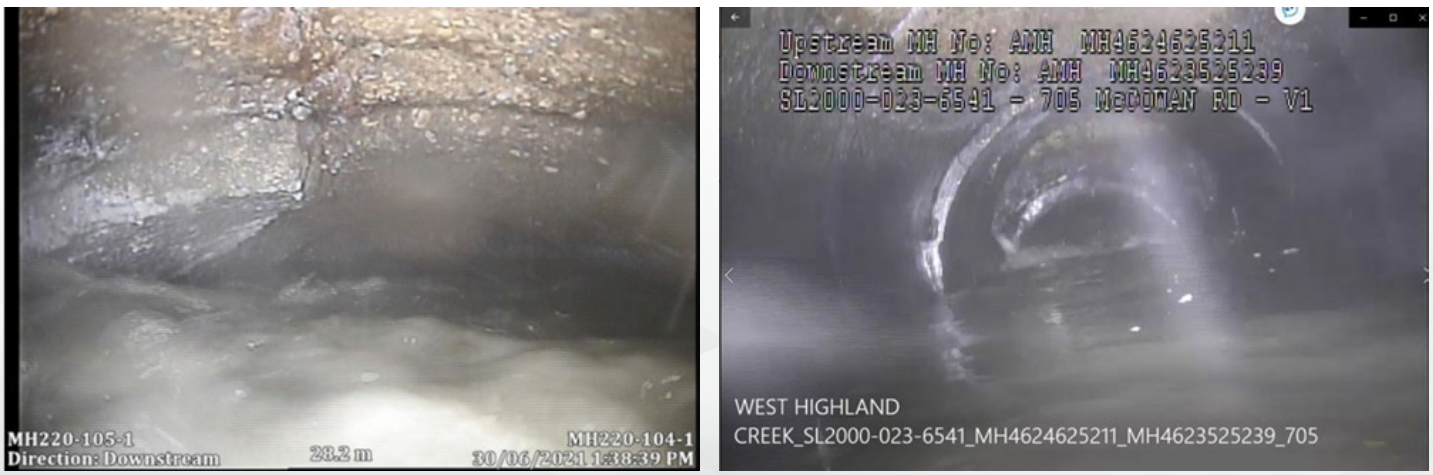

Figure 9 - HCI Severe fractures and Settlement Related Defects at MH Structure

settlement of the MH structure. The settlement trough had engaged the first 2 pipes out of the MH. The remainder of the pipe to MH103 had pronounced H2S corrosion in the crown often ranging up to 9:00 to 3:00 with aggregate fully exposed, reinforced steel exposed in some areas but no evidence of longitudinal fractures.

- MH220-14 was 9.4 m (31 feet) deep and was constructed with a lower, square/rectangular cast-in-place (CIP) concrete section about 4-5 m (13-15 feet) high and then topped off with a circular brick riser. The brick riser section was intact; however, the lower CIP concrete section had a distinct diagonal wall fracture consistent with a structure experiencing differential settlement.
- Geotechnical borings were undertaken and the soils in the upper strata around the MH were alluvial sands and gravels transitioning to a soft alluvial silt at the bottom of the MH and underneath. Standard Penetration Test blow counts in the silt later were less than 4.

The surficial sinkhole was also surveyed with Ground Penetrating Radar (GPR) in September 2021. This revealed a potential 3.0 m wide x 6.2 m long void with a depth of 600 mm in the curb lane and 300 mm in the passing lane. The road lane with the sinkhole had been isolated since original discovery of the surficial settlement and weekly monitoring had been taking place, which indicated that the situation was, at least for the time being, stable.

Based on the investigations, the primary cause of the sinkhole was believed to be:

- Settlement of MH220-104, which initiated the structural defects in both the 1050 mm pipe, the MH and settlement associated in both the 1050 mm and 900 mm pipes.

