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# TRENCHLESS NORTH AMERICA



The Official Magazine of the North American Society for Trenchless Technology



*“As a NASTT member, I have a wide network of people to call when I have questions. And when someone asks me a question that I can’t answer, I know who to send them to. Whether I have the answer or not, I’m still a resource. Membership gives me the opportunity to build my personal brand and to increase exposure to my company’s work in the trenchless industry, both through networking and by presenting on our client’s trenchless projects.”*

— Kim Hanson, PE, Senior Associate, Hazen and Sawyer



**CORPORATE MEMBER LISTINGS INSIDE**

**NASTT 2024 NO-DIG NORTH**

**OCTOBER 28-30, 2024 | NIAGARA FALLS, ONTARIO**

**FALL 2024**  
Volume 14 • Issue 4

A photograph showing several construction workers in safety gear (hard hats, high-visibility vests) working in a tunnel. They are gathered around a large, white, cylindrical pipe being installed. The pipe has an American flag and the Akkerman logo on it. The workers are using tools and equipment to manage the pipe's placement. The scene is dimly lit, typical of an underground construction site.

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# TRENCHLESS NORTH AMERICA



The Official Magazine of the North American Society for Trenchless Technology

## FALL 2024 – VOLUME 14, ISSUE No. 4

# 8

### JOIN US AT THE 6TH ANNUAL NASTT NO-DIG NORTH CONFERENCE IN NIAGARA FALLS!

The 2024 No-Dig North Show October 28 – 30 at the beautiful Niagara Falls Convention Centre will feature 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 nearly 100 exhibitors. Join us for this unparalleled in-person networking opportunity!



## FEATURES

### 12 Q&A: Hiva Mahdavi

Technical Program Committee Chair for No-Dig North 2024, Hiva Mahdavi, PhD, PEng, has maintained a lifelong interest in underground construction, geotechnics, tunneling and trenchless applications. First becoming involved with NASTT in 2019 at the first No-Dig North Conference in Calgary, she feels fortunate to have been part of many challenging and interesting projects throughout her 20-year career. In this interview Hiva offers a well-rounded and thoughtful perspective on the current state of trenchless technology and future prospects for the industry.

### 16 Morty's Trenchless Academy: The Next Step

The next step in lateral and CIPP repair is UV/LEDcuring. The advantages of LED are numerous, but the biggest benefit to the contractor is the reduced stress level while installing. The challenge for manufacturers of CIPP liners for small diameter wastewater pipes has been to get a LED head small enough to fit, as well as flexible enough to do the bends that are more common inside these pipes.

### 27 NASTT 2024-2025 Corporate Membership Listings

NASTT offers special recognition to its Corporate and Government, Utility and Education members in appreciation of their ongoing promotion of NASTT and the industry. The member lists are as of October 2023. The NASTT Corporate, Government & Education Members are highlighted here, along with key contacts, websites and corporate logos – the NASTT community!

### 42 Critical Aspects & Construction Challenges For Use of Direct Steerable Pipe Thrusting (DSPT)

This paper was selected as one of the Outstanding Papers – New Installations from all the presentation at the 2024 NASTT No-Dig Show in Providence RI. This paper describes the 14 Direct Pipe crossings that were part of the overall Trans Mountain Expansion Pipeline (TMEP) project. When expanding the range of the use of a new crossing technology, challenges are to be expected but always come paired with lessons learned.



## DEPARTMENTS

- 4 Executive Director's Message
- 6 Welcome from NASTT Chair
- 20 NASTT's Newest Staff Member!
- 24 NASTT Membership Benefits
- 38 Eye on Industry
- 50 NASTT Regional Chapters
- 52 NASTT Student Chapters
- 53 Events Calendar
- 55 Index of Advertisers

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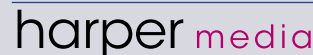
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## WELCOME TO THE FALL 2024 EDITION OF NASTT'S TRENCHLESS NORTH AMERICA

Dear NASTT Members and Trenchless Advocates:

As we enter the final quarter of the year, I want to take a moment to reflect on the incredible growth and progress of the North American Society for Trenchless Technology (NASTT). Our organization thrives because of you – our members – and your dedication to advancing the trenchless industry. In this issue of Trenchless North America, we are focusing on the heart of NASTT: membership value, and our shared commitment to collaboration, innovation, and education.

Membership in NASTT is more than just an affiliation; it is a powerful tool that connects professionals from all corners of our industry. Whether you're an engineer, contractor, manufacturer, or educator, our diverse community provides unparalleled opportunities to expand your network, stay informed of the latest technologies, and sharpen your skills.

NASTT offers numerous member benefits, including access to industry-leading resources such as technical papers, webinars, and publications. Members receive discounts on conferences, workshops, and NASTT's training programs, which provide professional development opportunities. Networking is a key benefit, with access to a community of trenchless professionals through local Regional Chapters, and our flagship events No-Dig Show and No-Dig North. Members also gain the chance to contribute to technical committees and participate in guideline development. Additionally, they receive exclusive access to job postings and industry updates, helping to stay current with trends and opportunities in trenchless technology.

As part of our Strategic Plan delivery the formation of a new Membership Committee recognizes the importance of reviewing recruitment & retention efforts. The objectives of this committee are to identify industry trends, member needs, review and expand membership benefits as well as creating a map for the career stage needs of trenchless professionals. You will be hearing from some of the committee about their own trenchless stories, and if you are inspired to be part of this group then please contact us to be involved.

We are also featuring 2024 No-Dig North, which this year is taking place in beautiful Niagara Falls from October 28-30. This year's conference promises to be one of the most exciting yet. The technical program is packed with over 84 peer-reviewed papers, including a track session of 13 presentations by NASSCO, covering everything from new installation methods to asset management and rehabilitation. Attendees will also have access to the largest exhibit hall to date with over 130 exhibitors showcasing the latest innovations in trenchless technology. Whether you're a seasoned professional or new to the industry, No-Dig North is a unique opportunity to engage, learn, and contribute to the future of trenchless solutions.

I would like to extend a personal invitation to each of you to join us. Beyond the technical sessions and exhibits, this is a chance to reconnect with colleagues, forge new partnerships, and experience the camaraderie that makes NASTT such a special organization. Your participation not only enriches your own professional growth but also strengthens the entire trenchless community. Registration and hotel reservations can be made at [www.nodignorth.ca](http://www.nodignorth.ca).

So, here's to you – our present and future members – Thank you!  
We look forward to seeing many of you in Niagara Falls!

Enjoy your read!

**Matthew Izzard, Executive Director**  
**North American Society for Trenchless Technology (NASTT)**  
[mizzard@nastt.org](mailto:mizzard@nastt.org)



**NEW HEIGHTS.  
UNDER GROUND.**

*“NASTT is more than  
just an affiliation, it  
is a powerful tool.”*

*“Experience the  
camaraderie that  
makes NASTT  
such a special  
organization!”*



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## WE CONTINUE TO STRENGTHEN OUR COMMUNITY AND ENGAGEMENT

Hello NASTT Members and Trenchless Champions!

As we enter the fall, I hope this message finds you well and thriving. I want to take this opportunity to share some exciting updates and important reminders as we continue to strengthen our community and engagement within the trenchless industry.

### Member Directory Edition

Welcome to this special edition of our magazine, dedicated to the Member Directory! This issue serves as a vital resource for networking and knowledge sharing within our community. As we highlight the profiles of our members, we encourage you to explore the diverse expertise and experiences that each individual brings to the table. Connecting with fellow members is essential for fostering collaboration and innovation, and we hope this directory inspires meaningful conversations and partnerships. Let's continue to learn from one another and strengthen our network as we work towards our shared goals!

### No-Dig North

I am thrilled to highlight the upcoming No-Dig North conference being held October 28-30 in picturesque Niagara Falls, Ontario! This event aims to support our approach to underground infrastructure rehabilitation and installation. This event is a premier opportunity for professionals in our field to learn about the latest innovations and best practices in trenchless technology throughout Canada. We encourage all members to attend and take advantage of the technical sessions, exhibits, and networking opportunities. Visit [www.nodignorth.ca](http://www.nodignorth.ca) for all the details.

### Upcoming Regional Chapter Events

In addition to No-Dig North, we have a range of regional chapter events lined up in the coming months. These gatherings are not only an opportunity to learn about best practices but also a chance to network with fellow members and industry experts. Each chapter will focus on specific topics pertinent to our field, offering valuable insights and resources tailored to regional needs.

Please mark your calendars! Whether you're interested in hands-on demonstrations, expert panels, or roundtable discussions, there's something for everyone. Details about these events, including dates and registration information can be found on our website at

<https://nastt.org/training/upcoming-events>. They are also listed on pg61 of this magazine. I encourage you to participate actively and take advantage of these invaluable opportunities to connect and grow.

As the holiday season approaches, it's a wonderful time to reflect on the year's accomplishments and the relationships we've built. I encourage everyone to take a moment to express gratitude to colleagues and mentors who have supported you throughout the year. Our community thrives on collaboration and mutual support, and this season is a perfect opportunity to celebrate that spirit.

I want to thank each of you for your continued commitment to our mission and your active participation in our initiatives. Your involvement is what makes our community so vibrant and effective. As we navigate the coming months, let's continue to support one another, share our knowledge, and push the boundaries of what we can achieve together.

Wishing you all a productive and fulfilling fall season!

*Matthew Wallin*

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



**NEW HEIGHTS.  
UNDER GROUND.**

*“Mark your calendars  
for the 2025 NASTT  
No-Dig Show  
March 30-April 4  
in Denver, CO!”*

*“Our community  
thrives on  
collaboration and  
mutual support”*

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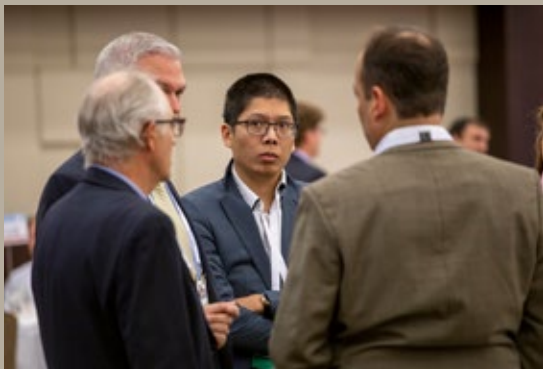
# UNDERGROUND INFRASTRUCTURE SUSTAINABILITY:

## NASTT and the Canadian Regional Chapters Host 6th Annual No-Dig North Conference

**N**o-Dig North is the largest trenchless technology conference in Canada where municipalities, contractors, consulting engineers, public utilities, industrial facilities, and damage prevention professionals attend to learn new techniques that will save money and improve infrastructure. This show offers topic tracks over the course of two days with peer-reviewed, non-commercial presentations, including case studies detailing environmentally friendly trenchless solutions and cost-saving opportunities. Additionally, an exhibition hall and networking events are offered throughout the week for opportunities to exchange ideas with colleagues. NASTT's suite of Good Practices Courses is offered on the first day of the conference as well.

No-Dig North held its first conference in 2019 and was an immediate success with over 800 attendees typically in attendance. This year we are expecting to reach the 1,000 + mark as well as welcome over 130 exhibiting organizations.

