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# TRENCHLESS NORTH AMERICA



The Official Magazine of the North American Society for Trenchless Technology



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**2023**

*Introducing the*

## NASTT 2023 Board of Directors

**NASTT 2023 NO-DIG SHOW  
Conference Edition**

**SPRING 2023**  
Volume 13 • Issue 1

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# TRENCHLESS NORTH AMERICA



The Official Magazine of the North American Society for Trenchless Technology

SPRING 2023 – VOLUME 13, ISSUE No. 1

## Q&A: JOE LANE, NASTT NO-DIG SHOW PLANNING COMMITTEE CHAIR



Interview with Joe Lane, Insituform, former NASTT Board Member and current Chair of the No-Dig Show Planning Committee. Joe's lengthy service and deep knowledgeable perspective on a wide range of trenchless methods has proven invaluable. He offers his thoughts on the current state of the industry, and future prospects.

10



40



## FEATURES

### 28 NASTT 2023 NO-DIG SHOW

WELCOME Trenchless Colleagues! Spring excitement is in the air, and the world's largest Trenchless Technology conference & trade show is back in action in the beautiful Pacific Northwest at the Oregon Convention Center in Portland. Full conference preview, events and networking schedule. Enjoy!

### 38 Hall of Fame 2012 - 2023

A legacy of trenchless technology leadership, innovation and success. The NASTT Hall of Fame honors members who have made outstanding accomplishments and exceptional contributions to the advancement of the North American trenchless industry. Profiles of the two exceptional 2023 inductees: Steven R. Kramer and Kevin Miller.

### 40 NASTT 2023 Board of Directors

Meet YOUR 2023 NASTT Board of Directors and Officers! At the helm of the largest and most active trenchless technology organization in the world! Guiding the way are the nineteen members of the NASTT Board of Directors, generously volunteering their own time to provide overall direction for the organization. A salute to the NASTT leadership!

### 58 Microtunnel Combined Sewer Replacement Project Overcomes Challenges

This paper was selected as an Outstanding Paper among the most highly rated and well-attended at the 2022 NASTT No-Dig Show in Minneapolis. It details the challenges associated with an infrastructure upgrade project to improve water, sewer and drainage services to the Maspeth neighborhood in the Borough of Queens, New York, one of NYC's major capital undertakings.

## DEPARTMENTS

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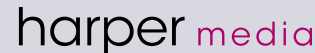
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## WELCOME TO THE SPRING 2023 EDITION OF TRENCHLESS NORTH AMERICA!

It is certainly going to be a busy year for NASTT with a major trenchless technology conference being held in each of the countries we represent: Canada, Mexico and the United States of America. First the 32nd edition of the NASTT No-Dig Show visits Portland, OR in April. October sees No-Dig North in Edmonton, AB as well as the ISTT International No-Dig being held in Mexico City – so hold onto your Stetsons, tuques and sombreros!

Around 6,000 people will participate in the NASTT program this year. Adding in our Regional Chapter seminars, conferences and Student Chapter activities as well as the growth of our scholarship program we aim to reach as many as possible with the best direct access to knowledge and education for trenchless technology.

Already two Good Practice Training courses have been delivered as well as a very successful webinar on Cured-in-Place Pipe (CIPP), supported by AEGION/Insituform. The full schedule for our range of virtual and in-person courses can be found at [www.nastt.org/training](http://www.nastt.org/training) and are delivered on a regular basis.

The program is being further developed with fully revised publications and courses on Horizontal Directional Drilling (HDD) and CIPP as well as a new subject, Direct Steerable Pipe Thrusting (DSPT). Please keep up to date for announcements through subscribing to our weekly e-news for Request for Proposals on these and the highly successful Introduction to New Installation & Rehabilitation Short Courses. Thank you to our Training & Publication Committee members and sub-committee chairs for putting together the 2023 program. Please contact us if you are also interested in being involved.

We are delighted to announce that with the growth of our education and training program, Kari Webb becomes Education Manager with direct responsibility for both our Good Practice Guidelines and Student Chapters – Congratulations Kari and you are an amazing part of our team!

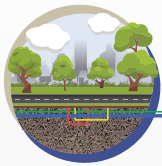
The first NASTT Board of Directors meeting has been held after recent elections. We thank Bo Botteicher, Dr. John Matthew (Louisiana Tech.) and Craig Vandaele (Michels) for their time and outstanding service to the Board of Directors and Alan Goodman (Hammerhead Trenchless) for his leadership and guidance during his time as Chair. We welcome Kim Hanson (Hazen and Sawyer) and Angela Long (City of Aurora, CO) to the team and particularly the 20th Chair of NASTT, Matthew Wallin, P.E. (Bennett Trenchless Engineers).

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

Enjoy your read!

**Matthew Izzard, Executive Director**

North American Society for Trenchless Technology (NASTT)  
[mizzard@nastt.org](mailto:mizzard@nastt.org)



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who volunteer  
and contribute to  
making us better,  
thank you.”*

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## DEDICATION & CELEBRATION IN 2023

This year I begin my term as Chair of NASTT's Board of Directors, and I am looking forward to seeing the continued progress and expansion of not only NASTT but of the trenchless industry. 2022 was an excellent year for us, despite all the challenges we have faced as a society over the past three years. We saw growth in our organization, and we welcomed our first Student Chapter in Mexico! And 2023 is already proving to be just as exciting as ever.

We are looking forward to the NASTT 2023 No-Dig Show being held in Portland, OR, April 30 – May 4. The abstracts submitted for the 2023 program were of the highest caliber and the technical schedule reflects this level of excellence. This issue previews all that the conference has to offer so be sure to look at the technical schedule, exciting networking events, awards and more in the coming pages.

Mark your calendars for October 17-18 for the 39th International No-Dig in Mexico City and October 23-25 for the fourth annual No-Dig North in Edmonton, AB.

The ISTT International No-Dig Mexico provides a multi-track conference program featuring a mix of technical sessions and a platform for the international community to come together to meet, exchange ideas and network with like-minded people. The conference will be held at the Expo Santa Fe in Mexico City. Visit [www.no-digmexico.com](http://www.no-digmexico.com) for all the details!

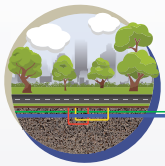
The NASTT Canadian Regional Chapters come together to present the No-Dig North conference. No-Dig North will take place at the Edmonton Convention Centre and features two full days and four tracks of sessions as well as Good Practice Courses on the first day of the conference. The conference will also include an exhibit hall with over 100 exhibitors. Visit [www.nodignorth.ca](http://www.nodignorth.ca) to learn more!

NASTT exists because of the dedication and hard work of our volunteers, and I'm delighted to recognize one of those volunteers, Past Chair, Craig Vandaele with the Chair Award for Distinguished Service. This award recognizes trenchless professionals that have provided both NASTT and the trenchless industry with meritorious, prominent, and long-standing service. One NASTT Member each year is chosen at the discretion of the NASTT Chair. In the transition year between outgoing Chair Alan Goodman and myself as the incoming Chair, it made sense to make a joint decision on the recipient of this year's Chair Award. As Alan and I discussed the award criteria, the obvious choice was Craig Vandaele. Craig came to the Chair position in 2019 with lots of energy and many plans for moving the Society forward. And then in the middle of his tenure, COVID stopped everything in its tracks. In that challenging time when many were floundering to adapt to a new normal, Craig's leadership was pivotal in guiding NASTT through our first year without a No-Dig Show in three decades. By keeping the Board focused on finding innovative ways to continue our mission of trenchless education, while protecting our financial foundation, Craig led us through those uncharted and difficult seas. Through the end of his Chair term, and continuing as a strong Immediate Past Chair, Craig helped forge an improved NASTT that is in a very strong and exciting position to continue as the premier organization for trenchless professionals. So, Alan and I offer this award to Craig Vandaele in appreciation of his years of exemplary service to NASTT!

Our Society is only as strong as our members, volunteers, and staff. With that in mind, we are in great shape! We truly thank you all for your dedication.

*Matthew Wallin*

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



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**Joe Lane**

*Starting out as a CCTV Operator and tap cutter, Joe Lane has for 30 years been working his way around and up the trenchless technology industry. The deep and knowledgeable perspective on trenchless methods he has acquired, has been of immeasurable value to NASTT as an organization. Joe served on the NASTT Board of Directors for six years and is Past President of the NASTT Rocky Mountain Chapter. He is the current Chair of the NASTT 2023 No-Dig Show Planning Committee.*



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

It might surprise you, but working in the underground construction industry was not a dream of mine when I was a kid. Like a lot of other professionals, life has a way of pointing us in a direction that we never knew existed. Graduating from college with a degree in biology, it didn't take me long to realize I could not pay off student loans on biologist wages. Having worked in the oilfield and construction industry throughout college, going to work in the field for an innovative company like Insituform in 1991 felt like, and turned out to be, the right move fresh out of college. I started as a CCTV operator and tap cutter then worked the next 30 years in many different roles that increased my career responsibilities into business development, training, operations, and executive management. I'm grateful that I was blessed with such a fulfilling career in the trenchless industry and still have a great deal to accomplish and contribute.

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

Trenchless technology, specifically cured-in-place-pipe (CIPP), was a relatively new construction method when I started. Primitive by today's standards, it often took us 24 hours or more to complete a single segment of small diameter CIPP. Working with early generations of cameras, robots, and equipment, we overcame numerous challenges often by techniques invented on-the-fly by individuals with above-average tenacity and grit. My earliest memories are of working summer nights in the back alleys of downtown Denver, freezing winters at Wyoming powerplants and hot, humid summer days in an Oklahoma paper mill with co-workers who became

lifelong friends. Today, trenchless technologies are much more sophisticated, cost-effective, and environmentally friendly, making them the preferred option for many infrastructure projects.

**What is your life purpose?**

My focus has shifted over time. For many years, I was very career-driven; always looking to advance to the next level. As a result, I have had fulfilling experiences living and working in several regions of the U.S., Australia, and Europe. I consider myself incredibly lucky to have been blessed with so many wonderful life experiences all over the world, and it's largely due to the opportunities provided by the trenchless industry. At this point in my career, I'm more focused on mentoring and bringing people along to improve their knowledge, skillset, and encourage them to enter and maintain their engagement in this industry. I've had some great mentors and I would like to give back to the industry by furthering the careers of those around me as my mentors did for me.

**How did you first get involved with NASTT? What are some of the goals and initiatives you would like to see NASTT pursue?**

I was in the industry for several years before I got involved with NASTT. I wanted to be more involved in the industry by carving out time for volunteering, education, mentoring, and leadership roles. I became involved with the Rocky Mountain Chapter in its infancy in 2009 then with NASTT as a Board member in 2013. It is hard to describe how valuable NASTT has been in my career. I have met many people with great ideas and done amazing projects resulting in so many improvements to our communities. NASTT members are consistently selfless and give back to the industry. These friendships have been personally and professionally rewarding.

**What are your thoughts on the current state of the trenchless industry? What areas do you see evolving in STEM education and post-secondary academics?**

I can't emphasize enough how critical the trenchless industry is for the reliability and resiliency of our nation's pipeline infrastructure. Water and wastewater pipelines are critical components, providing essential services to support public health, economic development, environmental protection, and resilience.

Our industry benefits from STEM programs in the areas of engineering, construction, robotics, and electronics. Many trenchless companies are working closely with Career & Technical Education (CTE) and trade schools to train and prepare operators and technicians for rewarding careers. I have presented trenchless construction in my kids middle school classrooms for Career Day and was amazed how many kids were interested and intrigued – construction drew more interest than police officers, fire fighters, doctors, and tattoo artists. Kids love the robots and cool equipment and we must find ways to appeal and attract our future workforce. I am proud of NASTT student chapters and the impact we are having to recruit future professionals into the trenchless industry. We typically have more than 100 students help us put on the No-Dig show each year and getting them involved

in industry events is an excellent way to expose them to amazing career opportunities.

**Is the trenchless industry generally doing a good job of attracting young professionals? What do you think can be done to better engage students and young professionals in the trenchless industry?**

The trenchless industry has been actively working to attract young professionals, but there is still room for improvement. Ironically, because of one of the biggest attributes of trenchless construction, which is minimal environmental disruption, our industry is largely unseen where students and young professionals (as well as the general public) are typically not exposed to the industry or our projects therefore are not aware of the opportunities available or may not understand the benefits of working in this field. NASTT is an industry leader in engaging students and young professionals through their student chapters and the opportunities they offer to collaborate with the industry including internship opportunities, research & development, projects, and networking opportunities. By taking the proactive approach to engaging students and young professionals as demonstrated by NASTT; contractors, engineers and owners can help build a pipeline of talented individuals who are passionate about advancing this field and driving innovation.

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

While acceptance and understanding of trenchless technologies has improved, there continues to be an ongoing need to educate employees, engineers and owners about the methods and benefits of trenchless construction. One of the biggest challenges facing the trenchless industry today is the need for increased public awareness, funding, and acceptance of trenchless technologies. Although these technologies have been proven effective and efficient for many infrastructure projects, there is still a perception among some stakeholders that traditional excavation methods are more reliable and safe. Another challenge facing the trenchless industry is the need for ongoing innovation and improvement. As infrastructure projects become more complex and demanding, there is a need for new technologies and techniques that can meet these challenges. This requires significant investment in research and development, as well as collaboration between industry stakeholders and academic institutions. Trenchless offers numerous environmental advantages over conventional pipeline replacements techniques and many professionals are drawn to better construction techniques that are less invasive to the environment and

community. An additional challenge faced by the trenchless industry is the shortage of skilled labor, an area we are addressing with multiple tactics such as expedited hiring practices, internal recruiters focused on talent acquisition at all levels, numerous advancement opportunities, and industry leading compensation.