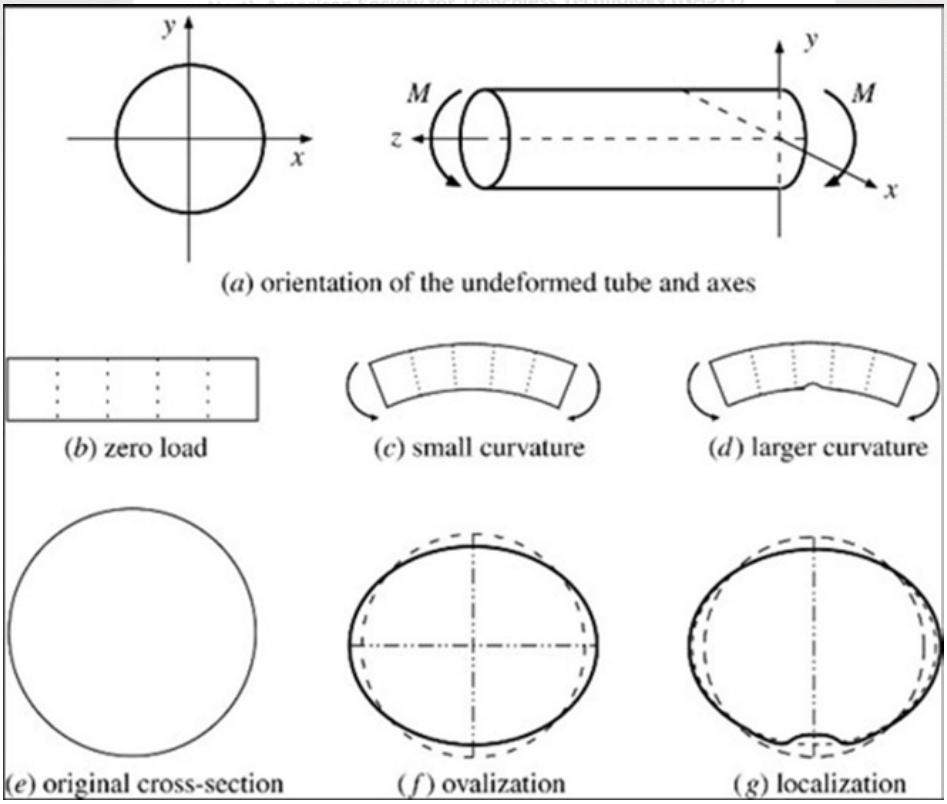

Figure 10. Longitudinal Design Checks

- Soil migrating into the STS system through the defects in the pipe initiating a loss of ground.
- While the settlement could have been initiated some time ago, it was likely exacerbated by the increased wet weather and the unique soil strata at the site.

While geotechnical investigations were initiated to assess whether a large slope instability had been initiated, it was clear that continued loss of ground would occur which if left unabated, could take out a portion of the bridge structure and would also result in a large release of raw sewage to the Highland Creek. Slope monitoring was put in place as noted and things were currently stable, but the loss of ground needed to stop. A prompt mitigation strategy was necessary.

4. THE SOLUTIONS

4.1 East Don River Trunk Sewer (EDTS) - Design

The 2019 Emergency Repair was undertaken using open cut construction. Dewatering, even to shallow depths, was found to be very expensive and complex to support conventional pipe replacement. Making watertight joints in that type of environment had also proved to be challenging. As well, in the pipe sections from MH86A-B that had settled, infiltration was occurring at rates that were not technically feasible to be arrested by conventional internal grouting methods. So conventional relining would be complex as well.

If infiltration could be mitigated, the defects present did not preclude a close-fit lining solution such as CIPP. There was a severe sag present and that could not be removed by lining. However, a simple hydraulic analysis including the upstream and downstream sections and the high flows present in the EDTS, suggested that a relined section ought to perform adequately as a short, inverted siphon. As the soils were very soft, there were concerns about some residual settlement occurring even with relining.