The No-Dig North 2024 conference will take place October 28-30 in Niagara Falls, ON at the Niagara Falls Convention Centre. Be sure to join us during the conference on Tuesday morning, October 29 for the presentation on the Canadian Projects of the Year. This year awards will be presented for New Installation projects and Rehabilitation projects. Networking events will be held throughout the week including an opening reception in the exhibit hall on Monday evening, Project of the Year and Keynote Breakfast on Tuesday morning and a cocktail reception held at the Niagara Falls Power Station on Tuesday evening.



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



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

**For agenda and an overview of technical please visit:**

**<https://www.nodignorth.ca/program/>**



# TRENCHLESS AT THE FALLS

NIAGARA FALLS, ONTARIO



OCTOBER 28-30 | NIAGARA FALLS, ON  
**NO-DIG NORTH**  
2024

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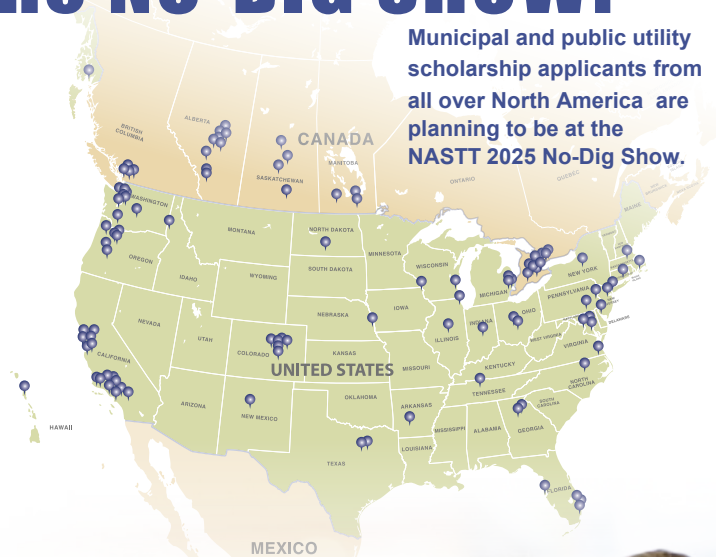
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**NASTT 2025 NO-DIG SHOW | MARCH 30-APRIL 3 | DENVER, CO**

## **ATTENTION TRENCHLESS CONTRACTORS....**

# **Municipal & Public Utility Decision Makers will be at the NO-DIG SHOW!**

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



Municipal and public utility scholarship applicants from all over North America are planning to be at the NASTT 2025 No-Dig Show.

### **CONNECT WITH THEM AT NO-DIG!**

- Networking Events
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with  
**Hiva Mahdavi**

*Hiva is the Conveyance Sector Leader for Canada East with Stantec who has enjoyed a lifetime interest in underground construction, geotechnics, tunneling and trenchless applications. She has managed and designed projects including large-diameter tunnels, microtunneling, horizontal directional drilling (HDD) auger boring (HAB). Hiva has led projects of wide-ranging scopes, including feasibility studies, impact assessments, advanced numerical modeling, instrumentation design, detail design, geotechnical baseline reports (GBR), and construction support. She is also an active volunteer with NASTT and is Technical Program Committee Chair for No Dig North 2024 in Niagara Falls, October 28 – 30. She shares her ideas on the current and future state of the trenchless technology industry.*



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

My interest in underground construction began during my underground studies. I was quite fascinated by soil and bedrock behaviour, how the subsurface reacts during excavation, how to support the ground, interaction between soil and structure, which is closely related to tunnelling and trenchless installation. Think about it, there is this massive medium composed of grains that are thousands of years old, and we have found ways to predict how soil or bedrock behaves through simplified equations. To learn more about this subject I pursued a master's degree in Geotechnical Engineering and later a PhD focusing on buried oil and gas pipelines. I worked on understanding how the failure of buried pipelines due to ground movements can be influenced by type of soil surrounding the pipe. In a way, there are similarities between how a buried pipe behaves in comparison with a tunnel which led me into tunnelling and trenchless industry.

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

I was first introduced to a variety of new installation methods during my college years, 1998 – 2002, however professionally it was 2010 that I became involved in geotechnical investigations for various tunneling and trenchless projects. From that point I directed my career to tunnel and trenchless design and construction support and have been fortunate enough to be part of many challenging and interesting projects.

***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 a speaker at No Dig North in 2019 in Calgary. Later, I became involved with NASTT as a conference track leader and moderator at No Dig North in 2022 in Toronto. My colleague Gerry Bauer connected me with the conference organizing committee, who were searching for volunteers. Since then, I have continued my volunteer work with NASTT. I believe NASTT is one of the most open and welcoming organizations in the trenchless industry, which I greatly appreciate. It's inspiring to see people from different areas of our industry collaborating. The short courses, conferences, and seminars offered are very helpful. A key goal for the industry is to attract younger minds. For No Dig North in Niagara Falls, the conference committee for Student Chapters is working to encourage more student papers and to support participants through awards and scholarships. I think it would be very effective to have experienced professionals visit universities or even high schools for mentorship programs and guest lecturers to inspire these bright young minds.

***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?***

The trenchless industry is evolving just like the rest of the technological world. One major change on the horizon is the application of artificial intelligence (AI) and machine learning. We are already seeing more advanced robots for the condition assessment of buried pipes, customized drones

*“I was quite fascinated by soil and bedrock behaviour.”*

capable of navigating complex networks of underground pipes, and Implementation of AI in CCTV reviews, all, making our everyday type of work faster and more efficient.

I imagine that these trends in AI and machine learning will become significant components of STEM education and post-secondary academics for our children.

***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?***

I would say yes, and there is always room to be a bit louder. The trenchless industry encompasses a wide range of fascinating subjects, from manufacturing products that can withstand a 40-meter head of water to installing pipes across a wide and deep river – take your pick. However, when kids are in school, they don't often learn about or hear much about these intriguing products and technologies.

*“A key goal for the industry is to attract younger minds.”*

NASTT's efforts to establish Student Chapters and involve them are great. In line with this, offering site visits, giving lectures in schools, and publishing materials in simple language targeted at younger students would be very helpful.

I recently bought a book for my eight year old son explaining variety of construction activities through interactive pages. There is one page showing a tunnel boring machine cutting through soils. You can rotate the disc cutters and learn how mucks being conveyed toward the launching shaft. My son was fascinated.

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

I think training professionals to maintain resources is a significant challenge for us. The construction industry is thriving, and owners need to secure proper resources to ensure projects are delivered on schedule. The trenchless

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*“NASTT is one of the most open and welcoming organizations.”*

*“Fortunate enough to be part of many challenging and interesting projects.”*

industry is a specialized field, and each area within this industry requires years of experience and training. People working in this industry come from diverse backgrounds. We need experts who can write Geotechnical Baseline Reports, locate utilities, design pipe or tunnel liners, design spray liners, and operate CIPP or tunnel boring machines.

We must continuously train people to keep these projects and the industry running smoothly and to keep up with the recent accelerated pace.

I would say yes, definitely. I have personally observed how my clients' acceptance of trenchless installation has changed over the past 20 years. I believe advancements in technology, from field investigation to actual installation, have helped reduce the level of risk.

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

Honestly, when you work in this industry, every single project is interesting. Your daily work is anything but boring. I work on the consultant side, where we usually start from scratch. Beginning with desk studies and field investigations to collect data, we then evolve the design to the tender process and continue through construction. As part of design preparation and project construction, I always work with the Owners, various manufacturers and trenchless installers, which I really enjoy.

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## The Next Step

### Advances in UV/LED Small Diameter Curing

By: Andrew Marshall, BRAWO SYSTEMS GmbH



## BRAWO SYSTEMS

The next step in the lateral and in-building CIPP repair is UV/LED-curing. The advantages of LED are numerous, but the biggest benefit to the contractor is the reduced stress level while installing. With a one-part resin that only cures when contacted by UV/LED light, the days of mixing then racing to get the liner installed before the resin cured are over. Now, if/when problems arise, the installer has time to troubleshoot, fix the problem and continue with the job instead of having to pull out the liner and start over if it's not an easy and quick fix.



*The BRAWO® Magnavity SX offers two easily interchangeable LED heads*

UV/LED-curing has been around for more than a decade now. Historically, UV/LED curing has been more commonly used on mainline and large diameter pipe, due to the need for multiple access points to pull the light train through. The challenge for manufacturers in small diameter wastewater pipes has been to get a LED head small enough to fit, as well as flexible enough to do the bends that are more common inside these pipes.

BRAWO SYSTEMS GmbH, headquartered in Kaiserslautern, Germany, has long been known globally as the premier producer of flexible liners for small diameter defective pipes. With their manufacturing process of a seamless liner with special loop construction, BRAWOLINER® has become the 'go to' brand name when running into a small diameter pipe with bends. UV/LED repairs are moving into the small diameter space, beginning in Europe and now with rapid growth in North America. BRAWO® SYSTEMS had already developed the BRAWO® Magnavity in 2020. Now its new, further developed light curing system BRAWO® Magnavity SX comes with 20 percent more range. The innovative system offers users a unique form of light curing: smart, efficient, and as powerful as usual with an even longer range of 60 metres (196 feet), still with compact dimensions and light weight. At the 2024 NASTT No Dig Show in Providence, Rhode Island, the smart light curing system BRAWO® Magnavity

SX won the NASTT Abbott Innovative Product Award. The BRAWO® Magnavity SX offers two easily interchangeable LED heads, Nano and Mega, to enable the rehabilitation of diameters DN 70 (3 inches) to DN 300 (12 inches) with the BRAWOLINER® and the BRAWO® UVPOX light resin without the need for multiple systems to do different sized projects. The curing takes place automatically, based on a few simple inputs into the touchscreen panel, and the entire rehabilitation process is documented and saved for post-installation review.

The BRAWO® Magnavity SX can be used to rehabilitate pipes featuring up to 90-degree bends in 4-inch lines over distances of up to 60 metres (196 feet) from one access point. The high installation safety and the usual high quality of BRAWO® Tech is guaranteed. This is underlined by the CE conformity and the Magnavity SX is the only UV/LED relining system with an NRTL certification, meeting all OSHA work safety standards for both the USA and Canada.

#### Smart – Efficient – Strong

These three attributes apply to the BRAWO® Magnavity SX, which makes curing with light even more efficient, smarter,



*Curing is done immediately after installation of the liner*

and more powerful. The system consists of an intelligent LED head, which keeps track of lifetime for maintenance purposes as well as communicating with the control box for the variable retraction speed. The 60-meter (196 foot) long combination hose contains both integrated power



*“The biggest benefit to the contractor is the reduced stress level while installing.”*



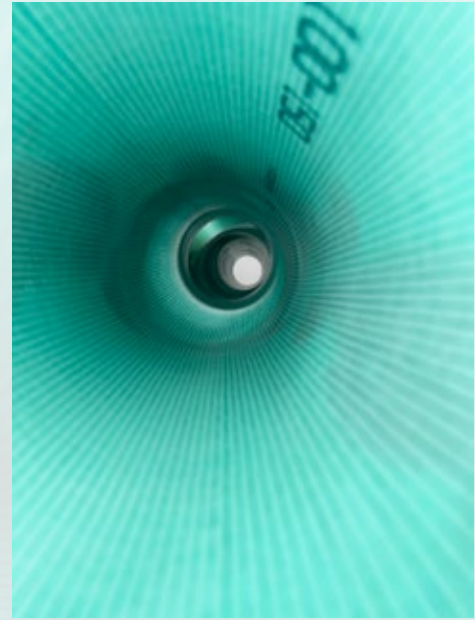
*Only one access point is necessary even for longer rehabilitation lengths*

and compressed air supply and a switchable dual camera system. The system is completed with a self-retraction unit and a control box with a 10-inch touch screen.