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

I've been thoroughly impressed with the level of talent and knowledge within NASTT and the industry at-large. The people, customers, and employees are what make this industry so rewarding. Our industry plays a significant role as environmental stewards in the conservation of water and the sustainability of our resources; our work has a significant role in reducing environmental impact with a much-reduced carbon footprint and minimized disruptions to residents and businesses compared to conventional pipeline replacement methods. We're also seeing more use of alternative delivery practices that value qualifications and expertise over low bid. This is an exciting time for the trenchless industry, and I'm proud to be part of it. The trenchless technology field is experiencing rapid growth, which means additional opportunities for career growth and advancement for individuals who work in this field. This may include opportunities for professional development, leadership roles, and other careers.



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## Where's Morty the Tunnel Rat?

### Morty's Adventures and Travel with Iowa Trenchless

By: Wes James, Iowa Trenchless



#### Introduction

Iowa Trenchless was excited to bring Morty the Tunnel Rat home from NASTT's 2022 No-Dig Show in Minneapolis, MN last year, and has been doing their best to keep him gainfully employed since!

At each year's NASTT No-Dig Show, Morty the Tunnel Rat donates his services for the upcoming year to the highest bidder, in a tradition of raising funds for NASTT's Annual Educational Fund Auction. Since 2002, NASTT's annual auction has raised over \$1.2M to support educational initiatives. All of the proceeds are used to support trenchless training, technical course manuals, university student chapter attendance at the No-Dig Show, awarding student and municipal scholarships, and to provide targeted training to NASTT members. (see pg 32)



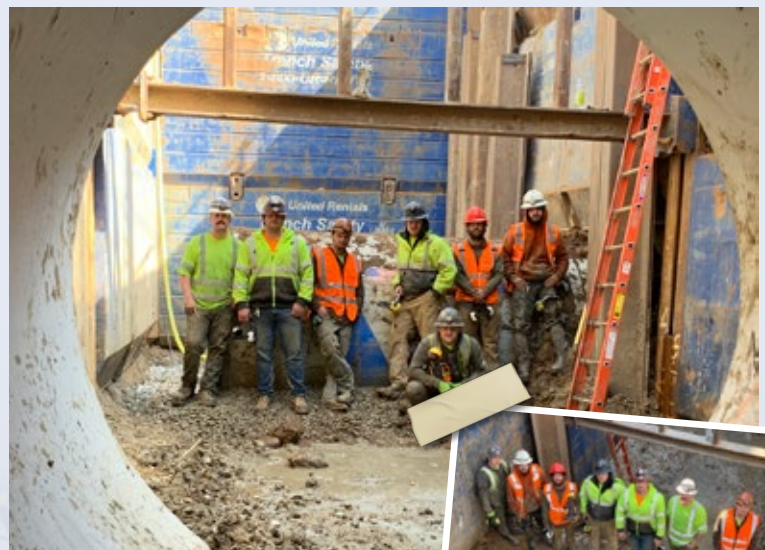
Morty's old crew (L-R): Tyler Ireland, Lance Atkinson, Chris McClellan, Kyle Spoon, Randy Siemers, James Bailey

Morty kicked off his year at Iowa Trenchless by catching up with his old tunneling crew including superintendent Randy Siemers and meeting his new team, then went straight to work on his first job of the year with foremen Lance Atkinson and Kyle Spoon on their Closes Creek project in Des Moines, Iowa.

#### Des Moines, IA - Closes Creek Storm Sewer

This project is part of the City of Des Moines, Iowa's multi-year plan to mitigate flooding in the Closes Creek Watershed. In an effort to mitigate future flooding issues, the City of Des Moines implemented four long-term stormwater improvement plans for areas with previously inadequate drainage. The project scope of work included increasing the capacity of existing stormwater culverts and installing additional storm sewer infrastructure including two separate 150-foot tunnels of 84-inch RCP, as well as 340-foot and 152-foot tunnels and jacking 72-inch RCP using open-faced Akkerman TBM tunnel machines and pipe jacking techniques.

In addition to performing efficiently and safely in a high-traffic residential setting, the Iowa Trenchless crew went the extra mile to create cost-effective work plans, including installation of two separate 84-inch tunnels from one launch shaft and job-site layouts to safely accommodate existing



Morty and team with the Akkerman 720TBM coming into the side of the shaft; (L-R): Shawn Hunt, Lance Atkinson, Kyle Spoon, Justin Jungles, Alex Bower, Jacoby Winters, Noah Ramsey



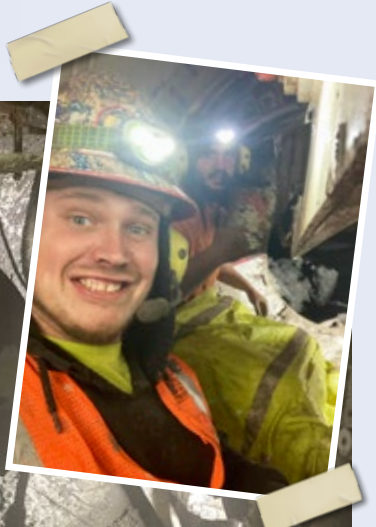
Morty loves the variety of projects he works on!



Tunneling Out – the Iowa Trenchless Excavator Shield operator gets a glimpse of their team member operating another excavator



BEFORE AND AFTER: Justin Jungles and Noah Ramsey taking a break inside the Akkerman 960 TBM



geography, multiple residences, and heavy pedestrian traffic while minimizing disruption to the neighborhood. This was a unique and important project, and earned a finalist spot for the 2022 NUCA Top Jobs competition.



In order to make this project work, multiple tunnels shared one shaft, which had to be angled to accommodate both purposes, and allowing a receiving shaft to be the launch shaft for the next drive

# Morty's Trenchless Academy

## Crawford County, IA DOT 301

Back at the yard, it was time for Morty to get back to work for the Iowa Department of Transportation, this time tunneling 200 LF of 72-inch RCP with the Akkerman TBM and 450LF trenchless installation of 30-60-inch steel casing for storm water culverts under highways 59 and 141.



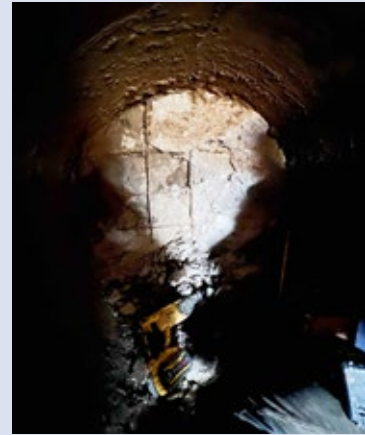
TUNNELING OUT - (L-R): Justin Jungles, Lance Atkinson, Lane Gagnard, Jacoby Winters, Shawn Hunt



Morty gets to work for the Iowa Department of Transportation



Twin 60-inch tunnels installed to replace a structurally deficient box culvert



Morty removes a reinforced concrete obstruction with explosive enthusiasm





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# Morty's Trenchless Academy

## Pre-Bidding and Job-Site Inspections

Then Morty tagged along to a pre-construction meeting in Utah with Superintendent Rick Siemers. As you can tell, he's really excited to promote Iowa Trenchless and the outstanding work performed by our professional crews. Morty helped Rick operate the drone for pre-bid and jobsite inspections.



Morty and Superintendent Rick Siemers heading for Oklahoma to inspect jobs



Rick and Morty use the Iowa Trenchless drone to inspect job sites before and during trenchless installation projects



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## Sioux City, IA - 6th Street Sanitary Sewer

After loading trucks safely all day, Morty and the crew are ready to mobilize for a Sioux City, Iowa project to jack & bore 140LF of 30-inch steel casing for an 18-inch sanitary sewer, including bore and receiving pits, to cross underneath the BNSF railroad.



*Morty ready to mobilize!  
(L-R) Shaylon Brady, Jim Herbst,  
Ryon Herbst, Kyle Spoon, Noah Ramsey*



*Before the machine can be set up, Morty and crew always make sure the bore pit starts out on line and grade. This Akkerman 240 GBM has it made in the shade*



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NASTT member Iowa Trenchless is a full-service boring and tunneling company located in Panora Iowa.

Founded in 2002, the company offers services nationwide that include auger boring, rock boring, pilot tube boring, microtunneling, pipe ramming, pipe jacking, pipe bursting, railroad crossing, and bore pit design.

Iowa Trenchless takes pride in using the newest technology and equipment to get the job done right the first time. Their website is [www.iowatrenchless.com](http://www.iowatrenchless.com).

# Morty's Trenchless Academy

## Glidden, IA - Minnesota St SS Extension

116 feet of 24-inch steel casing and 139 feet of 8-inch PVC for Sanitary sewer; set new manhole, connect to existing manhole; remove/replace pavement. Morty comes through on another crucial job!



Morty ready to mobilize! (L-R) Joe James, Jason Craver, Jon Kile



Joe James welding while Morty takes a break

## Conclusion

Working in the Trenchless Industry, Morty says he gets to work with the best people, and loves the variety of projects he works on. With a long family history in the Tunnel Industry, Morty is always eager to share the projects he's been working on and the places he's been. He won't gnaw your ear off... but he might talk it off!

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No-Dig North is owned by the North American Society of Trenchless Technology (NASTT).  
For more information about NASTT or other NASTT events, please visit [nastt.org](http://nastt.org).

# NO-DIG NORTH Trenchless Technology Conference 2022 Recap



## Third Annual NO-DIG NORTH Trenchless Technology Conference 2022

### Toronto Show Sets New Record for Attendance in Canada



As one of the foremost municipal regions in North America in the use of trenchless technology methods, Toronto was a natural location for the 3rd annual No-Dig North Show October 17 – 19, 2022 at the historic Beanfield Centre.

Jointly hosted by the three Canadian NASTT Regional Chapters – Great Lakes, St. Lawrence Atlantic (GLSLA), British Columbia, and the Northwest Chapter – the 2022 No-Dig North set a record in Canada, with 818 attendees, further cementing its reputation as one of the top underground infrastructure events in Canada. The two previous No-Dig North events were held in 2019 (Calgary – 573 attendees) and in 2021 (Vancouver – 489 attendees). There was no No-Dig North in 2020 due to the Covid-19 restrictions in place at this time.



*“I strongly believe that conferences like No-Dig North are invaluable resources to learn from peers and network with connections, old and new.”*

*– David Crowder CET, No-Dig North Conference Committee Chair*



Networking and close personal access to industry expertise is a central feature of No-Dig North

# NO-DIG NORTH Trenchless Technology Conference 2022 Recap



*GLSLA Chapter Chair Kevin Bainbridge, Robinson Consultants Inc., addresses the conference delegates*



*Lou Di Gironimo, General Manager, Toronto Water, delivers the keynote address at the opening breakfast*

No-Dig North delegates enjoyed two full days of technical presentations in four separate tracks, networking events and social occasions along with 92 exhibits showcasing a wide range of trenchless technology products and services. This was preceded by a full day of NASTT Short Courses covering Municipal Grouting, HDD Good Practices Guidelines, and an in-depth overview of CIPP from design to job completion.



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# NO-DIG NORTH Trenchless Technology Conference 2022 Recap



*Two full days of technical sessions in four tracks with 76 individual presentations were the main highlight of the conference.*

Attendees were relaxed and in good spirits at the kick off breakfast where Lou Di Gironimo, General Manager of Toronto Water, delivered an informative keynote address on “Trenchless Technology: A Vital and Versatile Tool in Toronto Water’s Tool Belt.”

As the record-setting success of the No-Dig North Conference in Toronto demonstrates, there is a bright sunny horizon ahead for trenchless technology in Canada! Plans are already underway for the next premier educational opportunity for forward-looking underground infrastructure professionals in Canada with the next No-Dig North 2023 Conference in Edmonton Alberta October 23 – 25, 2023.



*Delegates had easy access to industry experts and 92 trenchless technology exhibits featuring innovative new technologies*

For more details and updates please visit:

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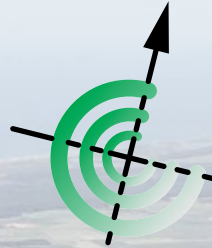
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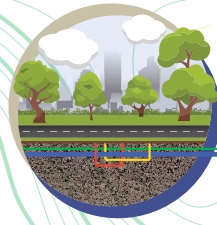
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**GREEN ABOVE.  
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# Now is the Time!

**NASTT 2023 NO-DIG SHOW | APRIL 30-MAY 4 | PORTLAND, OR**

## Educational & Networking Opportunities Await

The No-Dig Show is the trenchless industry's flagship educational and networking event. Each year No-Dig attendees are privileged to the best industry-related content and access to the leading companies and individuals in trenchless technology.

- **Technical papers & presentations**
- **Large exhibition hall**
- **Specialized trenchless training courses**
- **Engaging networking programs & events**
- **Prestigious industry related awards**

Visit [nodigshow.com](http://nodigshow.com) to learn more



**NETWORKING EVENTS | EXHIBIT HALL | TECHNICAL SESSIONS**



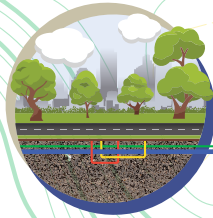
*The No-Dig Show is owned by the North American Society for Trenchless Technology (NASTT), a not-for-profit educational and technical society established in 1990 to promote trenchless technology for the public benefit. For more information about NASTT, visit our website at [nastt.org](http://nastt.org).*



APRIL 30-MAY 4 | PORTLAND, OR

**NO-DIG SHOW**

**2023**



**GREEN ABOVE.  
GREEN BELOW.**

# Conference Overview

**NASTT 2023 NO-DIG SHOW | APRIL 30-MAY 4 | PORTLAND, OR**

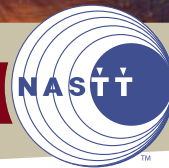


NETWORKING EVENTS | EXHIBIT HALL | TECHNICAL SESSIONS

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# WELCOME Trenchless Colleagues!



APRIL 30-MAY 4 | PORTLAND, OR

**NO-DIG SHOW**

**2023**

Spring excitement is in the air, and the world's largest Trenchless Technology conference & trade show is back in action in beautiful Portland, Oregon!