To assess the impact of longitudinal effects on liner design, a range of additional design checks as noted in Figure 10 were carried out to ascertain the limit states from Reissner Effect Buckling (i.e. buckling due to longitudinal bending of a cylinder), the strain limit due to the potential stretching of the liner from axial movement, and the flexural strength limit state due to increased ovalization from longitudinal bending. From a practical perspective it was determined that the liner could accommodate approximately 140 mm (5.5 inches) of additional settlement with full safety factor and would not likely fail due to axial effects until the additional settlement reached over 500 mm (20 inches).

While additional axial movements of this magnitude were not contemplated, ground stabilization measures were reviewed to ensure that they did not. A local Grouting Specialist, Peter White, was consulted to develop an external ground stabilization program. Working off a leveled surface platform, the final array developed and implemented is depicted in Figure 11. Ground stabilization via external grouting methods had the following advantages:

1. It was largely able to mitigate infiltration such that, man-entry techniques were now safe to touch-up residual infiltration and prepare the pipe for lining.
2. It strengthened the soft soils around the pipe to minimize further settlement risk.
3. It bought time, to prepare the site and put the necessary planning in place to line in slightly less of an urgent manner, as the primary causes of sinkhole development were arrested.

While a variety of grout mixtures were investigated, the EDTS used cementitious grouts to mitigate the majority of the infiltration and to the strengthen the soils around the pipe.

The remainder of the design used a standard unfilled polyester resin, a 30 mm nominal tube thickness based on design values for flexural modulus and strength of 2413 MPa (350,000 psi) and 31 MPa (4500 psi), respectively. A fully deteriorated pipe condition was assumed using the ASTM F1216, Appendix X1 design approach. From a functional perspective the CIPP liner was fitted with end seals at all MH terminations and the MH's themselves were water proofed with polyurethane grout at all joints.

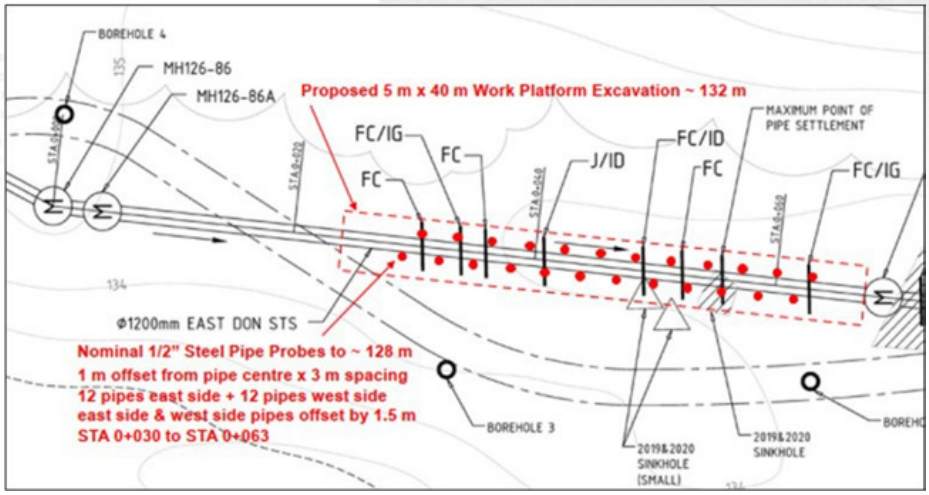

Figure 11.External Grouting Array - EDTS

4.2 Highland Creek Interceptor (HCI) – Design

The HCI was much deeper than the EDTS. MH220-104 (the MH that had settled) in Figure 7 was 9.4 m (31 feet) deeper. As noted in Figure 12, the MH structure as well as the pipes entering the MH exhibited severe fractures and 2 of the 900 mm pipes were engaged in a settlement trough and 4 of the 1050 mm pipes outside of the MH.

Figure 12. HCI Fractured Pipe (left) and Diagonal Fractures in Wall (right) Due to MH Settlement

It was rationalized that ground stabilization in conjunction with CIPP lining was still a viable approach, however, the ground stabilization was considerably more complex due to the depth involved and the liner included three different pipe sizes, thickness design conditions due to their condition state and the applied loading.