The innovative, unique design of the LED head uses an electromagnet, which allows it to be inserted simultaneously with the inversion of the liner. Curing is thus carried out immediately after installation of the liner, without the need for an additional step for the insertion of the LED head. When combined

with an end-cap, no second installation of calibration hose is required as well. In this way a complete work step is skipped, and material cost is lowered!

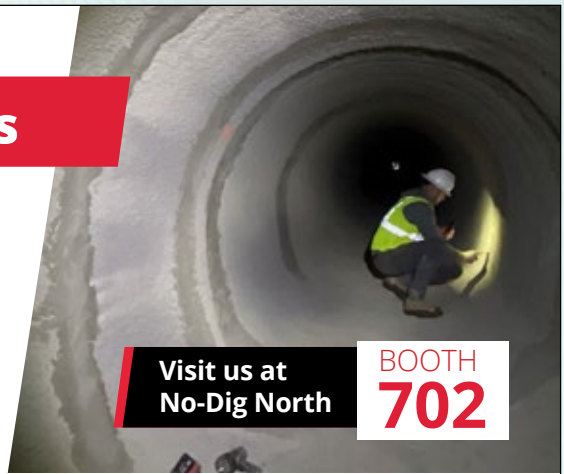
Furthermore, this means that only one access point is necessary even for longer rehabilitation lengths with bends as the LED head does not need to be pulled in via another access. In many cases, this becomes the only way to make rehabilitation possible at all, since an additional access opening (e.g. inspection opening, shaft) cannot be created or is only possible with considerable effort in most construction measures.



*BRAWO® UVFox is first pigmented light curing epoxy resin on the US market*

## Pipe Rehabilitation Solutions

Safe, unobtrusive pipeline repair is essential to our nation's infrastructure. Michels has perfected an array of solutions to maintain and rehabilitate pipes and utilities in places where new construction would not be feasible or affordable. From cured-in-place pipe (CIPP) and spray-in-place pipe (SIPP) to sliplining and chemical grouting, we extend the lifespan of sanitary, storm sewer and potable water mains.



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# Morty's Trenchless Academy

The core of the system is an electromagnet integrated in the LED head, which can be remotely unlocked via the system's control unit after inversion. The pull connection is released and the LED head, which is then activated, can be retracted at a speed of 0.1 to 2.0 m/min by means of the retraction unit. The liner cures completely using 96/196 high-power UV LEDs with over 50 percent efficiency instead of the usual 30 percent.

The system's installation log can be accessed and processed via an interface on the mobile device. As a result, the installer can track important information such as temperature and pressure should a customer claim arrive in the future.

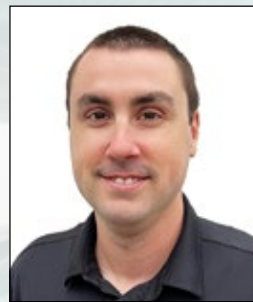
Thanks to its modular construction, compact design and at 155 pounds the BRAWO® Magnavity SX is easy to transport. The system runs on any US three-pronged wall outlet, so no need to drag an additional power source onsite. As a result, the system works even under the most difficult access conditions.

## Going Further

Traditionally, there were two challenges of the UV/LED resin, shrinkage and optical inspection of the wet out. With resins conventionally having been clear, unpigmented vinyl ester, when impregnating a liner, the installer had to pay very close attention to make sure the liner was completely saturated.

Additionally, styrene-based resins introduced strong odours and lead to post-install shrinking. As a result, they were not optimal for in-building rehabilitation. BRAWO® SYSTEMS changed the game with BRAWO® UVPOx. It is the first pigmented light curing epoxy resin on the US market that can be used with UV and LED light. The additional work that was previously necessary when using light curing for the rehabilitation of building and property drainage systems, such as the installation of a liner end collar to close the annular gap or a connection collar for the watertight connection of side inlets, is now no longer mandatory, saving time and costs.

In addition, an almost endless processing time ensures high installation reliability and targeted control of rapid curing by light. Furthermore, BRAWO® UVPOx is styrene-free and low-odour and for the first time, light curing resins have made it possible to visually check the impregnation before installation.



*Andrew Marshall is Sales Manager- USA at Brawo Systems, responsible for all sales in the US and Canada for Brawo Systems CIPP (Trenchless) products and equipment.*

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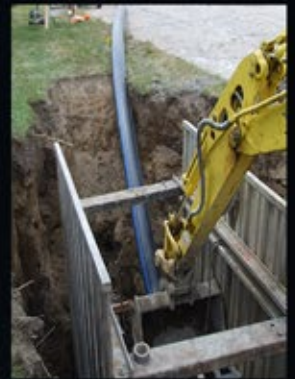
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## Meet NASTT's Newest Staff Member!

### AMY SHIPP

#### Conference Program Specialist



Amy joined the NASTT team in April of 2024 as the Conference Program Specialist rounding out the conference services team. Her extensive non-profit experience encompasses volunteer management and member engagement, meeting and event coordination, education and the delivery of training and development programs. Amy is motivated by cultivating relationships, delivering exceptional service, creative problem solving, and leveraging technology to meet business needs. A passionate volunteer, she brings her enthusiasm and skills to her children's Parent Teacher Organization.

Amy was born and raised in Northern VA and returned to her home state to put down roots and grow her family. She lives in the Shenandoah Valley with her husband, daughter, son and 5 kitties (yes, 5). When she's not in the kitchen cooking and baking for loved ones, you can find her out tromping in nature with her family and counting down until the next visit to the lake or beach.

Amy's responsibilities at NASTT include conference registration, the Municipal & Public Utility Scholarship programs and the conference technical session programs. Amy can be reached via email at [ashipp@nastt.org](mailto:ashipp@nastt.org).

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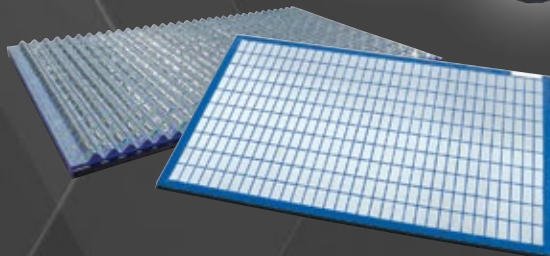
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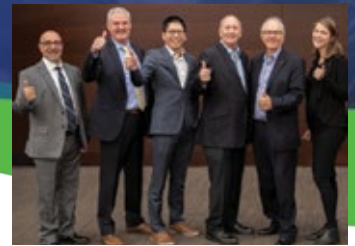
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### Be a solution provider.

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

### Be on the front lines of trenchless issues and products.

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

### Be the best with support from the best.

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



[nastt.org/membership](http://nastt.org/membership)

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

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

## Build Your High-Impact Career with NASTT

Having a high-impact career means building a useful skill set, establishing a strong platform of knowledge, sharing ideas, and gaining experiences in decision-making and problem solving. NASTT members value access to high-quality education, networking community, leadership opportunities, technical papers and publications and a broad community of trenchless professionals.



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

## Top NASTT Member Roles



### ENGINEER

- Civil Engineer
- Engineer Director
- Principal Engineer
- EIT/Staff Engineer
- Senior Engineer
- Tunnel Engineer



### MANAGER/DIRECTOR

- Supervisor
- Superintendent
- Branch Manager
- Division Manager



### PROJECT MANAGER/ TEAM LEADER

- Project Manager
- Sr. Project Manager
- Project Engineer
- Practice Lead



### EXECUTIVE/C-SUITE

- President/CEO
- Vice President
- Principal
- Owner
- COO



### SALES/BUSINESS DEVELOPMENT

- Vice President Sales
- National Sales Manager
- Regional Sales Manager
- Marketing Manager
- Business Development Manager

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



## Build Your Career Capital with NASTT



*“Membership is all about the connections I make. They go beyond, ‘Hey, I think that’s Tiffanie with Sunbelt.’ It’s, ‘Hey, Tiff, how are you?’ and hearing a response of ‘What are you working on? How can I help?’ These are relationships that you can build and trust – in order to further your work career and your personal goals.”*

*– Chris Knott, Director of Business Development and Estimating, BTrenchless*

## GET CONNECTED: NASTT Member Connect Directory (Members Only)

 <p><b>Don Del Nero PE, CDT</b> Sr. VP/Tunnel Engineering Director WSP USA Atlanta, Georgia Mr. Del Nero is a Sr. VP and Tunnel Engineering Director with WSP. He has a BS in Civil Engng. and MS in Geotechnical Engng. He is an instructor for several underground industry short courses. His trenchless engineering experience involves a wide variety of pipeline types and the full range of new installation trenchless methods. He is often sought by clients to engage on risk management and dispute resolution and has helped resolve several major claims on underground projects.</p>	 <p><b>Jennifer Glynn PE</b> Senior Technical Practice Lead Woodard &amp; Curran Sacramento, California Jen is a Senior Technical Practice Lead and Principal for Woodard &amp; Curran out of their Sacramento, California office. She has over 25 years of experience in Project Management and Infrastructure Design, with an expertise in Condition Assessment and Trenchless Rehabilitation. Jen has been authoring papers and presenting at conferences both domestically and internationally for the past 20+ years. She is a past Executive Board Member for NASTT and is currently on the WESTT Board of Directors.</p>	 <p><b>Branako Primm PE</b> Technical Consultant Burns &amp; McDonnell Kansas City, Missouri As a seasoned technical consultant with over 18 years of experience in pipelines, civil design and transportation, Kirby is a specialist in trenchless technology, with a focus on HDD, conventional bore, and Direct Pipe® installations. He holds a degree in civil engineering, as well as professional engineering licenses in 14 states, and has led the design and implementation of trenchless projects across the country.</p>
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Connect easily with other members to find referrals, identify leads for partnerships, find a mentor, contact technical paper authors and presenters or reconnect with former colleagues. Update your profile with your photo, bio, LinkedIn link and contact information. Search by Organization name, city, state and more.

<https://members.nastt.org/member-directory>

## GAIN KNOWLEDGE: NASTT Trenchless Knowledge Hub

*“Working and researching in academia, I read a lot of academic journal articles – which are highly valuable in technical and theoretical aspects. However, I sometimes find a gap, and I wonder ‘What is really happening in the field?’ NASTT’s technical papers guide me in the field and demonstrate their practical applicability through case studies. And I can have conversations with the presenters during and after the conference.”*

*– Inshik Park, Ph.D. Candidate / Graduate Research Assistant, University of Alberta*



The Trenchless Knowledge Hub is the only comprehensive collection of knowledge, wisdom and resources for the trenchless and underground infrastructure professional community from more than 30 years of NASTT No-Dig events.

**Technical papers are free – but only if you're a NASTT member.**

- Everything you need is in one place so you can access it from any device wherever and whenever you need it.
- All content (videos, publications and more) has been vetted, curated, organized, tagged and prepared for dynamic search and filtering capabilities.
- NASTT’s HDD Good Practices Guidelines, new fifth edition e-book is now available.

<https://knowledgehub.nastt.org>

# NASTT Membership

## GET INVOLVED: Local Regional Chapters, In-Person & Virtual Volunteer Opportunities



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

– Marya Jetten, Conveyance Market Sector Lead, AECOM

Involvement in a local Regional Chapters gives you the opportunity to meet in person to:

- Build a power network of trenchless professionals in your area.
- Identify projects, solutions and resources near you.
- Be a recognized leader in the regional trenchless community.
- Write Serve on a committee or the chapter board.
- Be a mentor to students at local colleges and university.