With six tracks of 130 peer-reviewed technical presentations, detailing environmentally friendly trenchless solutions and cost saving opportunities for municipalities and utilities, the NASTT 2023 No-Dig Show features the latest technology and research, nearly 200 innovative trenchless product and service exhibits and unmatched networking opportunities. This is the premier educational opportunity for trenchless infrastructure professionals from across North America, expanding their knowledge toolbox.

Check the overview schedule in this preview for more information. Included in the session schedule are interactive forums where audience participation is encouraged. One of these is the Innovative Products Showcase featuring the newest innovative product releases in the trenchless industry. Companies presenting products in this session are also this year's Abbott Innovative Products & Services Award finalists. There are an abundance of opportunities for business development, networking, and renewing friendships with trenchless colleagues including luncheons in the Exhibit Hall, the Educational Fund Auction & Reception, and the Casino Royale event.

Finally, be sure to download the NASTT No-Dig Show Smart Phone App! The app is a great way to get involved with the attendee community. Everything you need to make the most of your time at the NASTT No-Dig Show will be right at your fingertips.



*The NASTT No-Dig Show is a great opportunity to meet the hardworking NASTT staff in person! From left to right: Jenna Hale – Marketing Manager, Jessie Clevenger – Business Development Manager, Carolyn Hook – Membership Outreach & Database Manager, Matthew Izzard – Executive Director, Kari Webb – Education Manager and Michelle Hill – Program Director*

Download the full digital Conference Preview here to view the schedule, sponsors, exhibitors and more! Enjoy the show!

<https://www.nodigshow.com/conference-preview/>



2023 No-Dig Show Planning Committee Chair – Joe Lane, Aegion



2023 No-Dig Show Technical Program Committee Chair – Babs Marquis, Delve Underground



The No-Dig Show is owned by the North American Society for Trenchless Technology (NASTT), a not-for-profit educational and

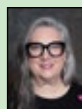
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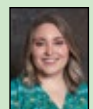
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# NASTT Awards Program

The NASTT awards program recognizes the commendable achievements and remarkable accomplishments of the individuals and companies associated with the trenchless technology industry.

## NASTT Hall of Fame

This award honors NASTT members who have made outstanding accomplishments and exceptional contributions to the advancement of the North American trenchless industry and NASTT.



*The Hall of Fame awards will be presented at the Casino Royale event on Tuesday, May 2.*

## NASTT Chair Award For Distinguished Service

This award acknowledges individuals who have selflessly given of their time and talents to enhance the Society and the industry. The person selected for the Chair Award is the decision of the NASTT Chair.

*The NASTT Chair Award for Distinguished Service will be presented at the Casino Royale event on Tuesday, May 2.*

## Ralston Award For Young Trenchless Achievement

This award applauds savvy NASTT members under 36 who have demonstrated excellence early in their career by making valuable contributions to the trenchless technology industry, achieving noteworthy professional success, and actively participating in NASTT or its regional or student chapters. With their talent and ability, these impressive people are the future of trenchless.

*The Ralston Award for Young Trenchless Achievement will be presented at the Opening Breakfast on Monday, May 1.*

## Abbott Innovative Products & Services Award

This award celebrates companies with a state-of-the-art product or service making a significant impact in advancing the trenchless industry in the areas of rehabilitation or new installation. All applicants will discuss their product at the Innovative Products Forum at the No-Dig Show.

*The Abbott Innovative Products & Services Awards will be presented during the Exhibit Hall Ribbon Cutting Ceremony on Monday, May 1.*



# No-Dig Show Events & Networking *Synopsis*

## Saturday, April 29, 2023

### **NASTT Board Meeting**

9:00 AM – 3:00 PM – Room D136

### **NASTT Technical Program Committee Meeting & Reception**

3:30 PM – 6:30 PM – Rooms D135 & F50

## Sunday, April 30, 2023

### **Attendee & Exhibitor Registration**

7:00 AM – 5:00 PM – Prefunction D/E

### **Introduction to Trenchless Technology – New Installations**

8:00 AM – 12:00 PM – Room D136

### **Introduction to Trenchless Technology – Rehabilitation**

8:00 AM – 12:00 PM – Room D135

### **Pipe Bursting Center of Excellence Meeting**

12:00 PM – 12:30 PM – Room D139/140

### **NASTT Chapter Chair and Vice Chair Meeting**

12:00PM – 1:00PM – Room E147

### **Annual General Meeting**

**(Current NASTT Membership Required)**

1:00 PM – 2:00 PM - Room D139/140

### **NASTT Regional Chapter Meetings**

2:00 PM – 6:30 PM – Rooms TBD

### **Student Orientation Meeting**

4:00 PM – 5:00PM - Room D139/140

### **Young Professionals/Student/Municipal Scholarship Social**

**(Private Event)**

5:00 – 7:00PM – Portland Ballroom Lobby

### **NASTT Past Chair Dinner**

**(Invitation Only Event)**

7:00 PM – 10:00 PM – Room F152

## Monday, May 1, 2023

### **Attendee & Exhibitor Registration**

7:00 AM – 5:00 PM - Prefunction D/E

### **Speaker Ready Room**

7:00 AM – 5:00 PM – Room E146

### **Kick Off Breakfast**

7:30 AM – 9:30 AM – Portland Ballroom

### **Technical Paper Sessions (Tracks 1 – 6)**

9:55 AM – 11:35 AM – Rooms E141, E143, D140, D138, D136 & D135

### **Exhibit Hall Ribbon Cutting Ceremony & Abbott Innovative Products & Services Award**

11:40 AM - 11:45 AM - Prefunction D/E

### **Exhibit Hall Open**

11:45 AM – 3:45 PM – Exhibit Hall D



### **Technical Paper Sessions (Tracks 1 – 6)**

3:45 PM – 5:00 PM – Rooms E141, E143, D140, D138, D136 & D135

### **NASTT Annual Educational Fund Auction & Reception**

5:00 PM – 6:30 PM – Portland Ballroom

## Tuesday, May 2, 2023

### **Attendee & Exhibitor Registration**

7:00 AM – 5:00 PM - Prefunction D/E

### **Speaker Ready Room**

7:00 AM – 5:00 PM – Room E146

### **Coffee Break**

7:00 AM – 8:00 AM - Prefunction D

### **Technical Paper Sessions (Tracks 1 – 6)**

8:00 AM – 10:30 AM – Rooms E141, E143, D140, D138, D136 & D135

### **Exhibit Hall Open**

10:30 AM – 5:10 PM – Exhibit Hall D

### **Casino Royale**

**(Ticketed Event)**

6:00 PM – 10:00 PM – Portland Ballroom

## Wednesday, May 3, 2023

### **Attendee & Exhibitor Registration**

7:00 AM – 12:00 PM - Prefunction D/E

### **Coffee Break**

7:00 AM – 8:00 AM - Prefunction D

### **Technical Paper Sessions (Tracks 1 – 6)**

8:00 AM – 9:15 AM – Rooms E141, E143, D140, D138, D136 & D135

### **Recruitment Connection Hours**

9:00 AM – 12:00 PM – Exhibit Hall D

### **Exhibit Hall Open**

9:00 AM – 1:00 PM – Exhibit Hall D

### **Closing Luncheon**

12:00 PM – 1:00 PM – Exhibit Hall D

### **NASTT Good Practices Course – Day 1**

1:30 PM – 5:30 PM – Rooms D135 - 141

## Thursday May 4, 2023

### **NASTT Good Practices Course – Day 2**

8:00 AM – 12:00 PM – Rooms D135 - 140

# NASTT Educational Fund Auction



## NASTT Educational Fund Auction

MAY 1 | 5:00-6:30 PM | PORTLAND, OR



### NASTT'S 22nd Annual Educational Fund Auction & Reception in the Ballroom!

**Exciting Auction Items**

Bid all day via your mobile device on great items like electronics, wine, spirits, industry items and more! Bidding is open to anyone in North America and items will be shipped to winners.

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**For more information visit [nastt.org/auction/](http://nastt.org/auction/)**

The Annual Educational Fund Auction helps raise money for important causes. Due to your generosity, NASTT is able to provide targeted trenchless training and courses to the industry, publish resource manuals and sponsor university students' attendance to the NASTT No-Dig Show, as well as award scholarships. *Text NASTT23 to 243725 to start bidding or make a donation!*


**Join us back in the ballroom for the trenchless networking social event of the year!** Come celebrate as we **Get Outdoors** in the great Pacific Northwest. Our beloved costume contest returns. Please come dressed in your favorite outdoor attire, whether that be a hiker, lumberjack, tree hugger, or simply a tree for a chance to win a cash prize for the best costume! Food and beverages will be served and plan on having a blast while we raise money for trenchless education!

**50/50 Raffle**

Win some cash for yourself and help our Educational Fund! Buy your tickets through the auction website. The winner will be drawn May 1. You DO NOT need to be present to win! The winner splits the cash pot with the fund.

## DOWNLOAD THE ND23 APP!

Simply search for **"NASTT No-Dig Show"** in your app store.







# Call for Abstracts

**SUBMISSION DEADLINE: JUNE 30, 2023**

The North American Society for Trenchless Technology (NASTT) is now accepting abstracts for its 2024 No-Dig Show in Providence, RI at the Rhode Island Convention Center April 14-18, 2024. Prospective authors are invited to submit a 250-word abstract outlining the scope of their paper and the principal points of benefit to the trenchless industry.

**The abstracts must be submitted electronically by June 30, 2023 on the NASTT website:**

[nastt.org/no-dig-show](https://nastt.org/no-dig-show)



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



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*NASTT Celebrate Trenchless Awards honor the growth and advancements in the trenchless industry. NASTT recognizes the many ways that these individuals contribute significant time, energy and intellect to developing trenchless technology and fostering its success.*



## Chair Award for Distinguished Service

*Recognizing trenchless professionals that have provided both NASTT and the trenchless industry with meritorious, prominent and long-standing service. One NASTT Member each year is chosen at the discretion of the NASTT Chair.*

### Craig Vandaele

Vice President, Trenchless Preconstruction Services at Michels Corporation

NASTT's Board of Directors Chair, Matthew Wallin, P.E. and Immediate Past Chair, Alan Goodman, have chosen Craig Vandaele as the recipient of the 2023 Chair Award for Distinguished Service. Craig is the Vice President, Trenchless Preconstruction Services and Michels Corporation. Craig has more than 20 years of experience in the North American tunneling and trenchless technology industries. His vast experience includes design, inspection, construction and construction management of trenchless projects throughout North America.

Craig has a deep understanding of the complexities of trenchless projects. In his eleven years at Michels, he has served as the project manager on many significant tunneling, HDD, and cured-in-place pipe (CIPP) rehabilitation projects. Among them are the McOrmond Drive Sanitary and Storm Sewer Trunks in Saskatoon, Saskatchewan, Canada; Big Lake Offsite Gravity Portion (W14) in Edmonton, Alberta, Canada; Vancouver City Central Transmission Project, Vancouver, British Columbia, Canada; and Upper Northwest Interceptor Sections 3 & 4 in Sacramento, Calif. He has worked on projects that include conventional tunneling, microtunneling, EPBTBM, pipe jacking, pipe bursting, CIPP and shaft construction of various types and sizes.

Craig is proud to be a leader and an advocate of the trenchless technology industry. He is active in many industry organizations, including North American Society for Trenchless Technology Northwest Chapter (Past Chair), Tunnel Association of Canada (TAC) and of course NASTT. Craig has co-authored papers for several No-Dig conferences. NASTT Chair, Matthew Wallin shared, "In the transition year between outgoing Chair Alan Goodman and incoming Chair Matt Wallin, it made sense to make a joint decision on the recipient of this year's Chair's Award. As Alan and I discussed, the obvious choice was Craig

Vandaele. Craig came to the Chair position in 2019 with lots of energy and lots of plans for moving the Society forward. And then in the middle of his tenure, COVID stopped everything in its tracks. In that challenging time when many were floundering to adapt to a new normal, Craig's leadership was pivotal in guiding NASTT through our first year without a No-Dig Show in three decades. By keeping the Board focused on finding innovative ways to continue our mission of trenchless education, while protecting our financial foundation, Craig led us through those uncharted and difficult seas. Through the end of his chair term, and continuing as a strong Immediate Past Chair, Craig has helped forge an improved NASTT that is in a very strong and exciting position to continue as the premier organization for trenchless professionals. So, Alan and I offer this award to Craig Vandaele in appreciation of his years of exemplary service to NASTT!"

Thank you for your leadership and strength, Craig! We congratulate you! The Chair Award for Distinguished Service presentation will take place during the Casino Royale celebration event in Portland, OR at the NASTT 2023 No-Dig Show on May 2. Join us!

*Celebrate Trenchless Award recipients are recognized at the NASTT No-Dig Show and promoted through NASTT communication outlets which may include [nastt.org](http://nastt.org), social media, NASTT E-News, and NASTT's Trenchless North America. Find out how you can become a NASTT award recipient at [nastt.org/awards](http://nastt.org/awards).*



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## NASTT Hall of Fame Honors Class of 2023

### A Legacy of Trenchless Technology Leadership

*The NASTT Hall of Fame honors members who have made outstanding accomplishments and exceptional contributions to the advancement of the North American trenchless industry and NASTT. We are grateful for their years of service and lasting impact on trenchless technology.*

*Nominees can be current or former NASTT members who have been members for a minimum of 10 years and are age 50 or older. Nominations accepted online March through August. Only current NASTT members can submit nominations. 2022 nominations are now open! Visit [www.nastt.org/no-dig-show/hall-of-fame](http://www.nastt.org/no-dig-show/hall-of-fame) for details.*

*Congratulations to the 2023 Hall of Fame inductees who will be celebrated at the 2023 No-Dig Show in Portland OR at the Casino Royale event May 2, 2023*

The NASTT Hall of Fame is pleased to present its Class of 2023 honorees to NASTT members and trenchless professionals across North America.