To address the complexities of grouting, the grouting specialist suggested the following approach:

1. To address the lower 5 m (17 feet) of the MH, the grout would be injected from the inside-outwardly as shown conceptually in Figure 13. While initially intending to surround the MH for a 1-2 m (3-6 foot) perimeter, the extents were considerable as the radial extent of grout along the 1050 mm sewer showed up in the open joints some 5 m (17 feet) away. The grout was also advanced under the MH to stabilize the soft silt layer.
2. Polyurethane grout was used. In NASSCO Test Cell Research (2016-2019), very soft soils could readily be converted into medium to stiff soils. It as well arrested the majority of the active infiltration.
3. The 4 m (12 feet) of the upper strata soils were grouted from the ground surface downward into the lower grout layer for full extents of voids identified in the GPR survey (Figure 8).

While the CIPP work included a very challenging local sewer, the most formidable relining was the use of a tapered tube to reline all 900 mm, through the MH, and all 1050 mm host pipe in a single shot. While the design involved the same design checks in the longitudinal direction the tube design was broken into the following sections to be installed as a single tapered tube:

1. Section 1 – MH220-104 to MH 103
   a. 900 mm NPS
   b. 3 percent nominal ovality
   c. Min thickness 19.2 mm; use a 22.5 nominal tube size based on other limit state considerations as noted below.

Figure 13. HCI Grouting for Ground Stabilization out of MH

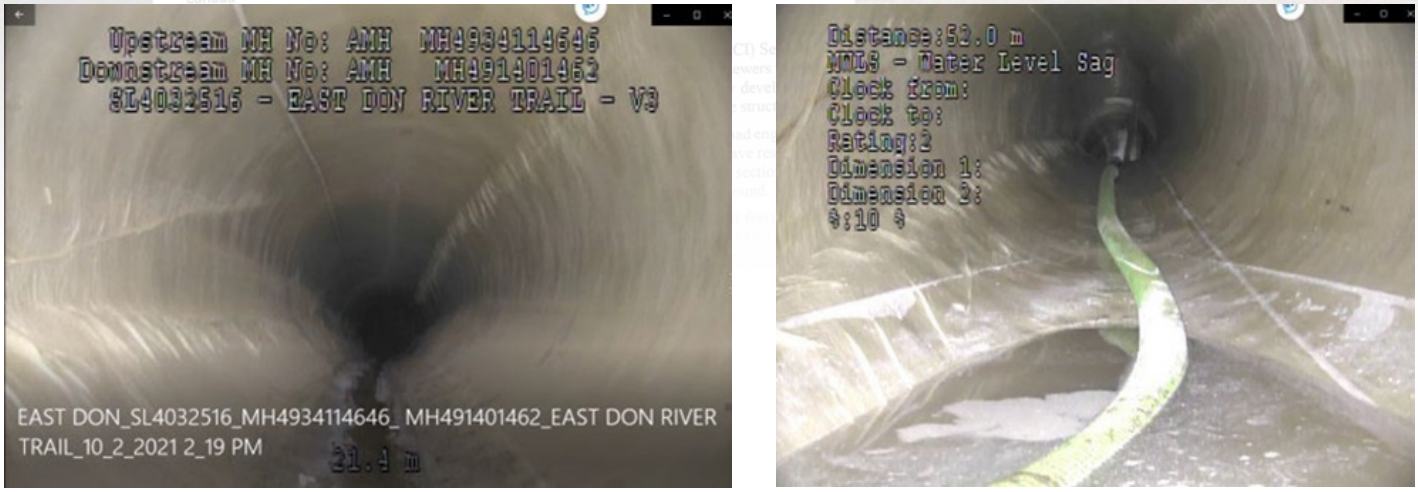

Figure 14. EDTS – Completed CIPP Liner through Settled Portion of Trunk Sewer

2. Section 2: Through MH220-104
   a. Taper tube and transition wall thickness from Section 3 to Section 1 (050 mm to 900 mm)

3. Section 3 – Deformed Section of – MH220-105 to MH 220-104, that started near the MH
   a. 1050 mm NPS
   b. Use 8 percent ovality
   c. Min thickness 32.1 mm use a 33.0 nominal tube size.