<https://nastt.org/about/regional-chapters>

NASTT volunteers are highly engaged in supporting the strategic direction set in place by the NASTT Board. NASTT members – **no matter their experience level** – can deepen their engagement through short-term projects, committee programs, board service, writing and speaking opportunities and more.

With every new volunteer, NASTT grows more energized, and better equipped to reach our common goals.

<https://nastt.org/membership/volunteer>



## FUEL YOUR INSIGHTS: NASTT Learning

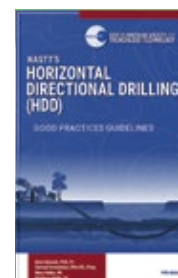
*“NASTT is far and away the leading educator and networking pool in the trenchless industry. If your company plays a part in the trenchless industry, you will benefit from NASTT membership more than you realize.”*

– Joe Lane, Vice President, Business Development, Azuria Water Solutions.



NASTT learning opportunities meet you where you are and help take you where you want to be. Live in-person instruction at regional chapter conferences and signature national events, the NASTT No-Dig Show and No-Dig North, deliver cutting-edge content across multiple technical areas, celebrate the industry and bring members together for innovation, education, business networking, and inspiration. NASTT’s Good Practices Courses take place both in person and virtually. Updated regularly, you’ll keep your skill set competitive and fresh with content taught by leading experts covering targeted trenchless topics: CIPP, HDD, pipe bursting, laterals and new installation methods. Plus, you’ll earn CEUs to keep your license active.

<https://nastt.org/training/upcoming-events>



## About the NASTT Member List

NASTT offers special recognition to its Corporate and Government, Utility and Education members in appreciation of their ongoing support of NASTT and the industry. Primary contacts for these Group Members are included in the listing. For contact information or to connect with individual NASTT members, log in to your NASTT profile to access the NASTT Member Connect Directory. The member lists are as of September 2024.

*Commercial solicitation is prohibited.*

## NASTT Group Membership Promotes Peak Performance

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

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



*“As a NASTT member, I have a wide network of people to call when I have questions. And when someone asks me a question that I can’t answer, I know who to send them to. Whether I have the answer or not, I’m still a resource. Membership gives me the opportunity to build my personal brand and to increase exposure to my company’s work in the trenchless industry, both through networking and by presenting on our client’s trenchless projects.”*

*- Kim Hanson, PE, Senior Associate, Hazen and Sawyer*

## About the NASTT Member List

NASTT offers special recognition to its Corporate and Government, Utility and Education members in appreciation of their ongoing promotion of NASTT and the industry. Primary contacts are included in the listing. The member lists are as of October 2024.

**Do not use this list for purposes such as advertising, solicitations, and mass communications.**

## Corporate Members

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




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*“NASTT has given me a venue to learn through listening and to give back through speaking, writing peer reviewed papers and teaching. Meeting and collaborating with friends/colleagues and finding new friends and colleagues, it has been a very rewarding experience and continues to be so.”*

*– Chris Macey, Americas and Global Technical Practice Leader, AECOM*



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*“Membership represents a great opportunity to have access to extensive quality information, made up of years of knowledge and experience in the sector that will allow us to access the best resources for the development of highest quality projects and/or works with the least impact on our country of Mexico.”*

*– Adrián Cordero, Coordinator, Tubepol*

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**GHD**  
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## CUIIC Awarded Major NSERC Alliance Grant for Underground Infrastructure Research *Mitigating Greenhouse Gas Emissions*

The Canadian Underground Infrastructure Innovation Centre (CUIIC) announces the award of a Natural Science and Engineering Research Council (NSERC) Alliance Grant for the groundbreaking project titled "Greenhouse Gas Emission Reduction in Design, Construction, Repair, and Maintenance of Underground Infrastructure."

This initiative, led by Dr. Alireza Bayat, Professor of Civil and Environmental Engineering and Director of CUIIC, brings together three Canadian universities to develop innovative strategies and technologies aimed at mitigating greenhouse gas emissions across various phases of underground infrastructure projects. The co-applicants include Dr. E. Davies, Dr. L. Hashemian, and Dr. S. J. Birchall (University of Alberta); Dr. R. Dziejcz (Concordia University); and Dr. I. L. Stefanovic (University of Toronto).

NSERC and 21 industry partners are funding cash and in-kind contributions totalling three million dollars over five years. The research will provide training opportunities for ten graduate and undergraduate students, allowing them to gain hands-on experience and interact with industry professionals in the field of underground infrastructure.

The Industry Partners include: Associated Engineering, EPCOR Water Services Inc., Metro Vancouver, Insituform Technologies, Region of Peel, AECOM, UDI Edmonton, Alberta Roadbuilders & Heavy Construction Association, Mott MacDonald Canada Ltd, Stantec Consulting Ltd., ATCO Gas and Pipelines Ltd, Dura-Line, eTrenchless Group, Lafarge Canada Inc., North American Society for Trenchless Technologies-NW Chapter, ParklandGEO, Precon, PW

Trenchless Construction Inc., Westlake Pipe & Fittings, Benjamin Media Inc., Uni-Bell PVC Pipe Association.

CUIIC, housed at the University of Alberta, continues to be at the forefront of research and innovation in underground infrastructure leading collaborative efforts between academia and industry to address critical infrastructure challenges.

Dr. Bayat expressed his excitement about the project, stating, "This initiative will advance sustainable practices in the design, construction, repair, and maintenance of underground infrastructure, significantly reducing greenhouse gas emissions and contributing to environmental conservation efforts."

### **About CUIIC:**

The Canadian Underground Infrastructure Innovation Centre (CUIIC) is a research and education centre focused on important issues of underground infrastructure. CUIIC is located at the University of Alberta in Edmonton.

CUIIC focuses on providing stakeholders across all sectors with opportunities to collaborate on research and training opportunities in underground infrastructure. Together, we foster innovation to provide cost-effective, sustainable solutions to the challenges involved in building, assessing, and rehabilitating underground infrastructure.

We acknowledge the support of the Natural Sciences and Engineering Research Council of Canada (NSERC).



## Vermeer Introduces Compact, Efficient MX150 Mixing System

Efficient mixing of drilling fluid is crucial for horizontal directional drilling (HDD) operations. The new Vermeer MX150 mixing system offers contractors a compact, powerful solution designed to optimize productivity in tight spaces. Featuring a Kohler 7-hp (5.2-kW) gas engine that delivers a maximum flow of 150 gpm (568 L/min), the MX150 mixing system provides quick yield times to help crews get drilling faster. Its slim profile and customizable configuration options make it an ideal companion for small to mid-size utility HDD projects.

"The Vermeer MX150 mixing system is designed to meet the needs of contractors working in increasingly compact jobsites," said Clint Recker, product manager of trenchless products at Vermeer. "With its powerful engine, efficient mixing capabilities and flexible setup options, the MX150 enables crews to work efficiently without sacrificing valuable space."

The new Vermeer mixing system can be paired with 300 gal (1,135.6 L), 500 gal (1,892.7 L) narrow or 500 gal (1,892.7 L) wide tanks, allowing contractors to customize their setup based on job requirements. Its 24.4 in (62 cm) narrow tank width enables the MX150 to fit alongside mid-size utility directional drills, making efficient use of trailer space.

The MX150 features a specially designed tank shape that allows for efficient fluid mixing and minimizes solids settling at the bottom. This, combined with the system's powerful engine, contributes to its quick yield time and high productivity. The unit also includes a convenient garden hose fitting for easy cleaning of the hopper and machine.

Maintenance is simplified with a premium high-grade seal built for longevity and resilience in dry operations. Additionally, the mud pump seal grease level indicator provides operators with feedback to help extend component life.

For added flexibility, the MX150 allows operators to configure the power unit with the hose outlet pointing to the back or side of the trailer, enabling efficient hookup from the mix system to the drill.



The MX150 comes with a 6-gal (22.7-L) fuel tank, providing enough capacity for a full day's work. Winterization is made easy with removable hoses and accessible drain points.

### About Vermeer Corporation

Vermeer delivers a real impact on the way important work gets done through the manufacture of high-quality underground construction, agricultural, surface mining, tree care and environmental equipment. With a reputation for being built tough and built in a better way, Vermeer equipment is backed by localized customer service and support provided by independent dealers around the world.

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## MCELROY Unveils 'MCELROY MUSEUM' Celebrating Company's History

McElroy, the world's leading designer and manufacturer of pipe fusion equipment, hosted a ribbon cutting ceremony this summer to commemorate the opening of the McElroy Museum.

Located in the company's new, 193,000-square-foot Tulsa metro campus, the McElroy Museum details the 70-plus-year history of the company, from its founding in 1954 to its latest cutting-edge products. The museum is made up of a series of vignettes, each one showcasing a milestone in McElroy's history. This includes the first products designed by founder Art McElroy, the company's foray into fintube and butt fusion equipment, and the evolution of its digital and equipment offerings.

Other vignettes show different marketing collateral and promotional items from decades past, such as vintage shirts and hats.

"What you see here is a testament to the legacy of McElroy's commitment to quality and the relationships we've cultivated throughout our history," said McElroy President and CEO Chip McElroy. "We can't wait to share this experience with our channel partners, , customers, and others who visit this campus."

A walkway guides visitors through the exhibits, beginning with McElroy's founding in 1954 and culminating with the advent of the TracStar® and machines for the polypropylene market. In the middle of the space, a nook with seating showcases some of the different educational and promotional videos produced by the company over the years.

McElroy's in-house creative team handled all aspects of the museum's design and execution, from the layout and flow of exhibits to choosing which elements to incorporate. The museum's design allows exhibits to be rotated or updated as needed, giving guests a unique experience each time they visit.

In addition to curating the wide array of historical photos, documents, and items from the company's history, the creative team also was tasked with creating an archival system that will ensure safe storage for each exhibit both on and off-display.

"It's been an enormous undertaking, but our team rose to the challenge and created something that we're all proud of," said Creative Services



*McElroy President and CEO Chip McElroy, Executive Vice President of Finance/Treasury Donna (McElroy) Dutton, and Executive Vice President of International Market Development Peggy (McElroy) Tanner join in cutting the ribbon for the McElroy Museum, unveiled Wednesday at McElroy's newest campus in the Tulsa metro area. The siblings are the children of McElroy founders Art and Panny McElroy and have continued to build upon the company's legacy of success.*

Manager Corey George. "We're excited to see others get to experience the museum now that it's complete."

To learn more about McElroy's legacy of success and continued commitment to innovation and quality, visit [www.mcelroy.com](http://www.mcelroy.com).

### About McElroy

McElroy is the leading manufacturer and innovator in the science of joining thermoplastic pipe. The Tulsa, Oklahoma-based company offers the industry's most complete line of butt, saddle and socket fusion equipment for 1/2" CTS to 2000mm OD pipe as well as quality assurance accessories that increase productivity and efficiency on the jobsite. For more than 65 years, McElroy has successfully demonstrated a complete dedication to excellence that lies at the heart of the design, engineering and manufacturing of its products.





## Wyo-Ben Expands Global Footprint with Launch of Wyo-Ben Pet Canada in Toronto

Wyo-Ben, a leading provider of high-quality pet products proudly announces the grand opening of Wyo-Ben Pet Canada, located in the vibrant city of Toronto, Ontario. This expansion marks a significant milestone in Wyo-Ben's commitment to delivering exceptional pet care solutions to customers worldwide.