“Each of the inductees have worked diligently and selflessly in both the trenchless industry and as NASTT volunteers,” said NASTT Executive Director, Matthew Izzard. “On behalf of the NASTT Hall of Fame committee, we thank them for being trailblazers who shaped the profession and for their contributions that continue to impact the development of trenchless technology solutions.”



#### Steven R. Kramer, PE, FASCE

*Senior Vice President, Tunnel, COWI*

Steven Kramer, PE, FASCE has 38 years of experience in engineering/construction and research and development serving the infrastructure industry. Kramer currently serves as COWI Senior Vice President where he oversees the operation, growth and development of the tunneling and trenchless practice. He is recognized as a pioneer and leader in the underground and trenchless industry. He was a key figure integral in the development of the trenchless tools and techniques that were created over 25 years ago that continue to be used today.

Kramer's expertise resulted in leading the design and construction of over 75 underground and trenchless projects around the globe with construction values up to \$800 million for municipalities, utilities and transportation authorities in the United States, Canada, France, Hong Kong, Ireland, Singapore and New Zealand.

Many of the projects have won awards such as the 1999 and 2003 Trenchless Projects of the Year. As a recognized authority with specialist expertise in trenchless and tunneling methods, Kramer is frequently called upon to serve as an expert in legal/arbitration cases. He often speaks at industry conferences, has published over 90 technical papers and is the co-author of the book, **Introduction to Trenchless Technology**. In recognition of his significant accomplishments and contributions to the industry, Kramer was named the recipient of the 2004 Trenchless Technology Person of the Year award, received a 2016 Engineering Alumni Achievement Award from Washington University in St. Louis and elected to the Moles in 2020.

He holds two B.S. degrees from Washington University in St. Louis – Civil Engineering and Engineering and Public Policy and a Masters in Management from Northwestern University. He is also a professional engineer in five states.



## Kevin Miller

*Senior Advisor, Miller Pipeline Corporation*

Kevin Miller officially started his career in 1973 at Miller Pipeline, an Ohio company started by his uncle and father in 1953. Unofficially, he had already been working at Miller Pipeline sweeping the floors and performing other chores after school. Kevin has worked in nearly every capacity at Miller Pipeline since then beginning as a general laborer. Over the next ten years, he advanced to operator and foreman, eventually moving up the ladder to superintendent, general superintendent, and vice president. It was during this time that Kevin embraced innovations like HDD, CIPP, fold and form, internal joint seals and pipe bursting.

In 2004, he was appointed President and Chief Operating Officer where he recognized the value of trenchless in industries other than natural gas, including the water and sewer industries. He has continuously pushed his teams to think outside the box for the best solution for a customer even if it did not serve Miller Pipeline the best.

Ultimately, Kevin provided many opportunities for manufacturers to test new products in the real world. Without this proving ground, advancement and improvements of many tools of the trade would definitely have had a longer path to fruition. Kevin led Miller Pipeline's growth from a small, regional natural gas distribution contractor to a large contractor with a presence across the country that is admired as a best in class contractor in many fields. Kevin continues to serve the industry as Miller Pipeline's Senior Advisor.

Miller Pipeline would not be the company it is today and many leaders within Miller Pipeline would not be where they are today without Kevin Miller's 50 years dedicated to the advancement of trenchless technology.

*“We thank them for being trailblazers who shaped the profession.”*

– *Matthew Izzard,*  
*Executive Director, NASTT*



## NASTT Hall of Fame Inductees (2012 – 2022)

### 2012

Frank Canon  
Bernie Krzys  
Gary Vermeer  
(1918-2009)

### 2013

Dr. David Bennett  
Ed Malzahn (1921-2015)  
Eric Wood (1935-1994)

### 2014

Bob Affholder  
Joe Loiacono  
Dr. Ray Sterling

### 2015

David Magill, Jr.  
(1943-2014)  
Ron Halderman  
Kaleel Rahaim

### 2016

Martin Cherrington  
Ken Foster  
Richard Thomasson

### 2017

John Hemphill  
David T. (Tom) Iseley  
Roderick W. (Rod) Sutliff  
(1934-2014)

### 2018

Chris Brahler  
Ian Doherty  
George Ragula

### 2019

Maynard Akkerman  
Chris Macey  
Robert Westphal  
(1944 – 2020)

### 2020

James S. Barbera  
(1940-2019)  
Tom Marti  
Lynn Osborn

### 2022

Dennis Doherty  
Paul Nicholas  
Michael J. Willmets

# NASTT 2023 Board of Directors



## *Introducing the* **NASTT 2023 BOARD OF DIRECTORS**



**Leading the WAY to a Bright Successful FUTURE!**

The 2023 NASTT Board of Directors is poised to resume the rapid growth NASTT and the trenchless technology industry have experienced in recent years. As the organization leading and promoting the trenchless technology industry, NASTT provides the membership with educational resources, activities, national and regional conferences, networking events, webinars and much more. With creativity and hard work from both the NASTT Board and Staff, the organization continues to maintain its position as the leading-edge organization for underground construction professionals, showing exceptional leadership looking forwards to a bright successful future for trenchless technology.

The Board is comprised of 19 directors, who are elected by the Society's members. Only elected Directors may serve as Officers of the Society and are appointed by the Board of Directors.

The NASTT Board of Directors manages the affairs of the Society, on behalf of NASTT and its membership. Guiding the way are the nineteen members of the NASTT Board of Directors, generously volunteering their own time to provide overall direction for the organization. Directors are elected by the NASTT membership each year in the fall. Only elected Directors may serve as Officers of the Society and are appointed by the Board of Directors.

New to the Board for 2023 are Kim Hanson, P.E., Project Manager and Tunnel Design Engineer, Hazen and Sawyer and Andrea L. Long, PE, PMP, Principal Engineer, Capital Projects, City of Aurora, CO. This brings the Board to the full complement of 19 Directors. Welcome to the NASTT Board Kim and Andrea!

Meet and welcome YOUR NASTT Board of Directors for 2023!!!



## Executive Officers



### **CHAIR & INTERNATIONAL REPRESENTATIVE**

**Matthew Wallin, P.E.**

*Partner & Senior Project Manager,  
Bennett Trenchless Engineers*

Matthew Wallin is a Principal Partner and Senior Project Manager with Bennett Trenchless Engineers, located in Folsom, California.

BTE's engineering practice is focused entirely on trenchless technology design, construction management, and claims assistance with clients and projects located throughout California, as well as Texas, Florida, Nebraska, Iowa, and Canada. Matthew holds both bachelor's and master's degrees in civil engineering from Case Western Reserve University in Cleveland, Ohio. He began his career working for URS in Oakland, California in 2000 in their geotechnical group. Since that time, Matthew has focused his practice on geotechnical engineering and the design and construction management of new pipeline projects using horizontal directional drilling, microtunneling, open-shield pipejacking, pipe ramming, tunneling and auger boring.

Matthew has been a member of NASTT since 2002 and has participated in the organization in many capacities. He has been an active member in the Western Chapter (WESTT) since 2003 and previously served as a member of the Board of Directors and as the Chapter Treasurer from 2008 to 2016. He joined the No-Dig Program Committee in 2010 and has acted as a session leader for the annual No Dig Conference since that time. Matthew is also an instructor for NASTT's HDD Good Practices Course as well as the Introduction to New Trenchless Methods Course, each of which are taught annually at the No Dig Show and at other off-site venues throughout the year.



### **VICE CHAIR**

**Greg Tippett, P.Eng.**

*Regional Delivery Lead,  
Western Canada Water Group,  
Stantec Consulting Ltd.*

Greg Tippett is the Regional Delivery Lead for the Western Canada Water Group at Stantec Consulting Ltd. He is currently responsible for the

group's project delivery and quality control. Greg graduated from Lakehead University in 2003 and has been working as a

consulting engineer in Alberta's Capital Region since. Throughout his career, Greg has specialized in the design, assessment, and construction of municipal underground infrastructure. Greg has successfully designed and implemented a number of projects within the Capital Region that included the use of several trenchless technologies. His past trenchless experience includes case bore, pipe jacking, horizontal directional drilling, microtunneling and conventional tunneling.

Greg has been an active member of the Northwest Chapter of NASTT since 2009 and is a past Chair of the Chapter's Board. Greg's journey with NASTT began in 2010 when he joined the NASTT-NW 2010 Conference planning committee and has never looked back. Since then he has served in many different capacities on these committees, including Conference Chair for the 2016 and 2018 NASTT-NW Conferences. In 2019, Greg was very proud to Chair the first ever No-Dig North, NASTT's inaugural Canadian Conference.



### **TREASURER**

**Dan Buonadonna, P.E.**

*Global Technology Leader,  
Jacobs's Condition Assessment  
and Rehabilitation Services (CARS)  
Practice*

Dan Buonadonna is a senior technologist for Jacobs's Condition Assessment and Rehabilitation

Services (CARS) practice. He has over 20 years of pipeline analysis, design, and rehabilitation experience for over 1,700 miles of buried water, sewer, and industrial infrastructure.

His consulting career has focused on trenchless condition assessments, trenchless rehabilitation technologies, and buried infrastructure asset management. He has authored over 20 technical publications on pipeline asset management, is a regular presenter at the NASTT No-Dig Shows, trainings, and webinars. He is a member of the Society's Pacific Northwest Chapter and is also involved with the Water Research Foundation as part of Peer Advisory Committees. Dan holds a Bachelor's degree in Civil Engineering from the University of Notre Dame, and a Master's in Environmental Engineering from the University of California, Berkeley.

On the NASTT Board, Dan is committed to improving the dialogue and coordination between municipal owners and industry providers, and advocating for increased diversity and inclusion programs in the heavy-civil marketplace.

# NASTT 2023 Board of Directors



**SECRETARY**

**Babs Marquis, CCM**

*Trenchless Practice Lead –  
East Coast, Delve Underground*

Babs Marquis is a principal consultant at Delve Underground with 30 years' experience in underground project design and construction. He is the

Trenchless Practice Lead for the East Coast, and is located in the Burlington, MA office. Previously, Babs worked for Jacobs Engineering Group for 10 years and Stone & Webster Engineering Corporation for 11 years as a construction manager. During his extensive career in the trenchless industry, Babs has been involved in major tunneling and trenchless projects in the northeast for clients such as the Massachusetts Water Resources Authority, Boston Water & Sewer Commission, the Metropolitan District Commission (Hartford, CT), and Narragansett Bay Commission (Providence, RI), DC Clean Rivers Project, (Washington, DC), New York City Department of Design & Construction, New York City Department of Environmental Protection and New York State Department of Environmental Conservation .

For the past 21 years, Babs has focused on underground construction management for tunnels and conveyance pipelines, including water and wastewater pipeline design and construction projects, with an emphasis on trenchless construction methods. He has worked on various pipeline projects utilizing microtunneling with wet retrieval; pipe jacking; horizontal auger bore; and pipeline renewal methods such as pipe bursting, slip-lining as well as cured in place pipe lining. Babs developed a work activity matrix specifically for microtunneling risk management during construction which can be adopted for other trenchless construction methods. Babs was involved with the planning and design of the East Boston Branch Sewer Relief Project as part of the Boston Harbor cleanup, ordered under a Massachusetts Water Resources Authority (MWRA) consent decree. From 2009 to 2011 he was resident engineer on the project's pivotal microtunneling and pipe bursting components. In 2011, East Boston Branch Sewer Relief was named North American Society for Trenchless Technology (NASTT) Project of the Year. Babs has authored and coauthored several papers for the NASTT No-Dig Show, American Society of Civil Engineers (ASCE) Pipelines Conference, and Rapid Excavation & Tunneling Conference (RETC); and is a member of NASTT, ASCE, Underground Construction Technology (UCT), and the Construction Management Association of America (CMAA).

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**OFFICER-AT-LARGE**  
**Tiffanie Mendez**

*National Director of Sales for Sunbelt Rentals, Pump Solutions*

A 25 year liquids solutions management professional, Tiffanie began her career in the early 90's in Yuma, AZ., focusing on specialty equipment rental systems and design/build liquids handling systems. Her early focus was groundwater dewatering, filtration systems, sewer bypass systems and construction storm water runoff management. After relocating to Northern California in 2005, the design/build systems focus grew to include temporary plants for environmental remediation, low and medium voltage electrical power systems and compressed air systems.

Tiffanie is the now the National Director of Sales for Sunbelt Rentals, Pump Solutions. She holds a BSBA from Northern Arizona University and an MBA, General Management from California State University, East Bay. Tiffanie has been a part of NASTT's No-Dig Show Program Committee since 2016,

and believes the future of the industry lies in preparing the new leaders of the trenchless industry now. As such, she particularly passionate about the student programs and student chapters associated with NASTT.



**IMMEDIATE PAST CHAIR**  
**Alan Goodman**

*Market Development Manager, HammerHead Trenchless*

Alan Goodman has more than twenty years of experience in the underground construction industry. Alan began his career in the auger boring/ HDD industry as a sales representative and is currently employed with HammerHead Trenchless as Market Development Manager for Oil & Gas in the United States and Canada. After learning Japanese in high school, Alan studied abroad in Japan and served as an Ambassador for the Rotary International exchange program. Alan completed his education with a B.A. in International Business from the Stephen F. Austin State University in East Texas and had

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# NASTT 2023 Board of Directors

the opportunity to manage the Asia/Australia business and utilize his Japanese.

During his tenure at HammerHead Trenchless, he has worked closely with municipalities, engineering firms, and contractors around the world providing customer training, technical support, pre-project planning, project specifications, and installations for pipe ramming, pipe bursting and slitting, cured-in-place pipe (CIPP) and other trenchless projects.

Alan currently serves as Immediate Past Chair on NASTT's National Board and sits on the Program Committee. He is also Past Chair of NASTT's (North America Society for Trenchless Technology) South Central chapter which includes Oklahoma & Texas.

Alan is also an active member of the following industry associations: DCA (Distribution Contractors Association), AGA (American Gas Association), CGA (Common Ground Alliance), PLCAC (Pipe Line Contractors Association of Canada), and NUCA (National Utility Contractor's Association).