4. Section 4 – MH220-105 to onset of deformation near MH 220-104
   a. 1050 mm NPS
   b. 3 percent nominal ovality
   c. Min thickness 23.0 mm use a 27.0 nominal tube size based on other limit state considerations as noted below.

For ease of installation, Section 3 and 4 were consolidated to the same thickness using the more severe of the design conditions noted.

5. IMPLEMENTATION

5.1 East Don River Trunk Sewer (EDTS) – Construction

Implementation required considerable coordination between Toronto Water Operations, Toronto Water's Capital Works Delivery Project Management Staff, design and inspection from the consultant supported by the grouting specialist and Capital Sewer Services to install the works with the support of Multiurethane to facilitate all specialist grouting.

Key implementation dates included:

- July 12 - 22, 2021 – External Grouting completed
- August/September 2021– Dewatering, MH Base Construction (MH126-86B) and External Sealing of one gusher not able to be sealed by external methods
- September 30 - October 1, 2021 – Installation and Curing of CIPP from MH 126-86A to MH 126-86C
- October – December 2021 – site restoration, miscellaneous drainage improvements and some tree plantings (the final tree plantings were completed in early 2022)
- December 7, 2021 – Installation of Link-Seal Joint Repair to seal a gusher present in section from MH 126-86C to 126-86D.

Figure 15. HCI Completed CIPP through Severe Fracture

All completed CIPP installations were subject to a standard design reconciliation and fully met design intent from a structural perspective. One year in service inspections were carried out in 2022 which revealed some point infiltration at one of the modified MH's, which were re-sealed. All other aspects of the installation appeared to be in excellent, the pipe was stable and geotechnical monitoring confirmed that no active slope stabilities were present. The completed liner heading into the severe sag is shown in Figure 14.

5.2 Highland Creek Interceptor (HCI) – Construction

As with the EDTS, implementation of the HCI emergency repairs required considerable coordination between Toronto Water Operations, Toronto Water's Capital Works Delivery Project Management Staff, design and inspection from the consultant supported by the grouting specialist and Capital Sewer Services to install the works with the support of Multiurethane to facilitate all specialist grouting. As the potential for long term geotechnical issues involved interface with an active transportation project to re-furbish the road and bridge structures, Thurber were involved providing additional geotechnical support.

Key dates in the HCI emergency repair included:

1. Completion of subsurface investigations, grouting and liner design in December 2021 and January 2022.
2. Completion of grouting/ground stabilization program in February 2022, and
3. Installation of the tapered CIPP liner the 900 mm and 1050 mm pipe sections in early April 2022.

All completed CIPP installations were subject to a standard design reconciliation and fully met design intent

from a structural perspective. One year in service inspections are due to be carried out in 2023. Geotechnical monitoring carried out over the past year have confirmed that no active slope movements are present. Representative shot of completed liner is shown in Figure 15.

6. CONCLUSIONS

The East Don River Trunk Sewer (EDTS) and the Highland Creek Interceptor (HCI) Sewers are both critical sanitary sewers in designated ravine areas in Toronto, ON. Their emergency repair noted herein captures two separate emergency response efforts in 2021 and early 2022. Both locations were uniquely repaired using a balance of external ground stabilization techniques and CIPP lining with minimal ground disturbance. The HCI repair also included MH lining and a single tapered CIPP tube shot with 4 different design sections (varying wall thickness and tube circumference).

The emergency response carried out was led by Toronto Water Operations and Toronto Water's Capital Works Delivery Project Management Staff. They provided excellent leadership, vision, and classic emergency response management techniques in terms of directly engaging a balance of key Subject Matter Experts and Specialty Contractors to solve a series of very complex problems in a manner that minimized cost and risk to the environment. The collaborative effort of all parties was key to transitioning from an emergency to a new design life for these critical assets.