The new facility, strategically situated in Toronto, will serve as a pivotal hub for finishing, packaging, and distributing premium cat litter products to discerning pet owners across North America and Europe. Wyo-Ben's dedication to innovation, sustainability, and pet well-being shines through in every aspect of this venture, reflecting the company's intent to enhance the lives of pets and their owners.

"We are thrilled to unveil Wyo-Ben Pet Canada, an integral addition to our global network," said David Brown, CEO & President at Wyo-Ben. "With this expansion, we aim to meet the growing demand for our exceptional cat litter products in

both North America and Europe while reinforcing our commitment to excellence and customer satisfaction."

Wyo-Ben Pet Canada is equipped with state-of-the-art facilities and adheres to the highest standards of quality control and environmental responsibility. By leveraging cutting-edge technologies and sustainable practices, the facility ensures that every bag of cat litter leaving its premises upholds Wyo-Ben's hallmark of superiority.

### About Wyo-Ben

Wyo-Ben, Inc. is a leading family-owned business since 1951, specializing in Wyoming Bentonite Clay based products. Our materials serve global industries including oil, gas, water well drilling, cat litter, and more. Headquartered in Billings, Montana, with manufacturing facilities in Wyoming, we provide high-quality solutions worldwide.

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# NASTT 2025 No-Dig Show

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The banner features a background of green topographic contour lines. At the top, it displays the event dates and location. Below this, the event title 'NASTT 2025 No-Dig Show' is prominently displayed in a green box. Further down, there are logos for NASTT and the event name 'NO-DIG SHOW 2025'. A circular graphic on the right shows a landscape with a well. The central part of the banner contains a photograph of several people in professional attire networking at a conference. At the bottom, a list of event activities is provided, along with a call to action to visit the event website.



North American Society for Trenchless Technology (NASTT)  
 2024 No-Dig Show  
 Providence, Rhode Island  
 April 14-18, 2024

WM-T4-03

### Critical Aspects and Construction Challenges for Use of Direct Steerable Pipe Thrusting (DSPT)

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#### 1.0 ABSTRACT

The Trans Mountain Expansion Pipeline (TMEP) is a world class pipeline project that has been designed and constructed over the course of 12 years. This megaproject has been constructed through very challenging terrain, thus several types of trenchless construction technologies were utilized. One trenchless construction method that stands out is the use of the Direct Pipe® (DP) technology. At the start of the TMEP design in 2011, Direct Pipe, now known as Direct Steerable Pipe Thrusting (DSPT) had not been used in Canada. However, the design team for the TMEP project, UPI Projects Inc. (UPI), recognized potential applications and started to consider Direct Pipe in 2012. During the course of the development of the project, a total of 14 Direct Pipe crossings were ultimately designed into the overall project alignment. These designs included two long and complex crossings which presented unexpected challenges. When expanding the range of the use of a new crossing technology, challenges are to be expected, but always come paired with lessons learned. Of the 14 crossings, 11 of the DP crossings went according to plan. A number of the 11 crossings were expected to have challenges related to the geotechnical conditions. Two of the 3 remaining Direct Pipe crossings did encounter very significant challenges but were ultimately completed while one crossing ultimately adopted an alternate trenchless method.

This paper will review the DP crossings designed into the project, present the rationale for the use of the technology and present lessons learned regarding the utilization of this technology.



# CRITICAL ASPECTS AND CONSTRUCTION CHALLENGES FOR USE OF DIRECT STEERABLE PIPE THRUSTING (DSPT)

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## 1. ABSTRACT

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The presentation of this paper was highly scored by attendees at the 2024 No-Dig Show in Providence RI. All No-Dig Show technical papers are available for download at [www.nastt.org](http://www.nastt.org)

learned. Of the 14 crossings, 11 of the DP crossings went according to plan. A number of the 11 crossings were expected to have challenges related to the geotechnical conditions. Two of the 3 remaining Direct Pipe crossings did encounter very significant challenges but were ultimately completed while one crossing ultimately adopted an alternate trenchless method.

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## 2. INTRODUCTION

The Trans Mountain Expansion Project (TMEP) pipeline spans the two western provinces of Canada. The pipeline extends from Edmonton, Alberta to Burnaby, B.C., carrying dilbit (diluted bitumen) to the Westridge Terminal in Burrard Inlet in Burnaby. The route largely follows the existing Trans Mountain Pipeline (TMPL) route, deviating only in areas of environmental or constructability challenges. Figure 1 shows the location of the Trans Mountain Expansion Project (TMEP) pipeline route relative to North America.

The Trans Mountain Pipeline Expansion Project included the following installations:

- 988 km of NPS 36 and NPS 42 Pipeline
- 347 km in Alberta and 640 km in British Columbia
- 190 km of reactivation pipeline
- 11 Pump stations
- 3 Maritime Berths
- 19 Petroleum storage tanks
- Current projected cost – 34 Billion CAN\$
- Trenchless pipeline crossings:
  - Horizontal Directional Drills (HDDs) - 51
  - Direct Pipe Installations - 15
  - Engineered HD Bores - 23
  - TBM Tunnel – 1
  - Drill and Blast tunnel - 2
  - MTBM microtunnels – Numerous
  - Misc bore methods (Auger Bore, Pipe Ram, Down the Hole Hammer)

Construction of the original Trans Mountain Pipeline (TMPL) was completed in 1953, connecting the Edmonton refineries and terminal to the offload point at Kamloops B.C., Sumas B.C. and the Westridge Terminal in Burrard Inlet, a total of 1181 kilometres (km). This pipeline was constructed as an NPS 24 line to carry approximately 300,000 barrels per day (bpd). Details about the original project are as follows:

- Originally conceived by the Trans Mountain Pipeline Company in 1951

- Original (Line 1) constructed in 1953 (NPS 24) with short sections looped (NPS 36) in subsequent years (now the Reactivation sections of TMEP)
- Originates at the Edmonton, Alberta Tank Farm and ends at the Westridge Terminal, British Columbia for a total of 1181 km
- Expands the capacity and markets for shipping oil offshore

The TMEP Line 2 Project will result in the looping (or twinning) of the existing 1,147 km TMPL system between Edmonton and Burnaby terminals with about 987 km of new buried pipeline. The previously constructed pipeline segments are shown in yellow in Figure 1. These NPS 36 segments were constructed in previous years and the original NPS 24 pipe was deactivated with plans to reactivate when the new Line 2 was constructed.

In addition to the new pipeline, all existing facilities, including the existing Westridge Terminal will be enlarged to accommodate the new capacity.

The Project will increase the capacity of the existing TMPL system from 47,690 m<sup>3</sup>/d (300,000 bbl/d) to 141,500 m<sup>3</sup>/d (890,000 bbl/d) of crude petroleum and refined products.

## 3. HISTORY OF DIRECT PIPE ON TMEP

Direct Pipe® was invented by the Herrenknecht company in Germany

with the design of the Herrenknecht “thruster”. From the inception to the completion of the TMEP project, Direct Pipe (or Direct Steerable Pipe Thrusting, as it is referred to now,) has gone from an unknown new trenchless technology to a well-accepted trenchless methodology with about 200 installations to date including the 48-inch Wastewater pipeline in New Zealand with a length of just over 2,000 m.

According to Herrenknecht, at the start of 2012 there were only 15 Direct Pipe installations completed around the world. Of these 15, only 3 had been constructed in the United States and the first one in Canada was not completed until 2013. However, the technology was proven and discussions were underway with Dr. Gerhard Lang (Herrenknecht) in early 2013 to see if this technology would have some benefit for the TMEP project. The first installation considered was the crossing of the Fraser River, which consisted of a crossing of about 1,000m. At the time, only a single DP crossing had been completed with a length over 1,000 m which was a crossing completed in the Netherlands at Lochem with a distance of 1,400 m and a diameter of 48 inches. TMEP’s product pipe was much smaller at 36-inch diameter, which required more specialized construction. This is due to 36-inch Direct Pipe installations being limited to under 1000 m due to the size of the pumps available to deliver fluids to the cutter head. This started



Figure 1. Location of the Trans Mountain Expansion Project

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**Table 1. Direct Pipe History During the TMEP detailed design and construction.**

2007	First DP constructed in Germany (464 m)
2010	First DP constructed in USA # 5 (224 m)
2011	TMEP Routing & Design begins
2013	First DP constructed in Canada #34 (344 m)
2013	First DP ‘discussed’ for TMEP’s Fraser River (1000 m length)
2017	Initial Construction Package for TMEP, contains only 2 DPs
2020	First TMPL DP constructed – TMPL Sumas River 1 #168 (311 m)
2021	First TMEP DP constructed – TMEP Sumas River 2 (259 m)
2023	Total of 14 DPs designed and constructed by mid-2023 on TMEP

the discussion of installing a casing first and then extracting the casing while installing the product pipe using a reducer to connect to the smaller diameter. However, the final crossing alignment was moved to another location due to conflicts with new and proposed infrastructure, and the concept of using Direct Pipe was set aside. The Fraser River was ultimately crossed using HDD with a length of 1400 m, but the groundwork for the Two-Pass Direct Pipe method had been laid.

TMEP’s trenchless construction needs had parameters that aligned to propose the use of the Herrenknecht Direct Pipe technology. When the project was initiated for design in 2011, the concept of Direct Pipe had not reached North America. By the end of construction in 2024 the technology had become a widely accepted solution to complex projects.

Over the course of the pipeline design and execution, Jim Murphy (UPI) remained in communication with Gerhard Lang as the methodology became used more frequently and for increasingly complex crossings. By the project’s completion, a total of 15 Direct Pipes were attempted with 14 being successful. Two experienced issues near the reception location, but were successfully recovered using large diameter rescue casing, and the installations completed.

The first one Jim discussed with Gerhard in 2013 never came to pass as the location

changed and the trenchless method changed. However, this effort led to significant investigation of the technology which gave UPI the ability and confidence to utilize the technique during the Trans Mountain Expansion design phase on at least 2 crossings.

Ultimately the use of the Direct Pipe methodology was introduced to the project by way of a replacement crossing for the NPS 24. The concept of the use of a temporary casing was also introduced on this crossing.

The method of installing an oversized casing first via Direct Pipe and then subsequently installing the product pipe became known as the Two-Pass method. The advantage of the technique is twofold. Maximum lengths of DP installations are usually limited by the pipe and MTBM diameter, so a larger MTBM thrust by temporary casing can install over greater distances than a size-for-size DP using the product pipe. Additionally, the method allowed for much more reliable installation of fiber-optic leak detection conduits, which was a design feature of TMEP.

The Line 1 NPS 24 pipe was inserted via a small HDD rig inside a 42-inch casing that had been installed using Direct Pipe. The casing was subsequently extracted by the Direct Pipe thruster and the void filled with a bentonite grout. According to Herrenknecht, this was world installation number 168, completed in early July 2021. This installation went so well that the NPS

36 pipeline construction was constructed using DP just a year later only metres away from the NPS 24. This installation was carried out by the same contractor, IPC (now Bothar) and the same 42-inch MTBM and two-pass system was utilized.