## Directors

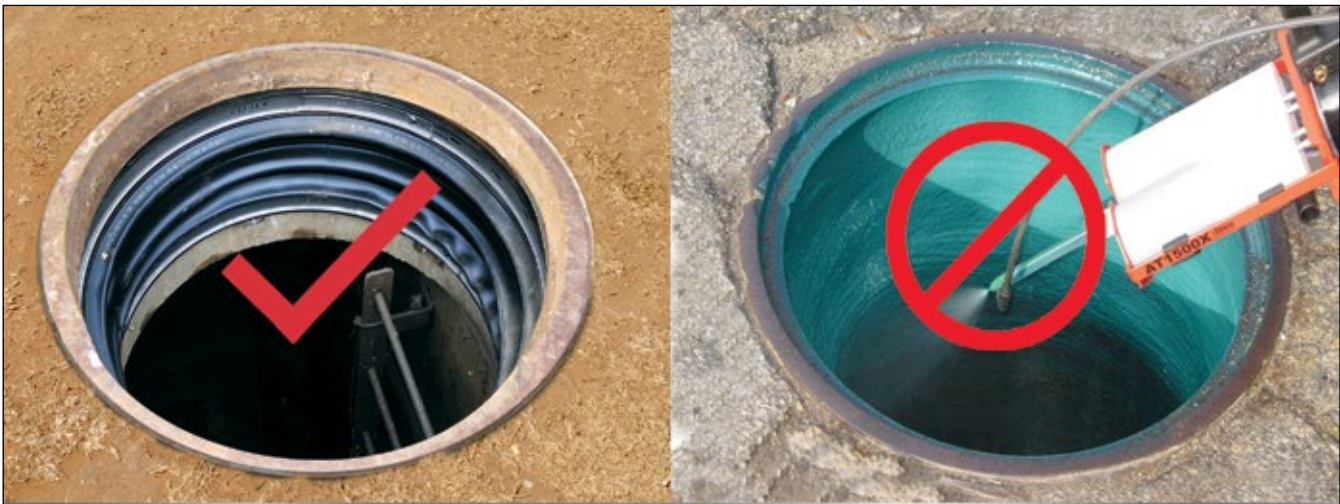


**Alan Ambler, P.E.**

Owner, AM Trenchless

Edward "Alan" Ambler has 19 years of experience working on engineering projects including the World Islands in Dubai and cruise ship berth construction in Alaska. While an employee at the City of Casselberry, Florida, Alan managed the day to day operations of a municipal utility while developing the capital improvement program and executing projects. Alan has designed over 370,000 linear feet of pipeline projects and is a national leader in trenchless technologies, such as pipe bursting.

Alan joined NASTT in 2013 and serves as a Track Leader on the No-Dig Show Program Committee. Alan is the Chair of NASTT's Pipe Bursting Center of Excellence and a co-author of the forthcoming Pipe Bursting Good Practices Guidelines, 3rd Edition. Alan also volunteers as an instructor for NASTT's Good Practices



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\* Data provided by the ASCE Manuals and Reports on Engineering Practice No. 92, "Manhole Inspection and Rehabilitation" third edition.

Training Courses. Alan has a BS in Civil Engineering, a MS in Environmental Engineering, holds two patents, and is the owner of AM Trenchless LLC.

Alan loves to play guitar, cook for his wife and coach baseball for his three boys.



## Lisa Arroyo, P.E.

*Project Manager, Carollo Engineers*

Lisa Arroyo is a Project Manager with Carollo Engineers and is located in southern California. She is a registered civil engineer in both California and Florida with over 20-years of planning, design, construction, and asset management related experience. Prior to joining Carollo, she owned her own construction company. She has also held progressively increase roles of responsibility while at the City of Santa Barbara, including Wastewater System Manager, where she managed a multi-million-dollar Capital Improvement Program and \$20 million operating budget.

Lisa has used her knowledge and experience to focus on Capital Improvement Projects that leverage trenchless technology to economically renew aging wastewater collection systems. She has experience with CIPP and pipe bursting methodologies. Lisa has long been a champion of trenchless technology, as it is proven to be both an effective and economical solution for improving wastewater collections systems.

Lisa holds Bachelor of Science degrees in both mathematics and civil engineering, and she is a NASTT Good Practices Instructor for the CIPP and Laterals courses.



## Maureen Carlin, Ph.D.

*Trenchless & Tunneling Infrastructure Practice Leader, Garver*

Dr. Maureen “Mo” Carlin is the Trenchless & Tunneling Infrastructure Practice Leader for Garver. Maureen has more than 20 years’ experience in construction engineering and project management for both vertical commercial construction and

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# NASTT 2023 Board of Directors

trenchless pipeline construction. Carlin's areas of expertise are in advanced project planning and market analysis for Horizontal Directional Drilling and Direct Pipe® engineering and construction projects both domestically and internationally.

Carlin received B.S. degrees in Civil Engineering and Architectural Engineering from the Missouri University of Science and Technology, a M.B.A from the University of Nevada-Las Vegas and a Ph.D. Civil Engineering with an Emphasis in Construction Engineering and Management.



## Andrew Costa

*Vice President, Business Development, Insituform Technologies, LLC*

Andrew Costa has worked in the trenchless water/wastewater industry since 2006. His experience includes positions in the contracting, manufacturing, and distribution sectors. His expertise in the water/wastewater markets includes cementitious/

polymer manhole rehabilitation, specialty coatings, cured-in-place pipe (CIPP) rehabilitation, carbon fiber remediation, geopolymer

solutions, and concrete corrosion. He is currently the Vice President of Sales, East Region for Insituform Technologies – the leading worldwide provider of CIPP and other technologies/ services for the rehabilitation of gravity and pressure pipeline systems.

Andrew has been with Insituform Technologies since 2014 and is heavily involved with NASTT at the national and regional levels, including active participation in a variety of NASTT committees including: No-Dig Show Technical Program Committee, No-Dig Show Track Leader, No-Dig Show Planning Committee, No-Dig Show Technical Session Moderator, No-Dig Show Innovative Product Award Committee, No-Dig Show Regional Ambassador, NASTT Education/Training Committee – CIPP Subcommittee Chair and SESTT Board Member.

Andrew holds a NACE Level 1 Coatings Inspector License and is also a member of AWWA and NASSCO.

*Welcome to the board!*



## Kim Hanson, P.E.

*Project Manager and Tunnel Design Engineer, Hazen and Sawyer*

Kim Hanson is a Project Manager and Tunnel Design Engineer with Hazen and Sawyer in Raleigh, North Carolina. Hazen and Sawyer currently has 1,500 employees in 65 offices across the country where they focus on water,

wastewater, and stormwater engineering.

Kim manages and coordinates the workload for the company's tunnel design team and is also involved in Hazen's Construction Management group, which she considers invaluable experience in developing practical and constructible designs. Kim is a registered professional engineer in both North Carolina and Texas and has over 10 years of experience working in surveying and engineering. She is currently working towards obtaining her Certified Construction Manager (CCM) certification. Before joining Hazen and Sawyer, Kim served in the United States Navy working internationally as an IHO Certified Hydrographic Surveyor.

Kim has her B.S in Ocean Engineering from the United States Naval Academy and Master of Civil Engineering from North Carolina State University.

She is an active member of NASTT and currently serves on the No-Dig Planning and Technical Program Committees, as a No-Dig Show Track Leader, and as the Vice Chair of the Silent Auction Committee. She is also an active member of the American Water

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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. She currently serves as the Vice Chair of the NC Chapter of Water for People.

Outside of the office, Kim volunteers as a Blue and Gold Officer (admissions representative) for the United States Naval Academy and coaches Little League Softball.



## Chris Knott

*Lead Trenchless Estimator,  
BTrenchless*

With more than 26 years in civil utilities construction, Chris Knott began his career as a laborer and quickly progressed to an operator for an auger bore crew. He then advanced to supervisor, overseeing the auger bore crews, pipe ramming crews and the directional drilling operations. Chris enjoyed working with a variety of trenchless methods, and ultimately took on project management and estimating.

Chris began working at BT Construction, Inc. in 2005 in the role of both trenchless estimator and project manager. He has been integral to the formation of their trenchless division, BTrenchless, and is currently the lead trenchless estimator, reviewing all work involving bores and tunnels. Additionally, his expertise is utilized to market BTrenchless, Inc. as the region's premier tunneling contractor, showcasing their ability to perform Pipe Ramming, Auger Boring, Pilot Tube, TBM, Microtunnels, Hand Tunneling and Slip Lining as the Director of Business Development. Over the years, Chris has become a valuable resource for engineers and owners alike, helping to determine the best trenchless methods in a wide array of soil conditions. He has a passion for sharing the capabilities and opportunities of trenchless construction, helping to inspire young engineers by presenting the applications of trenchless construction at annual presentations, hosted by The Colorado School of Mines (Microtunneling Short Course) and the University of Colorado-Boulder.

His natural ability to convey an aggressive but attainable game plan stems from decades of coaching lacrosse. Chris often brings the enthusiasm of a championship game to his professional endeavors, as witnessed in the organization of the inaugural Rocky Mountain NASTT No-Dig in Denver in 2010.

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# NASTT 2023 Board of Directors

Involved with RMNASTT since its inception, Chris serves on its board as an officer, helping with the local NASTT show, clay shoot, and recently contributing to the Program and Auction Committee for the National show.

Chris continues to contribute fully to the foundation and growth of the trenchless industry and progress the NASTT membership. He generates energy and provides expertise to all his pursuits, both on and off the field or in this case, in and out of the field.

*Welcome to the board!*



## Andrea L. Long, PE, PMP

*Principal Engineer, Capital Projects,  
City of Aurora, CO*

Andrew Long began working for the City of Aurora in 2015 and is currently the Principal Engineer for the Capital Project's Wastewater and Stormwater Programs. In this role, she works with internal and external stakeholders to

upgrade and repair their aging infrastructure and support the

growth and expansion of the City. These duties require her to have a technical understanding of various means and methods to construct buried pipelines in a wide variety of conditions. Since working at Aurora, she has utilized a variety of trenchless technologies to successfully execute design and construction projects. From performing in-house CIPP design and training staff, to more complex applications such as guided auger bore, pipe bursting, jack and bore, and microtunneling.

Over the years, Andrea has become active in NASTT at both the local and national levels. She volunteered on the program committee for the national conference, reviewed papers and presentations, and moderated. She has also published papers and presented at both the local and national NASTT conferences. She is excited for the opportunity to serve on the NASTT board so she can utilize her municipal background to bring a different perspective to the board and support the organization's mission to advance trenchless technology and to promote its benefits to the public and environment.



## Rick Melvin

*National Product Specialist,  
TT Technologies, Inc.*

Rick Melvin is a National Product Specialist for TT Technologies, Inc. He has been involved in a variety of underground construction applications for over 20 years. This includes sales and servicing of pipe ramming, horizontal directional boring machines and pipe bursting systems. Rick has also been heavily involved in pursuing overall growth of the trenchless technology market. He has assisted in educating engineers and contractors on the extensive benefits of various available trenchless technologies and trenchless equipment techniques.



## Stephanie Nix-Thomas, P.E.

*President,  
Claude H. Nix Construction Co.*

Stephanie Nix-Thomas earned her degree in civil and environmental engineering with a business minor from Utah State University in 1984. She worked as a consultant engineer in Salt Lake City for seven years before moving to the State Department of Environmental Quality where she worked in water quality as an environmental engineer. In 1992 she moved to the policy office of DEQ as a liaison with small businesses and Native American tribes.

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In January 2000 Stephanie joined her family's construction business, Claude H. Nix Construction Co. Her experience in engineering and government proved to be beneficial as she and her brother, Jon Nix, purchased and took control of the business from their parents in 2002. She also found that underground construction, especially trenchless technologies, was her career of choice. It has held her attention for 20 years!

In 2004, Nix Construction completed the first pilot tube microtunneling project in the state of Utah and, in 2005, they made the decision to focus their general contracting company on trenchless methods of construction. In the same year, they won recognition from NASTT for pioneering pilot tube pipe ramming on the commuter rail project in Utah. Over the years, the company has gained expertise in not only pilot tube microtunneling, but also tunnel bore, auger bore, pipe ramming, pipe bursting and any combination of methods. They have made choosing the "right horse for the course" with respect to trenchless methods, a resource for construction projects and for assisting engineers with trenchless designs.

At the inception of the Rocky Mountain Chapter of NASTT, Nix Construction established Utah's first group of participants. Stephanie was involved from the beginning and organized one-day Training Day Conferences in Utah in 2015 and 2016. In

the fall of 2016, she led the organization's first regional chapter conference on the west side of the Rockies and has led or helped with conferences in Utah and Colorado since. She served as the chapter treasurer (2016-2020), vice chair (2021-2022), and is currently the regional chair. Recently, she is a volunteer on the Auction Committee for No-Dig, the Education Committee as well as other committees as needed. In addition to NASTT, Stephanie is a member of the American Society of Civil Engineers, and the Associated General Contractors (AGC). She was recently elected as a board member of the Utah AGC.



### Charles Pullan, P.Eng.

Senior Project Engineer,  
City of Calgary Water Resources  
Department

Charles Pullan is a Senior Project Engineer with The City of Calgary's Water Resources department in Calgary, Alberta. Charles holds a Bachelor of Science degree in Civil Engineering from the University of Calgary. In his current role, Charles focuses on linear capital construction of water, sanitary, and drainage systems. Charles has been involved with various trenchless technologies, including electromagnetic inspection



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# NASTT 2023 Board of Directors

of PCCP water mains, HDD projects, and microtunneling installations.

Charles has been heavily involved in the Northwest Chapter of NASTT since 2014 and has been part of the organizing committee for the 2015 and 2017 Northwest Trenchless Conferences. Charles has also co-authored papers for NASTT's No-Dig conference and various Northwest Trenchless Conferences.