7. REFERENCES

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There are many benefits for students who belong to a NASTT Student Chapter – scholarships, networking opportunities, education and career opportunities, to name a few. Members of NASTT Student Chapters attend and participate in regional events and the NASTT No-Dig Show where they present trenchless research posters, participate in competitions, and provide event support, monitoring the technical paper sessions.

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To learn more about the 17 NASTT Student Chapters, please visit:
www.nastt.org/student-chapters

NASTT Events Calendar

NASTT NO-DIG SHOW

Upcoming Conferences, Courses & Events

November 7-9, 2023
Western Chapter Good Practices Course and HWEA Conference
Honolulu, Hawaii, USA

November 13-14, 2023
NASTT-NE Northeast Regional Conference
Albany, New York, USA

November 16, 2023
Municipal Sewer Grouting Good Practices Course
VIRTUAL

December 13-14, 2023
Pipe Bursting Good Practices Course
VIRTUAL

April 14-18, 2024
NASTT 2024 No-Dig Show
Providence, Rhode Island, USA

October 21-23, 2024
No-Dig North 2024
Niagara Falls, Ontario, Canada

March 30 – April 3, 2025
NASTT 2025 No-Dig Show
Denver, Colorado, USA

March 29 - April 2, 2026
NASTT 2026 No-Dig Show
Palm Springs, California, USA

Since its inception in 1991, NASTT's No-Dig Show has been the premier North American conference and trade show for the trenchless technology industry. Thousands of professionals from around the globe attend to learn new methods and systems that will save money and improve infrastructure. This conference provides attendees an opportunity to learn trenchless methods, network with peers and gain knowledge from vendors during exhibit hall hours.

NASTT's No-Dig Show is the ideal event for municipalities, contractors and engineers.

March 30 - April 3, 2025
Colorado Convention Center
Denver, Colorado

April 14 - 18, 2024
Rhode Island Convention Center
Providence, Rhode Island

March 29 - April 2, 2026
Palm Springs Convention Center
Palm Springs, California

SPONSORSHIPS:

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For more information and the latest course offerings, visit nastt.org/training/events.

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- Mobile App Sponsorships
- Premium Conference Sponsorships
- And more!

To sponsor or exhibit at any of these events, please contact NASTT:

888-388-2554

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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.

Pipeline construction can pose risks to a project if the construction is not approached properly. Risk mitigation is critical to the success of the project. NASTT is a not-for-profit engineering society offering education and training for the **engineer** that can help mitigate these risks and result in successful project planning and completion!

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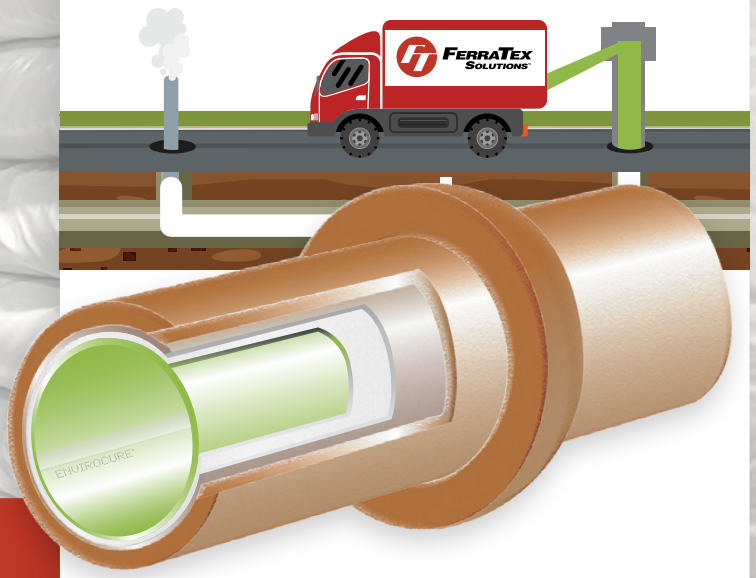

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