As the pipeline design developed and construction continued, multiple other locations were identified as feasible DP locations, typically in response to construction challenges. In the end, 6 Direct Pipe installations of the NPS 36 product pipe were accomplished using a size-for-size MTBM, with the remaining 9 locations being Direct Pipe installations of an oversized casing with the product pipe pulled in after casing installation. In most cases the casing was extracted successfully afterwards.

Michels utilized the DP technology to construct the adjacent Highway No 1 (the Trans Canada Highway) undercrossing just a few hundred meters to the south of the Sumas Direct Pipes. This crossing was constructed successfully about 2 years after the Sumas ‘double’ cross, in 2023.

The TMEP and its associated DP crossings certainly experienced weather extremes; the first DP crossing was performed in the middle of the July 2020 heat wave when temperatures reached over 100 degrees F, a rare occurrence for this area. It was virtually impossible to go inside the pipe as the temperature was too hot. In 2021 an atmospheric river led to the Pacific Northwest Floods, putting large portions of the project underwater for a significant amount of time. Construction on the project in the area was halted for many months. Once restarted, construction of the Sumas River 2 Direct Pipe 42-inch casing went very well.

The TMEP pipeline elevation profile is shown in Figure 3 in a very condensed format. Starting out at an elevation of 680 m at KP 0.0 (Baseline Road HDD) in Edmonton, the pipeline rises to an elevation of 1229 m at KP 350 (near Hinton AB and the Hardisty Creek Geohazard HDD) before

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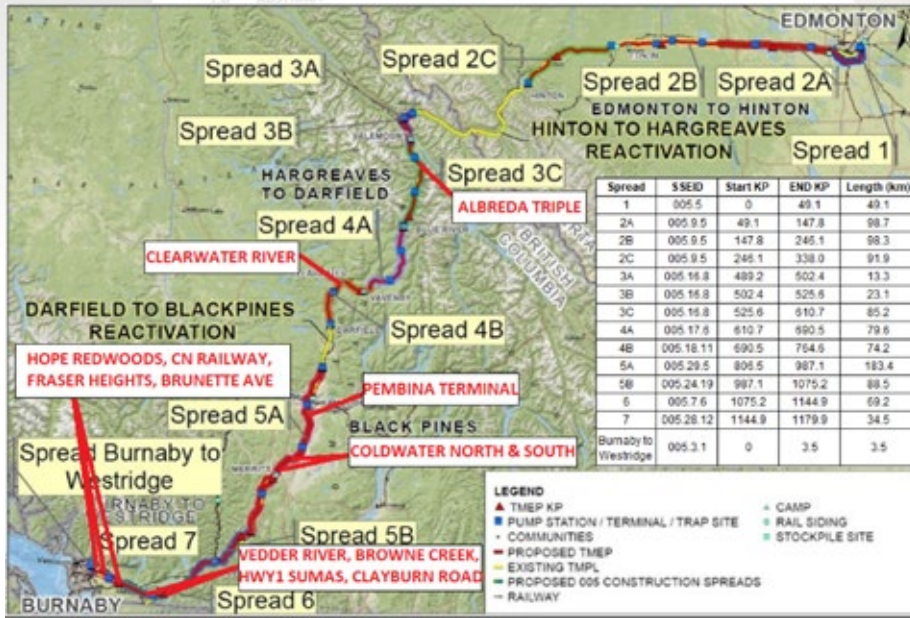


Figure 2. Locations of the Direct Pipe Crossings on Trans Mountain Pipeline

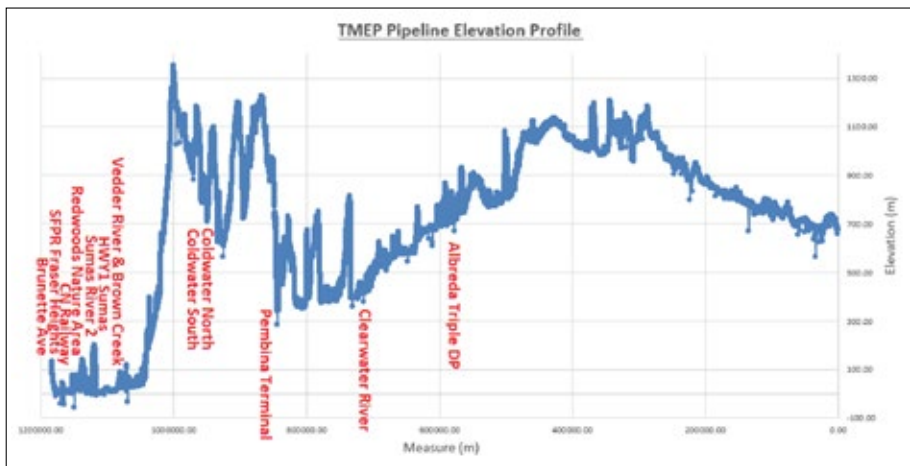


Figure 3. Trans Mountain Pipeline Elevation Profile Showing the Direct Pipe Crossings

CROSSING	CROSSING METHOD	DP TYPE	CROSSING TYPE	WT (mm)	Crossing Length (m)	SPREAD	AREA
Albreda River, CN and Hwy 97	DP (2P)	2-Pass	River/Road/Rail	22.2	401.1	SPREAD 3	BC
Clearwater River Crossing	DP (2P)	2-Pass	River	19.0	399.1	SPREAD 4B	BC
Pembina Terminal	DP (2P)	2-Pass	Buried Pipelines	19.0	344.3	SPREAD 5A	BC
Coldwater North	DP	1-Pass	River	19.0	210.7	SPREAD 5A	BC
Coldwater South	DP	1-Pass	River	19.0	252.7	SPREAD 5A	BC
Vedder River DP Crossing	DP (2P)	2-Pass	River, Dykes	19.0	468.5	SPREAD 6	BC
Browne Creek and South Vedder Dyke	DP	1-Pass	Creek, Dyke	19.0	280.9	SPREAD 6	BC
HWY1 Sumas	DP	1-Pass	Road	19.0	268.6	SPREAD 6	BC
Sumas River 1 DP Crossing (NPS24)	DP (2P)	2-Pass	River	12.7	311	SPREAD 6	BC
Sumas River 2 DP Crossing	DP (2P)	2-Pass	River	19.0	258.6	SPREAD 6	BC
Clayburn Road Nursery DP Crossing	DP (2P)	2-Pass	Road, Property	19.0	497	SPREAD 6	BC
Salmon River DP	DP (2P)	2-Pass	River	19.0	732.4	SPREAD 7	BC
Hope Redwoods Nature Area DP Crossing	DP	1-Pass	Nature Area	19.0	252.5	SPREAD 7	BC
CN Railway Crossing (CWP 38)	DP	1-Pass	Rail	19.0	347.7	SPREAD 7	BC
SFPR Fraser Heights Crossing	DP (2P)	2-Pass	Property	19.0	722.9	SPREAD 7	BC
Brunette Ave DP Crossing	DP (2P)	2-Pass	Road	19.0	416.2	SPREAD 7	BC

Figure 4. Specifics of the Direct Pipe Crossings

dropping to the central plateau with an elevation of approximately 400 m at KP 840 (Kamloops BC and the Thompson River HDD) and then rising again to a peak elevation of 1360 m at about KP 1000 (the Dry Gulch HDD) then finally dropping off to sea level at the Westridge terminal at the termination of the Burnaby Pipeline Tunnel. This geography has presented numerous challenges which have been solved in some cases with the use of trenchless construction methodologies.

Figure 4 demonstrates the versatility of the methodology with rivers, dykes, railway, highway, pipelines, commercial private property and nature reserves being crossed. Note that while only 2 Direct Pipe crossings were designed at the time of the original regulatory filings, ultimately 15 successful crossings were performed including the Sumas River NPS 24 replacement. This also demonstrates that, as the geographical challenges increased from Spread 3 to Spread 7, standard HDDs and bored crossings no longer were sufficient. The Direct Pipe crossings were utilized in areas where other crossing methods might not or could not work. A good example is the Clearwater River Direct Pipe; the mainline contractor told us that he didn't understand why Direct Pipe was chosen until he looked at all other options and then agreed that it was the

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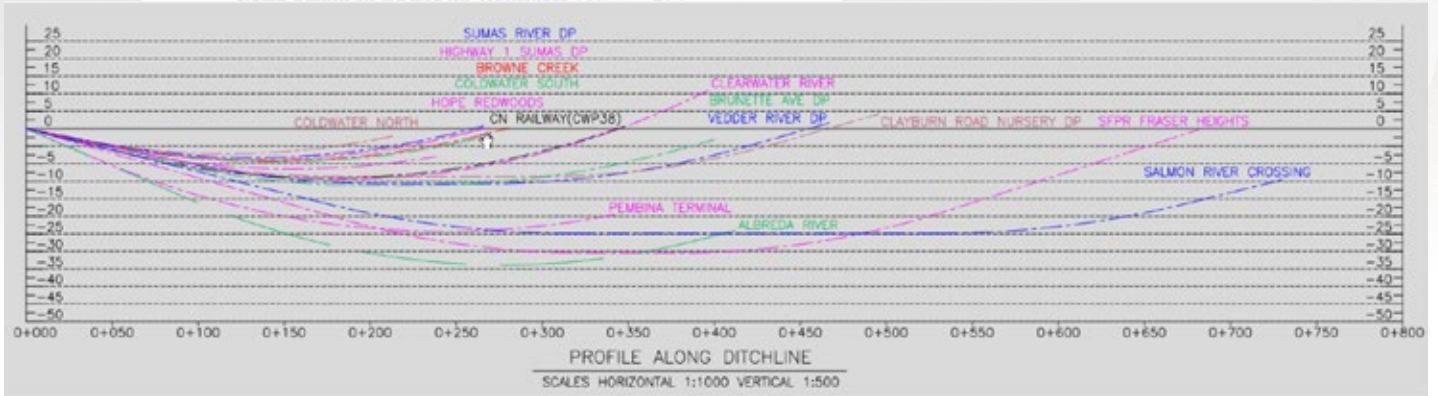


Figure 5. Comparison of TMEP Direct Pipe Profiles

only technology that would work in that location. This Direct Pipe crossed the river, but unfortunately a large boulder lodged in the cutting head doors and stalled the advancement.

This required the first use of a large diameter Rescue Casing that was driven over the MTBM, essentially swallowing the machine. The product pipe was then pulled through once the MTBM was removed.