## Chris Sivesind

*Territory Sales Manager, Akkerman*

Chris Sivesind is a Territory Sales Manager with Akkerman, pipe jacking and tunneling equipment manufacturer. Sivesind is responsible for sales in the western-most portions of the United States as well as Western Canada, Europe

and Southeast Asia. Sivesind's career in the pipe jacking and tunneling industry has been multi-faceted. Early on, he was regional manager for his family's pipe jacking and auger boring construction business. Following this, he worked as west coast sales representative and specialty shoring installation consultant for a trench safety rental group. Prior to Akkerman, Sivesind

worked for another pipe jacking equipment manufacturer. Sivesind is an active participant in industry associations NASTT, ISTT and CSITT, has authored and presented several papers at their conferences and served as chair and secretary for the Pacific Northwest Chapter of NASTT. He received his formal education from Washington State University with a bachelor's degree in Business Administration. Go Cougs!



## Andrew (Drew) Sparks

*Director of Engineering, Engineering Group, Laney Directional Drilling*

Drew Sparks is geotechnical engineer with 26 years of experience and is a registered professional engineer in 27 states. He has 19 years of experience in designing Horizontal Directional Drill and Direct Pipe® projects up to

48-inches in diameter and lengths over 13,000 feet.

Drew worked on a team of engineers to develop a design procedure for Direct Pipe® design as well as developed a proprietary software program to evaluate the hydraulic fracture and drilling fluid surface release risk for Horizontal Directional Drill crossings.

Drew received his B.S. in Civil and Environmental Engineering and a M.S. in Geotechnical Engineering from Brigham Young University. Drew currently holds the position of Secretary for the ASCE Manual of Practice Committee for Direct Pipe® and is serving as the Director of Engineering for the engineering group of Laney Directional Drilling.



## Jim Williams, P.E., PMP

*Senior Associate, Brierley Associates*

Jim Williams' experience includes 27 years in the trenchless industry in design and project management in HDD and other trenchless projects including design/build and EPC delivery methods, allowing him to remain on the cutting edge of

current technology in this niche. He has completed projects as an owner, a consulting engineer, and a contractor, resulting in a uniquely comprehensive perspective on project execution in the areas of water, wastewater, gas distribution, and other conveyance needs.

Jim has a BS in Environmental / Civil Engineering from the University of Florida and is the Immediate Past Chair of the South Central Regional Chapter of NASTT.



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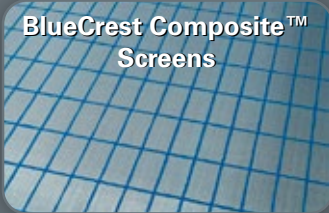


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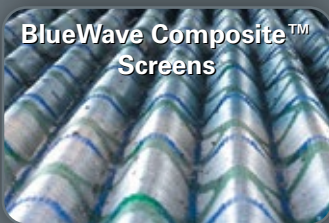
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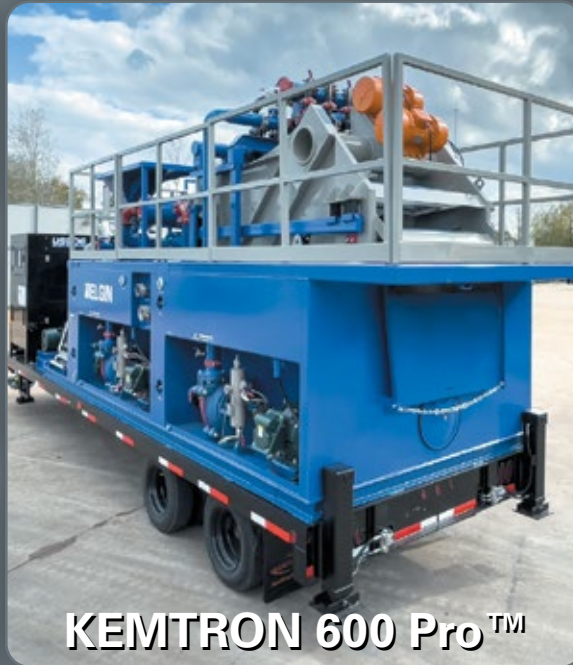
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## Underground Solutions Becomes Major U.S. Distributor of Vylon® Slipliner Pipe

Underground Solutions, an Aegion Corporation portfolio company, recently signed an agreement to become the main U.S. distributor of Vylon® Slipliner Pipe, adding yet another solution to the parent company's growing portfolio. Underground Solutions is now the exclusive national distributor of Vylon with the exception of Mississippi and Louisiana, which will continue to be handled by HMIM, Inc.

Vylon is a profile wall, segmented PVC product used in non-pressure applications that compares to other large-diameter gravity sewer products, including centrifugally-cast, fiberglass-reinforced, polymer mortar (CCFRPM) pipe.

For more information, contact Dave Gellings, Product Manager, Vylon Slipliner Pipe, at [dgellings@aegion.com](mailto:dgellings@aegion.com)



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## Gemini Pipeline Rehabilitation Solutions, LLC-Pipeline Rehabilitation Management Consultants:

*Providing construction management support to execute projects successfully*



Gemini Pipeline Rehabilitation Solutions, LLC are rehabilitation management experts with experience utilizing the most technologically advanced pipe lining systems and materials across the trenchless industry. We are independent consultants that work alongside trenchless technology providers and pipe lining contractors to provide lining solutions that best fits our client's needs. On each project, our primary goal is to rehabilitate our clients' pipelines to reduce project costs by the maximum extent possible and ensure that all stakeholders are satisfied with the results.

With respect to underground pipeline rehabilitation, it is perhaps the most risky in the construction industry and if not managed appropriately; it is also amongst the most costly. Oftentimes there is limited information available about the piping system prior to the start of construction that could impact the project's outcome. To avoid potentially expensive change orders and significant delays, Gemini specializes in helping pipeline owners' assess their options, identify the best course of action and execute projects successfully. We help guide our clients through the due-diligence, planning, estimation, risk assessment and procurement process, then through construction and all the way till the rehabilitated pipeline is successfully commissioned and operational.



understanding of the complexities necessary to manage & execute projects successfully.

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For more information about Gemini Pipeline Rehabilitation Solutions, LLC, please visit their website at [www.geminipiperehab.com](http://www.geminipiperehab.com) or call (970) 946-7450.



Gemini Pipeline Rehabilitation Solutions, LLC was founded by Sean Borris after having worked 12 years as Senior Project Manager at Aegion Corporation, one of the global leaders in trenchless rehabilitation of existing piping systems which installed Cured-In-Place-Pipe (CIPP), HDPE, Fusible PVC, FRP, and other specialty materials and lined pipe systems. Sean's past experience as a contractor which entailed constructing and rehabilitating pipelines located around the globe provides Gemini with a deep



## New Technical Document Announced For HDPE Pipe Use In Seismic Sensitive Areas

### *Provides Cost and Performance Ratio Data*

The Municipal Advisory Board (MAB) of the Plastics Pipe Institute, Inc. (PPI) has announced the publication of a new technical document that provides data for high-density polyethylene (HDPE) water lines in earthquake sensitive areas. *MAB-9, Design of HDPE Water Mains for the Lateral Spread Seismic Hazard* is available for free on the group's website.

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

MAB serves as an independent, non-commercial adviser to the Municipal & Industrial Division of PPI, the major North American trade association representing the plastic pipe industry. The MAB-9 Task Group was made up of industry experts who volunteered their time. It was headed by Michael O'Rourke, Ph.D., P.E., F.SEI, M.ASCE, professor emeritus civil engineering, Rensselaer Polytechnic Institute (Troy, NY).

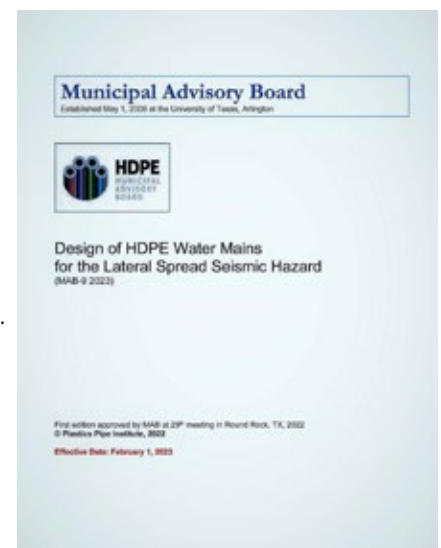
"Experience suggests that high-density polyethylene pipe does very well in earthquakes," O'Rourke said, "but engineers like to have ways to calculate and substantiate their design. Listening to what somebody else says that, 'Oh yes, the pipe is great', but they still are faced with the question of 'what wall thickness do I need?' 'I have this particular diameter pipe and it's going to be buried this far underneath the ground so what wall thickness do I need for some expected seismic event?' The goal is to have HDPE pipe that will be able to withstand the expected earthquake loads on this inherently ductile material. With that in mind, MAB thought it would be useful to develop a document that provides designers with some relationships,

tables, formulas, et cetera, that they can use to figure out how thick the wall would need to be for an expected lateral spread. And that's the purpose of the MAB-9.

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

Rubeiz elaborated, "MAB-9 is essential for many reasons. Proper wall thickness is very important, especially with earthquakes, and ground movement. Plus, there continues to be a dire need to replace the aging infrastructure, especially pipes that are older and brittle that many seismic events will cause them to crack. HDPE pipe and the information contained in MAB-9 will help in those replacement programs to provide a proper and resilient water main system.

For additional information, go to the Municipal Advisory Board's website: MAB Publications ([plasticpipe.org](http://plasticpipe.org)) [www.plasticpipe.org](http://www.plasticpipe.org).





## Sunbelt Rentals Sets the Gold Standard for Recruiting, Employing and Retaining Veterans

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Sunbelt Rentals, North America's premier equipment rental company, has been recognized with three prestigious awards for its efforts to recruit and retain military veterans in North America and globally.

For the first time, Sunbelt Rentals has received the Honoring Investments in Recruiting and Employing American Military Veterans (HIRE Vets) Gold Medallion Award from the U.S. Department of Labor. This is the only federal award that distinguishes this accomplishment. To achieve the 2022 Gold Level recognition in the large employer category, Sunbelt Rentals met two requirements: Hiring no fewer than 7 percent of veterans during the 2021 calendar year and retaining no fewer than 75 percent of veterans hired in 2020 for 12 months.

"We had a vision to build a multinational program geared to support the unique challenges faced by our veteran teammates and their families," said Shane McKenzie, director, Veterans Programs, Sunbelt Rentals. "We now lead one that exceeds industry standards and is recognized internationally as better than best-in-class."

In addition, Sunbelt Rentals has been named a top 2023 Military Friendly® Employer in the nation for the third year in a row. This is the first year that the company earned the Gold Distinction, which requires an employer to score within 10% of the 10th-ranking employer in their category.

Sunbelt Rentals U.K. also recently received the highly coveted United Kingdom Ministry of Defence (MOD) Gold Armed Forces Covenant Award.

Sunbelt Rentals is committed to supporting veterans and providing a fulfilling workplace. Purpose-built to assist with challenges faced by the veteran population, the Sunbelt Rentals Veterans Program focuses on four pillars: resources, recruitment, recognition and retention.

The company offers veterans access to a hotline, administrative and accommodation support, and interagency coordination. Veteran Ambassadors support military employees throughout their careers and are available to guide them through the company's resources.





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**Microtunnel Combined Sewer Replacement Project Overcomes Construction Challenges and Navigates Multiple Constraints in Queens, New York**

Babs Marquis, McMillen Jacobs Associates, Burlington, MA  
 Vijay Jeyakrishnan, McMillen Jacobs Associates, New York, NY  
 Dinesh Patel, Arcadis, New York, NY  
 Richard Palmer, Northeast Remsco Construction, Wall Township, NJ  
 Eric Macfarlane, New York City Department of Design and Construction (NYC DDC), Long Island City, NY

**1. ABSTRACT**

The NYC DDC SE859 project is an infrastructure upgrade to improve water, sewer, and drainage services to the Maspeth neighborhood in the Borough of Queens, New York. The project involves construction and resident engineering inspection for replacement of a combined sewer in 70th Street between Queens Boulevard and Queens-Midtown Tunnel Expressway.



**MICROTUNNEL COMBINED SEWER REPLACEMENT PROJECT OVERCOMES CONSTRUCTION CHALLENGES AND NAVIGATES MULTIPLE CONSTRAINTS IN QUEENS, NEW YORK**

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The NYC DDC SE859 project is an infrastructure upgrade to improve water, sewer, and drainage services to the Maspeth neighborhood in the Borough of Queens, New York. The project involves construction and resident engineering inspection for replacement of a combined sewer in 70th Street between Queens Boulevard and Queens-Midtown Tunnel Expressway.

As one of New York City’s major capital improvement undertakings, the project as designed includes open-cut installation for 5-foot by 8-foot box culverts, and microtunneling to install 96-inch inside diameter/115.5-inch outside diameter reinforced concrete pipe (RCP) for 3,425 feet at 40- to 65-foot depths in mixed ground conditions consisting of glacial till, sand, gravel, cobbles and boulders, and clay. The alignment runs through busy residential streets and crosses Queens Boulevard—a major thoroughfare with eight lanes of traffic, two train tracks, and bicycle lanes connecting Queens to Midtown Manhattan. Technical and construction challenges during construction involved extensive coordination with various state and city agencies, traffic management, subsurface utility coordination, public safety, and

This paper was selected as an outstanding paper, among the most highly rated and well-attended at the 2022 NASTT No-Dig Show in Minneapolis. NASTT No-Dig Papers are available for download, free to members, at [www.nastt.org](http://www.nastt.org)

community liaison required to effectively execute a project of this magnitude in a densely populated residential and commercial community. Added to these challenges was competition for limited construction space with a mandated project requirement to minimize the construction footprint to the extent possible to limit impact to the environment, residents, and the concentrated fast-paced commerce in Queens.

This paper presents technical design details and construction challenges and highlights the level of construction coordination and the project team operational approach undertaken to navigate and resolve project constraints during construction.

# Microtunnel Combined Sewer Replacement Project

## 2. INTRODUCTION

The SE859 project involves construction to replace an aging combined sewer and to upgrade a water main in the Borough of Queens. The New York City Department of Design and Construction (NYC DDC) accepted bids on October 24, 2018. Northeast Remsco Construction was the successful Contractor. Resident Engineer/ Inspection services were provided by Arcadis and McMillen Jacobs Associates.

The project alignment for the combined sewer replacement and related work is shown in Figure 1, which depicts roadway reaches and sections where replacement and upgrade work will be performed. Also shown are the selected construction methods required to complete different sections of the project based on ground conditions, existing subsurface utilities, construction access, roadway usage, traffic flow pattern, and the need to minimize construction footprint to the extent possible to mitigate impact to the resident community, schools, and businesses along the project route.

SE859 is the third of four projects undertaken by NYC DDC to relieve sewer backups and street flooding in the Middle Village section of Queens. The project is designed to rehabilitate and upgrade transitional structures, replace combined sewer, and upgrade a significant section of the water mains in 70th Street between 54th Avenue and Calamus Avenue to tie into the SE814 project when completed. As shown in Figure 1, a significant section of the new sewer main is planned to be completed using microtunneling trenchless construction methods, cut-and-cover installation at locations with shallow ground cover, and direct jacked box culvert installation to mitigate construction risk impact to sensitive Long Island Railroad (LIRR) support structure.

General subsurface conditions along the project alignment varied with the depth of the excavation as well as along different sections of the alignment and



Figure 1. SE859 Project Alignment Map

included clay, silt, sand, gravel, cobbles, and boulders. While groundwater was encountered for much of the open-cut work, most of the microtunneling work was above the water table. The new sewer is located within the public right-of-way with sections of the project alignment grouped into five main segments. These segments are presented below according to how they follow the alignment in plan and profile from north to south with named streets:

1. 69th Street between Queens Boulevard and 48th Avenue; approx. 686 linear feet (LF):

- a. Microtunnel Section: 85-inch Hobas pipe at Queens Boulevard crossing, between SE corner and NE corner of 69th Street and Queens Boulevard intersection; 214 LF where depth of cover varied from 18 feet to 21 feet.
- b. Cut-and-Cover: 85-inch Hobas pipe on 69th Street between 47th Avenue and Queens Boulevard; approx. 78 LF where depth of cover varied from 12 feet to 18 feet.
- c. Box Jacking: 12 ft x 8 ft box sewer, underneath LIRR, on 69th Street between 47th Avenue and Queens Boulevard; approx. 183 LF where depth of cover varied from 9 feet to 12 feet.

# Microtunnel Combined Sewer Replacement Project

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d. Cut-and-Cover: 5 ft x 8 ft box sewer, between 47th and 48th Avenues; approx. 211 LF where depth of cover varied from 8 feet to 9 feet.

2. Maurice Avenue to Calamus Avenue at 70th Street; approx. 541 LF:

a. Cut-and-Cover: 5 ft x 8 ft box sewer. Approx. 541 LF, which includes a curved cast-in-place 5 ft x 8 ft box sewer (approx. 46 LF) with 23.5 ft curve radius. Because of shallow ground cover, it was constructed by cut-and-cover where depth of cover varied from 6 feet to 12 feet.

3. 70th Street alignment from Calamus Avenue to 54th Avenue; approx. 1,960 LF:

a. Cut-and-Cover: 96-inch RCP, between Calamus and 52nd Avenues; approx. 120 LF where depth of cover varied from 7 feet to 11 feet.

b. Microtunnel Section: 96-inch RCP, between Calamus and 52nd Avenues; approx. 240 LF where depth of cover varied from 11 feet to 29 feet.

c. Microtunnel Section: 96-inch RCP, between Calamus Avenue and 52nd Avenue Intersection to 54th Avenue; approx. 1,600 LF where depth of cover varied from 23 feet to 52 feet.

4. 54th Avenue through 71st Street to Grand Avenue; approx. 700 LF:

a. Microtunnel Section: 96-inch RCP, between 70th and 71st Streets; approx. 110 LF where depth of cover varied from 50 feet to 52 feet.

b. Microtunnel Section: 96-inch RCP, between 54th and Grand Avenues; approx. 590 LF where depth of cover varied from 43 feet to 50 feet.

5. Grand Avenue from 71st Street to Mazeau Street:

a. Microtunnel Section: Approx. 300 LF where depth of cover varied from 38 feet to 43 feet.

6. Mazeau Street from Grand Avenue to Queens Midtown Expressway:

a. Microtunnel Section: Approx. 730 LF where depth of cover varied from 29 feet to 38 feet.

### 3. CONSTRUCTION PLANNING AND STAGING IN HIGHLY URBANIZED MASPETH COMMUNITY

The work on 70th Street included approximately half of the contract microtunneling work, excavation of three shafts ranging from 50 to 65 feet deep, construction of four cast-in-place concrete chambers, and the cut-and-cover installation of 270 feet of 96-inch RCP. To have a lesser impact on the community and to keep an active traffic lane throughout the construction, the Contractor proposed offsetting the microtunnel alignment approximately 4 feet from the initial design. Additionally, an intermediate pass-through shaft was shifted south to keep the intersection open to traffic.

This is a 30 feet wide residential street with a single traffic lane and two parking lanes. To mitigate the construction impact on residents of 70th Street between Calamus Avenue and 52nd Avenue, the Contractor proposed shifting the location of the Chamber 4 Jacking shaft approximately 100 feet and increasing the length of the microtunneling. The corresponding reduction in deep open-cut pipe installation maintained better access and reduced impact to the homes on this block.

#### 3.1. Microtunnel Shaft Selection

With the ground conditions generally consisting of sand with varying amounts of gravel, silt, and clay and no groundwater present, different support of excavation (SOE) methods were considered in order to select the most suitable SOE for the project conditions and challenges. The shafts ranged from 40-feet to 65-feet deep and were located near residential and commercial

# Microtunnel Combined Sewer Replacement Project

structures. Despite the depth of the shaft no groundwater was present; blow counts ranged from 11 to 63 per foot, indicating loose to densely compacted soil material.

With limited space for shaft and equipment staging, ground support systems that could be installed in circular geometry for both microtunnel jacking and receiving shafts ranked high in the selection and consideration process. Ground support systems considered include jet grout columns to create a ground improved ring, steel sheeting, rib and board lagging, and liner plates. Jet grout columns were eliminated because the diameter of the columns would result in a large shaft footprint, impacting the project's ability to maintain an open traffic lane and prohibiting future NYC utility work and upgrade within a narrow right-of-way. Steel sheeting was eliminated because of the depth

of the shafts and the long steel-sheets that would have been required to be handled, maneuvered, and driven through the narrow streets. Furthermore, steel sheet piles were eliminated because of proximity of the shafts to building structures and sensitive high pressure gas main, which would be prone to damage from vibration generated to drive the steel sheets. Rib and board lagging was considered and eliminated because of inadequate soil stand-up time due to the length of time required to advance the excavation in 4-foot intervals to install the boards and internal rib beam bracing for the next level.

The final choice was to use liner plates with the benefit of installation within proximity of the shaft to residential building foundations with no vibration. The liner plates were well suited to this project since the shafts were so close to houses and

commercial buildings. In addition, even though the shafts were deep, there was no groundwater to contend with. The liner plates were back grouted as each ring of liner plate was installed. At locations where lenses of loose sand were encountered, the zones were stabilized with permeation grouting.

The jacking pits were constructed at 30-foot diameters, while the receiving pits varied from 20 feet to 28 feet in diameter with sufficient room to retrieve the microtunnel boring machine (MTBM) and accommodate follow-on permanent structures—size and configuration to be constructed at each location. King beams and bracing were added at each portal opening cut through the liner plates to transfer the SOE compression loads across the opening. To mitigate surface settlement and provide face stability during the MTBM launches, the ground outside each portal was improved with sodium silicate permeation grouting.



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# Microtunnel Combined Sewer Replacement Project

## 3.2 Management and Coordination

### 3.2.1 Traffic Management and Coordination: Public Transit, Bicycle, and Pedestrians

The project alignment runs through narrow residential streets and busy roadways and through one of the major roadways (Grand Avenue) with businesses, bicycle lanes, and transit bus stops on both sides. The bus stops in conflict with project construction required relocation upstream and downstream of the project construction zone. The alignment also cuts across Queens Boulevard—a major thoroughfare consisting of eight lanes of traffic, two train tracks, and bicycle lanes at an intersection with high commercial activities. Some sections of the alignment had restricted working hours from 9 a.m. to 2 p.m. instead of the normal 7:00 a.m. to 3:30 p.m. Any modifications to Traffic Stipulations



Figure 2. Aerial view of Grand Avenue Jacking shaft and work zone support equipment layout.

included in the contract required complex coordination and approval from NYC Department of Transportation (DOT). Because of the COVID-19 Pandemic, in person meetings were not permitted and the project team were

faced with unplanned coordination challenges deploying virtual platforms through Microsoft Teams and WebEx with DOT. Virtual coordination with many of the state and city agencies is a process that was not previously planned

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# Microtunnel Combined Sewer Replacement Project

or tested prior to the nationwide (global) abrupt lockdown imposed by the pandemic in response the health crisis.

### 3.2.2 Community Coordination: Residents, Businesses, and School in Close Proximity

The resident engineer/inspection (REI) team included a dedicated position for Construction Community Liaison (CCL). The primary responsibilities of the CCL consisted of keeping the community informed, providing construction updates and notifications for road closure and/or water shutdown to community and businesses, fielding complaints, and addressing specific community concerns. For example, the project proactively coordinated daily with the public school in close proximity to a microtunnel work shaft, one result being that the Contractor

refrained from using the crane and/or swinging heavy loads during students' arrival and discharge.

### 3.2.3 Interagency Coordination: MTA, Transit, Parks and Recreation, DOT, Department of Buildings, ConEd, and National Grid

Because of the equipment staging requirements, the deep shafts, and the project alignment running through busy and narrow streets, interagency coordination was crucial to the successful microtunneling operations and to the safety of the public and construction crews. Provision for interagency coordination was included in the construction contract facilitated by the REI team in order to assure compliance with the required coordination effort. Also, this project was designed as a Joint Bid with utility companies. That means there is a provision in the contract to

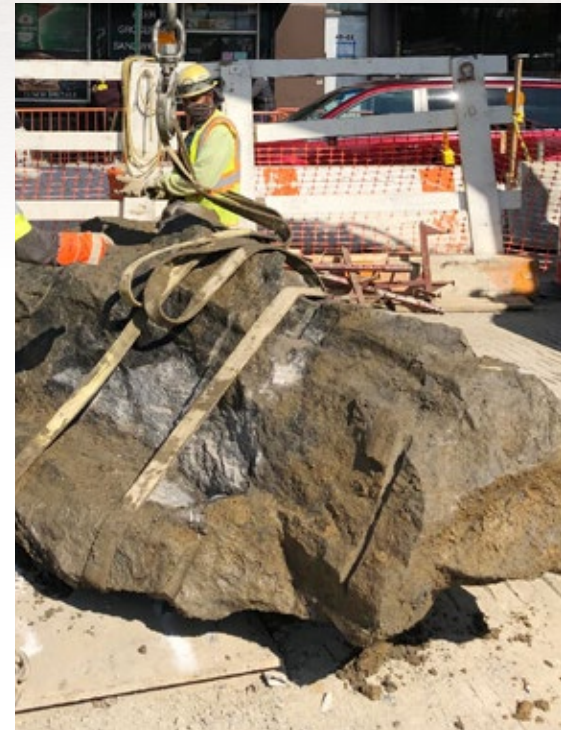


Figure 3. Extracted portion of split boulder from within the receiving shaft

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relocate existing utilities if required. All potential utility interferences identified in the contract were scheduled and utilities coordinated to be relocated after Notice to Proceed. One of the major utility conflicts and challenges involved coordination to protect, support, or relocate an existing 30-inch-high pressure gas main in close proximity to a microtunnel alignment and within inches of the outer face of a jacking shaft on Grand Avenue.

In addition to subsurface utility conflicts, the construction contract included retaining the services of an arborist to directly coordinate with NYC Department of Parks and Recreation to minimize construction impacts to trees in close proximity to construction and within the heavy equipment swing radius.

### 3.3 Microtunneling Pipe

The contract required the combined sewer installed by single pass

microtunneling to be 96-inch reinforced concrete pipe (RCP). Class V, wall C pipe was selected with each 10-foot section of pipe weighing over 18 tons. Each section of pipe included three 2-inch threaded ports for lubrication during pipe installation and for grouting between the pipe and the ground after the microtunneling is completed. The interior of the pipe is factory finished with two coats of coal tar epoxy treatment topped with one coat of white paint, as required by New York City standards.

The city standard also specified the pipe to have steel bell and spigot joints, otherwise known as Carnegie joints. In lieu of the specified joint, a steel bell and concrete spigot joint, known as the European joint, was proposed by the Contractor, and accepted. The steel bell and concrete spigot joint is preferred and more suitable for microtunneling because of its increased jacking capacity

and its inherent protection against soil particles entering the pipe joint as the pipe string is advanced.

### 3.4 Microtunnel Jacking Shafts and Drive Configuration

With the project located in a highly urbanized setting, the space available at the jacking shafts was extremely limited. Much of the work took place on 30-foot-wide roads. One segment was located on a wider road, but that extra space was encumbered by the need to maintain two lanes of traffic plus sidewalks and bike lanes. The equipment was spread out at intersections with equipment set up on multiple streets to take advantage of every available usable area, even when it was not contiguous to the jacking pit. A typical example is shown in Figure 2 for the jacking shaft and work zone setup on Grand Avenue.