## 4. PROJECT FINDINGS AND CROSSINGS COMPARISON

After construction of 15 Direct Pipes, with just a single unsuccessful attempt, and two that had significant challenges that required rescue casing installations, two of these seemed to have some similarities in their geometry. Seeing the similarities, Figure 5 was developed to show a relationship between the crossing profiles of successful and challenged crossings. Fraser Heights and Salmon River both seemed to be longer and deeper than the other crossings. These crossings failed due to the required thrust force to proceed either exceeding the available thrust capacity of the 750 Tonne thrusters, or of the casing pipe. The Clearwater crossing was much shorter and was stalled for geotechnical reasons. There were two other crossings that when plotted, had similar depths, Pembina Terminal and the Albreda River (triple crossing). However the lengths were significantly less and they were both

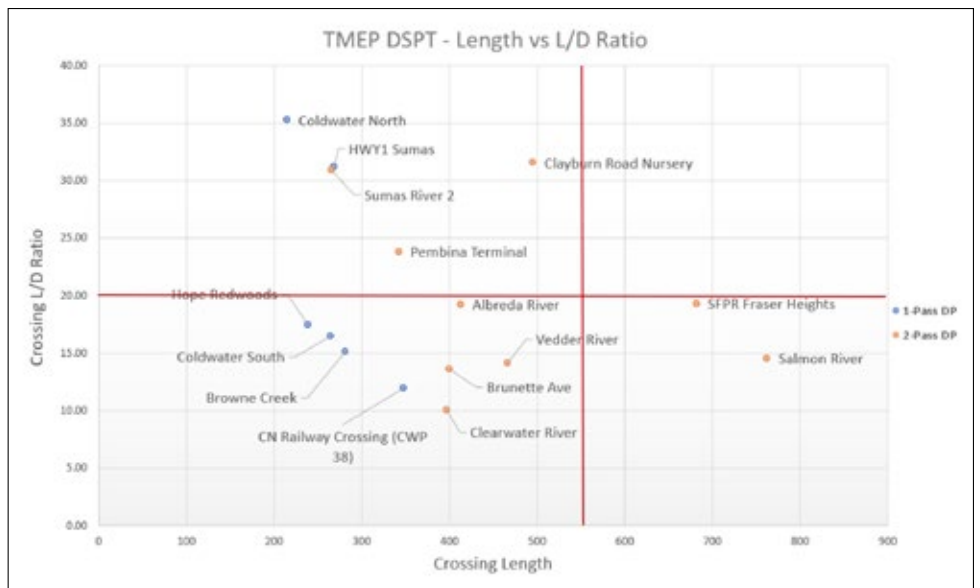


Figure 6. Trans Mountain Direct Pipe Length vs L/D Ratio

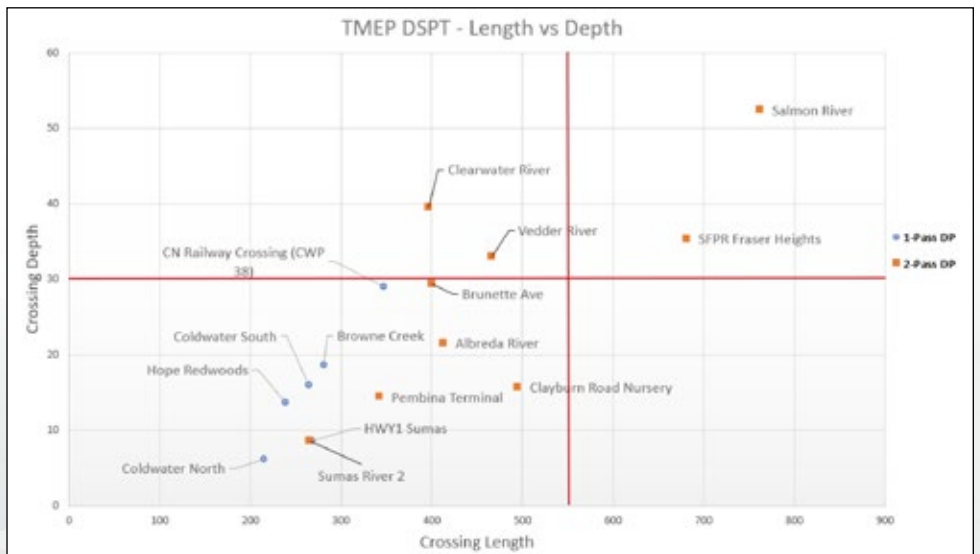


Figure 7. Trans Mountain Direct Pipe Crossings Length vs Depth

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tunneled from high to low which offset the potential for the high thrust forces.

Figures 6 & 7 summarize the crossings with regards to Length/Depth vs Length and then Length vs Depth. The two Direct Pipes, Fraser Heights and Salmon River seemed to share similar locations on both graphs. The results seem to imply that these Direct Pipe installations with Length > 550 m and the L/D < 20 were challenging, even with an oversized MTBM. Therefore, where the DP length is > 550 m and the depth is greater than 30 m, the DP installation may have challenges that might not be immediately obvious. With this geometry, one should consider the soil conditions and the use of the two-pass system where it is possible to have preinstalled bentonite injection points at regular intervals not unlike a microtunnel installation.

The Fraser Heights two-pass crossing essentially maxed out the available thrust near the halfway point but was successfully retracted. The second attempt, which had bentonite injection points added along the length of the casing, almost made it to the reception point before thrust forces were maxed out. Unfortunately, with

all the DP internals inside the casing already present, it was not possible to install injection points in the most advantageous locations. If the injection points could have been installed at more regular intervals and specifically in the invert locations, the Direct Pipe would likely have made it to the reception point unassisted.

Unfortunately, the two-pass Salmon River Direct Pipe was unsuccessful. It had been decided that in this case it would be prudent to use a 48-inch MTBM for the 42-inch casing and fill the additional void with the bentonite slurry. The thrust forces maxed out at roughly the halfway point of the crossing, buckling the casing pipe, and the decision was made to extract the casing and MTBM. Unfortunately, the larger diameter MTBM did not survive the attempt. During extraction, there was an indication that the MTBM had separated, likely at the interface of the cutter head. With the machine now open and flooded with groundwater and slurry, it was decided to abandon the attempt and the recovery. An HDD was initiated and was successful in completing the crossing.

The Albreda Triple crossing was unique in both scope and execution. Originally

envisioned as three semi-contiguous auger bores of a highway, railway, and river that run parallel in proximity, it was determined during construction that the terrain features and environmental challenges made conventional boring unfeasible. The Project turned to Direct Pipe as the solution, but the constraints meant that all three crossings needed to be completed with a single DP installation. After careful alignment selection and an extensive geotechnical program, the Albreda Triple DP was declared feasible if performed as a two-pass installation. Unlike other crossings on the project, the Albreda crossing existed in a section of the project that used an NPS 42 product pipe, so a 48-inch MTBM and casing were utilized instead of the standard 42-inch/NPS 36 arrangement.

Due to availability of workspace for the thrust sections, the DP was executed from the high elevation to low with three thrust sections. Installation forces for the crossing were noted as being somewhat higher than expected, likely due to mixed ground conditions along the DP path. Once underway, installation thrust forces were, on average, around 2000 kN. Once the product pipe was installed, it was found that the

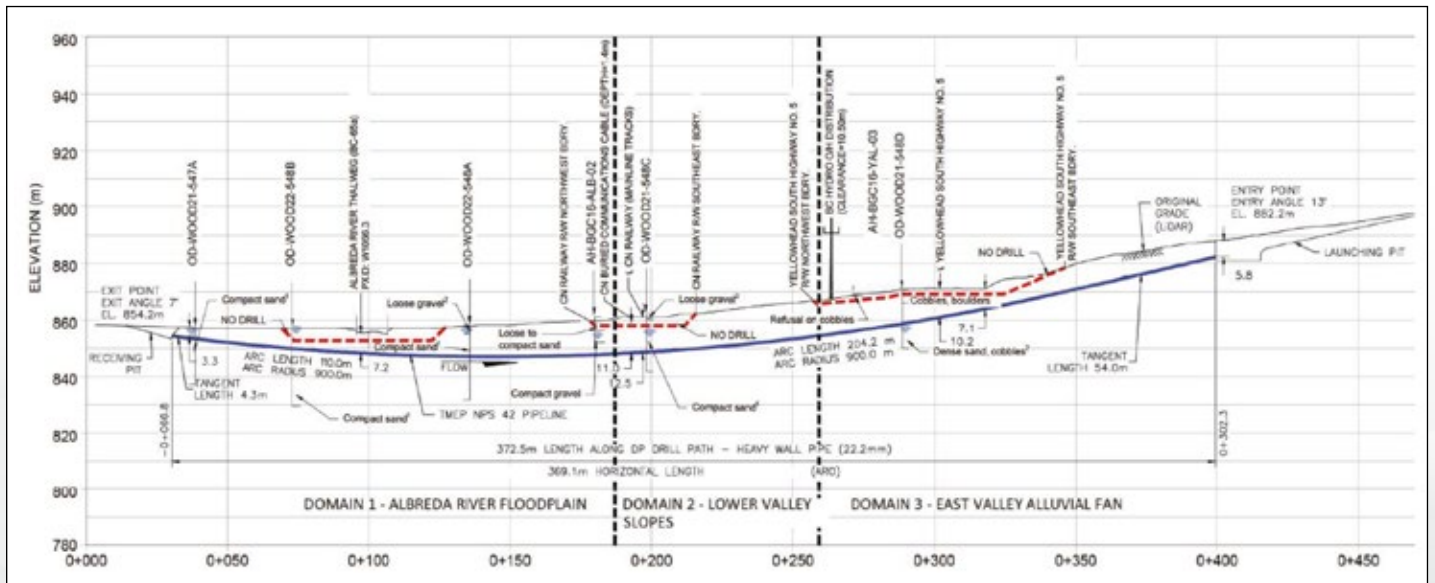


Figure 8. Albreda NPS 42 Triple Crossing of River/Highway/Railway

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Figure 9. Albreda Triple Crossing Looking down from Launch to Reception

Settlement at the dykes was essentially negligible, similar to the Sumas Crossings. The Vedder River crossing was quite long at 469 m, necessitating the two-pass method to be successful. The river had overflowed during the extensive British Columbia flooding in 2021, so extreme care had to be taken to maintain the integrity of the four dykes running parallel to the river, of which the Vedder DP crossed three.

The installation of the Vedder River crossing went quite smoothly; thrust forces were largely as expected and well within the limits of the equipment, while casing extraction after product pipe installation was performed entirely by the DP thruster without any hammer assistance required. The annular space was filled with viscous bentonite slurry, and the dyke settlement monitoring results were well within the acceptable range (max of 31mm) three months after construction.

temporary 48-inch had become stuck and the DP thruster was incapable of getting it moving. A 24-inch pneumatic hammer was employed to free up the casing, and the crossing was successfully completed.

In two locations, two Direct Pipe crossings were in very close proximity. The Vedder

River and Browne Creek Crossings were essentially back-to-back with Vedder constructed first then Browne Creek. Vedder River was a two-pass crossing, while the shorter Browne Creek crossing was completed with a size-for-size DP. They crossed multiple dykes which required extensive settlement monitoring.

## 5. LESSONS LEARNED

The following bullets identify some of the lessons learned from the aforementioned DP crossings:

- The Two-Pass DP system was highly effective in pursuit of extended crossing

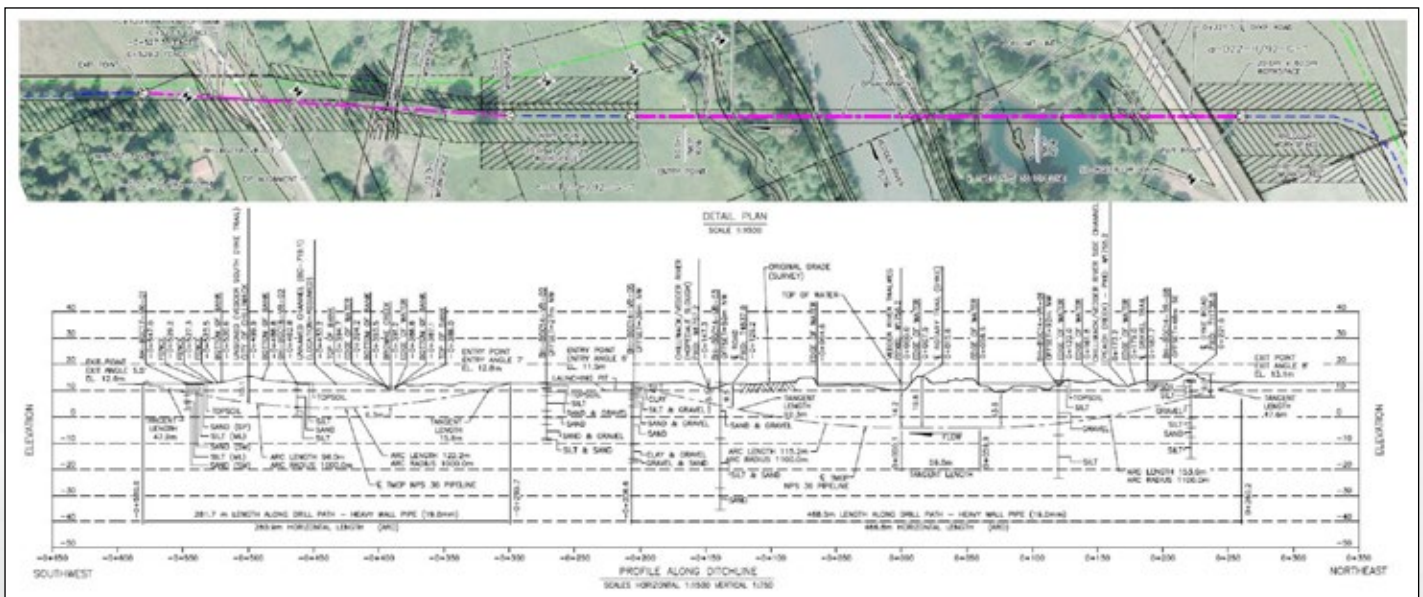


Figure 10. Back to back Direct Pipe Crossings



length and leak detection conduit installation.

- Plan on some casings not being able to be extracted – even with hammer assistance, some casings may become too cemented-in to be broken free and a contingency plan should be on hand.
- On deep long crossings, bentonite injection points may be required and should be designed into the casing system for the two-pass DP system.
- Plan for multiple confined space entries for survey and/or repairs. Hydraulic, mechanical, electrical, and instrumentation problems led to scores of casing entries across the DP installations.
- Steep inclinations causing strain in the internal assembly connections. Ensure that internal connections are strong and fully seated, as an internal connection is a messy and time-consuming issue.
- Extreme cold weather can have effects on the externals & internals above ground – contractors should be familiar with working in the Canadian climate and ready to hoard and heat when needed.
- Steep inclination increases control survey time and effort (internal piping moving once the bore enters into flatter tunnelling.)
- Gas detection monitors need to have models that read specific gases that could be encountered set up in the TBM and relayed to the Operator. Redundancy on gas monitoring is also

beneficial; a faulty gas monitor led to significant delays on one DP crossing as erroneous readings prevented the team from performing a standard confined space entry into the casing.

- Establish connection points to the supplied air so if entries must be performed in gaseous conditions, SCBAs/hoses don't have to be dragged in the entire length by the entrants.
- Specifying a larger design radius early on allows for flexibility during the project. Reducing the design radii can still be done where circumstances demand, but starting with a larger radius gives more headroom for steering deviations. Several crossings had to undergo extensive analysis of the as-built data to approve the as-installed radii.
- Thruster foundation design and construction in weak soils and in rock and boulders can be challenging – geotechnical investigation at entry locations can inform designers and contractors alike of potentially weak or difficult soils that may lead to challenges in designing/constructing a foundation capable of handling the thruster's maximum output.
- Guidance issues may be present in small diameter installations, where the pipe size makes it impossible to enter for control surveys on longer crossings. Albreda was longer than the length that surveyors were permitted to enter.

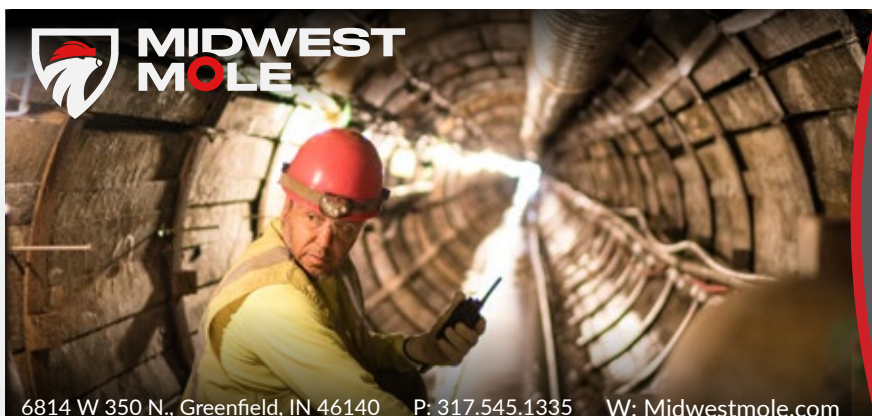
- MTBM Head nozzle selection: consider all soils in the tunnel path in sizing nozzles and select appropriately. (The MTBM used for the Albreda crossing needed to be pulled back just after launching to replace the nozzles.)

## 6. CONCLUSION

The Trans Mountain Expansion Project clearly demonstrates the versatility of the Direct Pipe technology. The major takeaway is that there is possibly a point where the L/D ratio may prove challenging and that a two-pass system with bentonite injection points may solve the problems that may occur.

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[www.nastt-bc.org](http://www.nastt-bc.org)

The British Columbia Chapter (NASTT-BC) was established in 2005 by members in the province of British Columbia, Canada.



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[www.mstt.org](http://www.mstt.org)

The Midwest (MSTT) Chapter was established in 1998 to promote trenchless technology education and development for public benefit in Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio and Wisconsin.



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[www.glsa.ca](http://www.glsa.ca)

The Great Lakes, St. Lawrence & Atlantic (GLSLA) Chapter was established in 1995 and represents the Eastern Canadian perspective of the trenchless technology marketplace. Members are from Ontario, Quebec and the four Atlantic provinces.



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[www.nastt-ne.org](http://www.nastt-ne.org)

The Northeast Chapter was established in 2015 by members in the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island and Vermont.




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**Mexico**  
Website coming soon!

The Mexico Chapter was established in 2021 and represents the country of Mexico's perspective of the trenchless technology marketplace. MXTT members are currently from the entire country of Mexico.



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[www.nastt-nw.com](http://www.nastt-nw.com)

The Northwest Chapter was established in 1995 by members in the provinces of Alberta and British Columbia, Canada, and in Washington state. In 2005, the members in BC established the NASTT-BC Chapter. In 2009, members in Washington state established the Pacific Northwest Chapter and the Northwest Chapter adjusted the geographic area to include members in the provinces of Manitoba and Saskatchewan.



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[www.mastt.org](http://www.mastt.org)

The Mid Atlantic (MASTT) Chapter was established in 2004 by members from the states of Delaware, Maryland, New Jersey, Pennsylvania, Virginia, West Virginia and the District of Columbia.



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[www.pnwnastt.org](http://www.pnwnastt.org)

The Pacific Northwest Chapter was established in 2009 by members in the states of Alaska, Idaho, Oregon and Washington.



## Rocky Mountain

[www.rmnaastt.org](http://www.rmnaastt.org)

The Rocky Mountain Chapter was established in 2009 by members in the states of Colorado, Utah, Montana and Wyoming.

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[www.sestt.org](http://www.sestt.org)

The Southeast (SESTT) Chapter was established in 2001 to serve the members of NASTT from Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee and Puerto Rico.

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[www.nastt.org](http://www.nastt.org)

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## Western

[www.westt.org](http://www.westt.org)

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To learn more about the 18 NASTT Student Chapters, please visit:

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### November 11-12

8th Annual Northeast Regional Chapter Conference  
Sturbridge, Massachusetts, USA

### November 13

CIPP Good Practices  
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### November 14

RMNASTT Trenchless Elevated 2024  
Sandy, Utah, USA

### November 21

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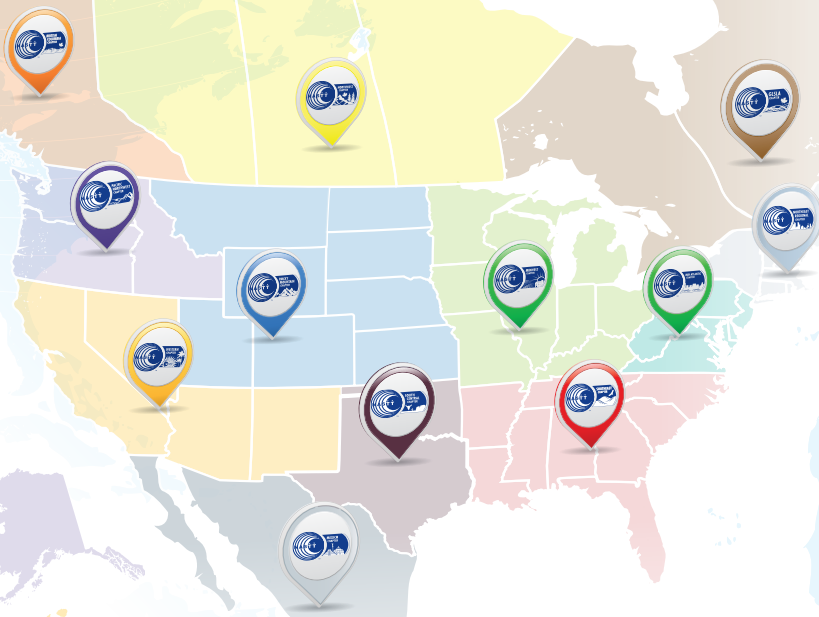


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Atlas Trenchless LLC.....	www.atlas-trenchless.com.....	31
Bennett Trenchless Engineers.....	www.bennetttrenchless.com.....	29
Binnie Consulting.....	www.binnie.com.....	18
Claude H. Nix Construction.....	www.chnix.com.....	11
Contech Engineered Solutions, LLC.....	www.conteches.com.....	7
CUES Inc.....	www.cuesinc.com.....	20
Elgin Separation Solutions.....	www.elginseparationsolutions.com.....	21
Gabe's Construction Co., Inc.....	https://www.gabes.com.....	34
Michels.....	www.michels.us.....	17
Midwest Mole.....	www.midwestmole.com.....	49
OBIC LLC.....	www.obicproducts.com.....	13
Plastics Pipe Institute, Inc.....	www.plasticpipe.com/MABpubs.....	19, 30
Rain For Rent.....	www.rainforrent.com.....	14
Staheli Trenchless Consultants.....	www.stahelitrenchless.com.....	34
Sunbelt Rentals.....	www.sunbeltrentals.com.....	5
Trinity Products LLC.....	https://trinityproducts.com.....	37
Underground Magnetics.....	www.umaghdd.com.....	15
United Felts.....	www.unitedfelts.com.....	Outside Back Cover
Vector Magnetics.....	www.vectormagnetics.com.....	33
Vylon Pipe.....	www.vylonpipe.com.....	51

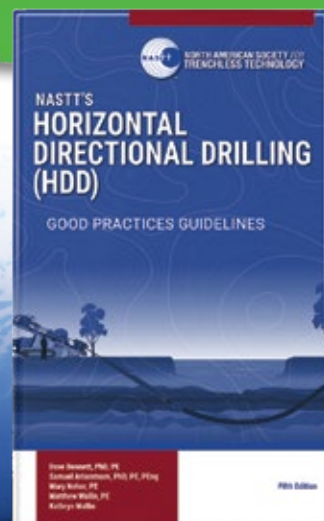
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