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## 4. PROJECT CONSTRUCTION CHALLENGES

### 4.1 Challenges Associated with Shaft Construction

There were many shaft construction challenges to overcome on this project, including the limited space to build the deep shafts in the narrow roadways as well as the need to maintain both bike lanes and traffic lanes in Grand Avenue, a major thoroughfare. The latter required that decking be used to span the excavation as it progressed in order to provide the minimum lane width. Other challenges included loose, running sand encountered during shaft excavation, which required ground improvement to stabilize; and a clay layer encountered during one of the shaft excavations, which prompted the Contractor to perform additional ground investigation along the tunnel alignment to determine whether a mixed face condition

existed that might lead to more ground improvement being required above the clay layer.

Two shafts were located close to a public school. Close coordination with school officials resulted in limiting the work hours during school days for the safe passage of school buses and the off-loading of the students.

Commercial and residential structures were located in close proximity to most of the shafts. Therefore, prior to any shaft excavation, settlement monitoring points were installed on those buildings. These points were continuously monitored for movement during shaft excavation and microtunneling to confirm no settlement. In addition, pre-construction surveys were performed to document the condition of these buildings prior to the start of construction.

Offsetting and/or complete relocation of underground utilities in conflict with the

shaft construction was required in many locations.

### 4.1.1 Queens Boulevard 72-inch Steel Water Main

Queens Boulevard is a major thoroughfare in the New York City Borough of Queens, as it connects to Midtown Manhattan. Part of the contract included crossing under an existing 72-inch steel water main at the Queens Boulevard and 69th Street intersection. Owned and operated by the NYC Department of Environmental Protection (DEP), the water main was to be exposed, supported, and protected within the SOE for the construction of Modified Chamber 1. A major section of this SOE incorporates the receiving shaft for the microtunnel drive across Queens Boulevard. During excavation of the shaft, the crew encountered a 10 ft x13 ft x 12 ft boulder seated below the 12-foot-long section of the exposed active 72-inch water main. Because of the space



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constraints and presence of the critical utility, a rock splitter was deployed to fracture the boulder into manageable sizes to enable its removal. Longer shifts, weekend work, and additional manpower were deployed to break and remove a considerable portion of the boulder in order to finish constructing the SOE and to reach the final grade before the MTBM breakthrough and for retrieval.

## 4.1.2 Fiber Optics Communication Cable: 70th Street Alignment

One of the initial challenges in mobilizing and staging the microtunneling equipment for the 70th Street jacking shaft work zone located at the intersection of 70th and 52nd Streets (which are 30-foot-wide busy densely populated residential streets) involved the protection of low hanging overhead communication cables that had to be raised and zip-tied to provide clearance for the soil separation plant. For added

safety to the crew members servicing the soil separation plant, line guards had to be used to sleeve and protect the ConEd overhead electrical cable prior to mobilization.

Another critical utility was Verizon's fiber optics communication cables, which serve a major portion of the Maspeth neighborhood and run along the 70th Street project alignment between Calamus Avenue and 54th Avenue. These fiber optics cables had to be winged-back for the SOE of the jacking shaft (Chamber 4) and the drive/pass-through shafts at locations of Special Manholes 1 and 2 and receiving shafts/Special Manhole 3.

In addition, an active 30-inch RCP combined sewer had to be exposed and supported along with the communications cables within the SOE of the jacking shaft (Chamber 4). Also, the east side the SOE face of the

jacking shaft / pass-through shafts and the receiving shaft of the 70th Street alignment were very close to an active 8-inch plastic gas main.

## 4.1.3 30-inch Cast Iron Gas Main: Grand Avenue Jacking and Receiving Shaft

Another major microtunneling operation setup was required to complete the two drives from the jacking shaft located on Grand Avenue (a busy throughfare connecting Brooklyn and Queens Boroughs) and the intersection of 71st and Mazeau Streets. The biggest challenge at this location was to protect the National Grid-owned 100-year-old, 30-inch cast iron gas main. It is very close to the south side face of the SOE for special manholes (SMHs) 5 and 6. Being an old, sensitive, high-risk utility and for public safety reasons, the gas utility owner, National Grid, with the help of NRC, decided to cut and cap the 30-inch cast iron gas main prior to any major excavation in the area. The

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initial cut-and-cap work was completed by mid-April 2021. NRC completed the two-shaft excavation and completed the two microtunnel drives on Grand Avenue, and the gas main was returned to service in October 2021. In addition, an active 20-inch ductile iron pipe (DIP) water main passed within the north side SOE of SMHs 5 and 6 shafts, and the south side face had a very close proximity to 8-inch DIP water main.

## 4.1.4 Challenges and Risk Mitigation for Cut-and-Cover Sections: Queens Boulevard Crossing

A challenging part of the project involved the required open-cut crossing of Queens Boulevard to install the 5-foot x 8-foot precast concrete box culvert. It was specified to be completed at night and opened to traffic each day. This section of the boulevard has eight traffic lanes, two train tracks, three median strips, and two bike lanes. Therefore, this was a prime opportunity to explore a trenchless crossing alternative.

After considering a variety of options, the Contractor proposed microtunneling installation of 230 feet of 85-inch Hobas centrifugally cast fiberglass reinforced (CCFRP) pipe in lieu of the box culvert. Hobas pipe provided the required flow characteristics, and the reduced pipe wall thickness allowed the outside diameter (OD) to fit within the available crossing path. Furthermore, the change to a circular section was easily accommodated with minor design changes to the connection points to the cast-in-place concrete chambers at each end of the drive. The pipe crossing was jacked with a custom OD Herrenknecht AVN 1800 MTBM owned by the Contractor.

This change allowed all but one lane of traffic to remain open during construction. This greatly benefited the community by eliminating a complex traffic management plan, avoiding prolonged night work construction, and

preventing disruptions to train track works and the need to coordinate with MTA. The change was a welcome quality of life relief to the community as it completely avoided nightly traffic detours through narrow residential streets.

## 4.2 Box Culvert Jacking

A section of the project required open-cut installation of a 12-foot by 8-foot precast concrete box culvert beneath an elevated section of the Long Island Railroad (LIRR). Inadequate overhead space clearance (only 11 feet 5 inches of clearance) created unique challenges, such as the need to install shoring and excavate immediately adjacent to the pile-supported pier footings the demolition and removal of the existing pipe, and the lifting and placing of the box sections.

The Contractor explored trenchless alternatives to complete the section as well as to mitigate the risk associated with undermining the railroad support

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structure. Unlike the Queens Boulevard crossing, however, this location required removal of an existing 96-inch reinforced concrete pipe on a cradle. Therefore, changing to a circular section and microtunneling was not an option. Ultimately, NRC proposed jacking the precast concrete culvert sections into place using a custom shield that protected the LIRR foundation and provided sufficient room for the removal of the existing pipe as the new culvert is jacked into position.

## 5. CONSTRUCTION PROGRESS UPDATE

The construction to replace the aging combined sewer on 70th Street was completed in eight segments along the roadway alignment between Queens Boulevard and Queens-Midtown Tunnel Expressway. Table 1 presents each reach of the segment to include subsurface conditions, tunnel lengths, jacking and

receiving shaft sizes and configurations as well as the type of support of excavation system selected and constructed at each shaft location. The microtunneling portion of the work is complete and construction of the permanent MH structures and chambers are underway. The 12ft x 8ft box sewer jacking under the LIRR track bridge on 69th Street between 47th Avenue and Queens Boulevard is in progress. Surface restoration at many of the work sites have begun and continuing as construction activities are completed.

## 6. SUMMARY

The SE859 is a major infrastructure construction project undertaken by the NYC DCC to mitigate flooding and improve quality-of-life in the Maspeth community. Due to the level of coordination and cooperation from community leadership and residents with the project team, the combined

sewer replacement and water main upgrade is projected to be completed ahead of schedule.

The Contractor's early and proactive proposal to making adjustment to the design alignments by shifting Chambers & Special Manhole structures, offsetting the microtunnel alignment and proposing trenchless construction alternative in lieu of open cut construction at Queens Boulevard crossing had a positive influence on the construction schedule, and facilitated minimum traffic disruption and social impact to the community.

Provision and allocation of resources in the Contract for dedicated Community coordination meetings, project updates, and notifications proactively addressed the community's expectations of the impacts resulting from the selected trenchless construction methods which allowed the project team close working relationship with the community.

While the Covid19 Pandemic was not anticipated at the start of the construction, the abrupt global shut down to control spreading of the virus, imposed coordination challenges on the project team to include unintended benefits:

- Classified as a major infrastructure project, SE859 construction continued without interruption
- Raw material shortage delayed production of 96in reinforced concrete microtunnel pipe fabrication.
- Increased work from home reduced traffic volume at the onset of the pandemic lockdown as only essential and healthcare workers were allowed to be on the road. As such, with the majority of the population not having to commute, traffic volume and impact to construction reduced significantly.
- With the reduced roadway vehicular and pedestrian usage, construction activities experienced fewer interferences with construction equipment movement and material deliveries to the project sites.

Table 1. Microtunnel drives completed

Microtunnel Drive Location	Jacking Shaft SOE System/ Structure	Receiving Shaft SOE System/ Structure	Pipe Information	Drive Length (LF)	Ground Condition
Drive 1: Queens Boulevard Crossing	Slide Rail 33'Lx15'Wx31'D	Soldier Pile & Timber Lagging with Double Waler HP14x117	85"(OD 88.6"): Centrifugally Cast, Fiberglass-Reinforced, Polymer Mortar Pipe (CCFRP)	214	Silt, Sand, Rocks (Possible Boulder), Cobbles, Gravel, Clay, Presence of Groundwater
Drive 2: 70th Street	Chamber 4: Soldier Pile, Mega Bracings & Timber Lagging (29'L x 28'W x 37'D)	SMH3-Liner Plate: 30' OD x 64' Deep	96" (115.5" OD) Reinforced Concrete Pipe (RCP)	1,600	Glacial Till: Silt, Sand, Cobbles, Rocks, Boulder, Stones
Drive 3: 54th Avenue	SMH3: Liner Plate - (30' OD x 64' Deep)	SMH4-Liner Plate: 22.5' OD x 61.5' Deep		110	Glacial Till: Silt, Fine Sand, Rocks (Possible Boulder), Cobbles, Stones
Drive 4: 70th Street towards Calamus Avenue	Chamber 4: Soldier Pile, Mega Bracings & Timber Lagging (29'L x 28'W x 41'D)	Slide Rails Panel (Day Light): 23'x15'x22'		240	Silt, Sand, Stones / Gravel, Rocks (Possible Boulder), Cobbles
Drive 5: 71st Street	SMH5: Liner Plate- (30' OD x 54' Deep)	SMH4: Liner Plate (22.5' OD x 61.5' Deep)		590	Glacial Till: Clay, Silt, Coarse Sand, Stones, With Cobbles and Rocks (Possible Boulder)
Drive 6: Grand Avenue	SMH5: Liner Plate- (30' OD x 54' Deep)	SMH6: Liner Plate- (28' OD x 49' Deep)		300	Clay, Silt, Sand, Stones, Cobbles, and Rocks (Possible Boulder)
Drive 7: Mazeau Street	SMH7: Liner Plate (30' OD x 48' Deep)	SMH6: Liner Plate- (28' OD x 49' Deep)		310	Silt, Sand, Stones, Gravel, and Some Rocks (Possible Boulder), Cobbles
Drive 8: Mazeau Street	SMH7: Liner Plate (30' OD x 48' Deep)	SMH8: Liner Plate- (28' OD x 42' Deep)		420	Silt, Sand, Stones, Gravel, and Some Rocks (Possible Boulder), Cobbles

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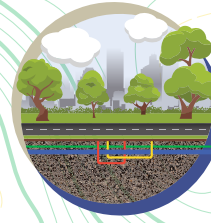
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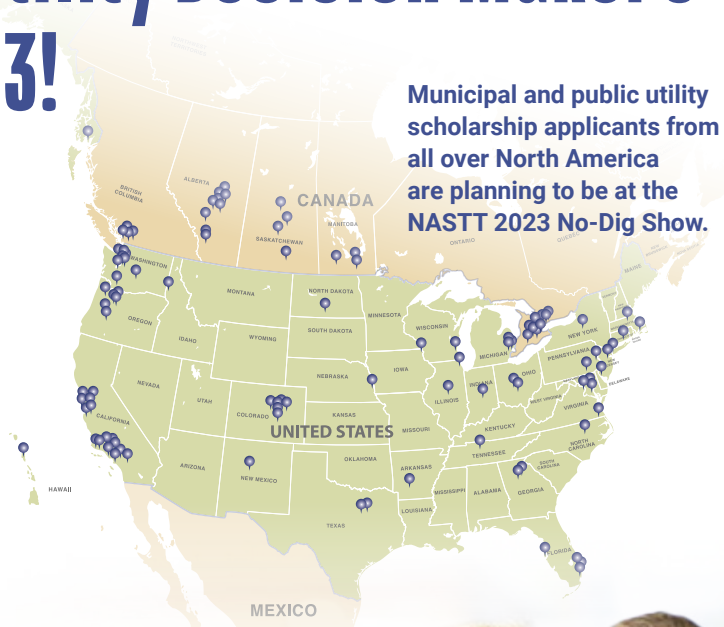
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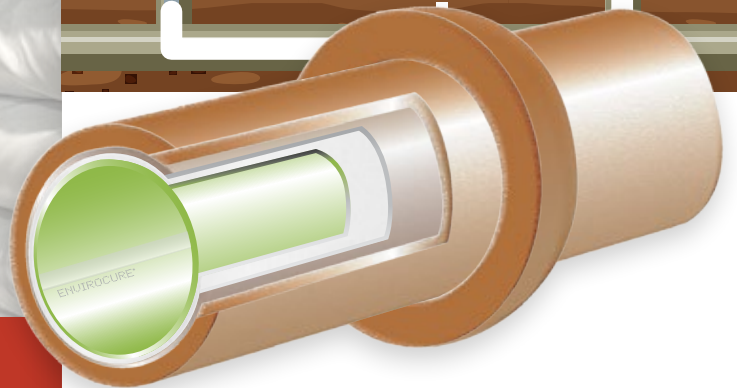
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