Necessity of Educating the Future Decision Makers

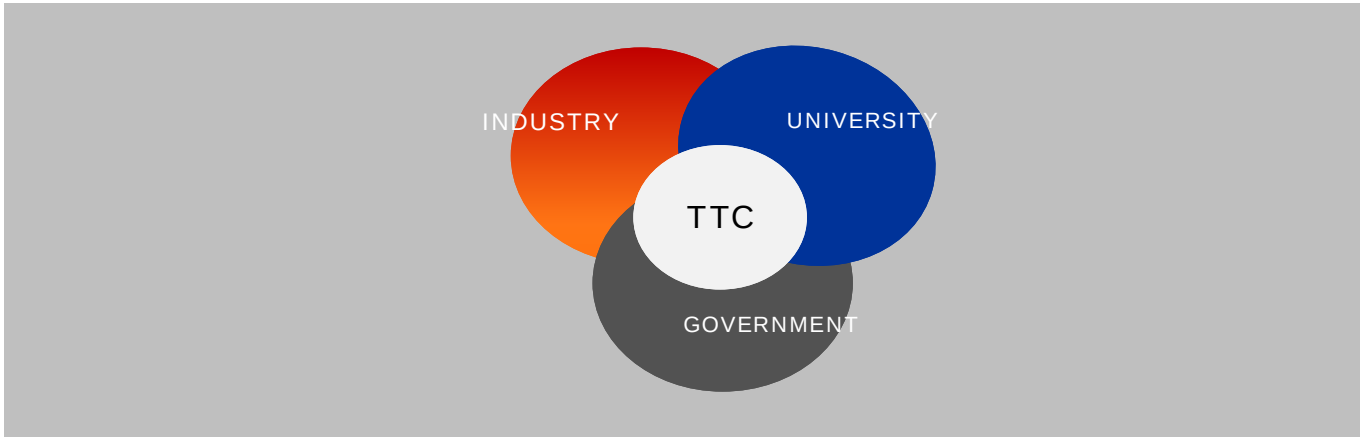
Presenter: Professor Tom Iseley, Ph. D., P.E., Dist. M. ASCE

- Professor, Louisiana Tech University
- Assoc. Director of International Operation, Trenchless Technology Center (TTC)
- Chair, Buried Asset Management Institute-International (BAMI-I)
- Director, UNITRACC International
- Adjunct Professor, Xi'an Jiaotong University, China

Overview of TTC

TTC is expanding the research focus on integration of trenchless technology into asset management and continues to grow research programs to further increase understanding of the fundamental performance issues associated with various trenchless methods.

Louisiana Tech University
Trenchless Technology Center
From 1989-2017



• Research • Education • Technology Transfer

TTC & CHINA & HK

Industry area:

- Wuhan Industrial Technology Research Institute of Geo-resources and Environment Co., Ltd (IGE)
- Xaimen ANYUE Trenchless Engineering Technology Co., LTD (ANYUE),
- Tianjin Qingcheng Waterworks Engineering Co., Ltd
- Tianjin Hua Miao Research & Design Institute of Water & Wastewater Co., Ltd.
- Banzan
- Asoe Hose Manufacturing Inc.
- REIT

Academia

- China University of Geosciences (CUG)
- Hong Kong Polytechnic University (HKPU)
- Xi'an Jiaotong University
- Southwest Petroleum University (SWPU)
- Harbin Institute of Technology, China
- Harbin Engineering University (HEU), China


TTC·TJ
TRENCHLESS TECHNOLOGY CENTER
天津市青成自来水穿越分公司
天津三博水科技有限公司


TTC·TJ
TRENCHLESS TECHNOLOGY CENTER
非开挖技术中心
非开挖研究中心（中国）合作备忘录
签约仪式

Technology Business Development Summit

Trenchless Technology Center – Tianjin - Experience Center (TTC-TJ-EC)

Tianjin, China

October 11, 2017

QingCheng 青成公司

TTC·TJ TRENCHLESS TECHNOLOGY CENTER 非开挖技术中心

LOUISIANA TECH UNIVERSITY

Trenchless Technology Center

Trenchless Industry Today

- Trenchless no longer an afterthought / Trenchless considered from the start
- Trenchless revolution started in mid-1980's and began to explode in early 1990's
- Formation of an industry structure and support system in mid-late 1980s
- Emergence of many new technologies – Cured in place lining, directional drilling, microtunneling and later pipe bursting
- Multi billion dollar industry with large and small companies

Innovation ***Validation*** ***Education***

Trenchless Innovation

Insituform / Cured-In-Place Pipe

Created in 1971 by Eric Wood in the UK

Insituform / Cured-In-Place-Pipe

- Insituform grew rapidly in the USA
- Insituform goes public in the USA in 1980
- Early users: WSSC, St. Louis MSD
- Jerry Kalishman merged Insituform Mid-America with other US operating companies
- Now Aegion -- $1.3B company

Trenchless Innovation

Horizontal Directional Drilling (HDD)

In 1960's: The use of Horizontal Directional Drilling

In 1964: Cherrington built his first drill rig and formed Titan Contractors a company specializing in utility road boring in Sacramento, California.

First HDD rig

Trenchless Innovation

Horizontal Directional Drilling (HDD)

In 1971: Titan Contractors was invited to look at and bid on several road crossings for PG&E (a major California gas and electric utility) near Watsonville, California just south of San Francisco. PG&E's R&D department funded the Pajaro River project that made it possible for Cherrington to prove his concept and introduce Horizontal Directional Drilling, HDD, to the world.

- For a revolutionary new idea using the discarded downhole drilling tools, Cherrington tested this method in the Feather River, a few miles north of Sacramento.
- Reverting to the lessons learned while drilling adjacent to the Feather River, Cherrington successfully crossed the Pajaro River using the discarded drilling tools that tended to drill back to the surface.

Trenchless Innovation

Midi Directional Drilling

Rapid growth of utility directional drilling in the 1990's

Mid-size Directional Drilling

- Early research by Flowmole, GRI and Ditch Witch
- Entry of many manufacturers followed by industry consolidation
- Commitments by Ed Malzahn, Ditch Witch and Gary Vermeer, Vermeer
- Over 2,400 rigs sold / year worldwide
- 6,000+ HDD contractors (< 300 in early 1990's)

Trenchless Innovation

Guidance Technology for Directional Drilling

Guidance Technology for Directional Drilling

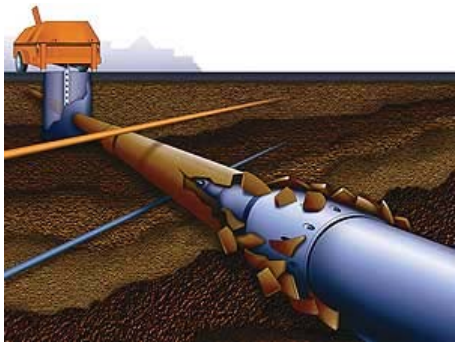
- Digital Controls (DCI) introduces Digitrak with depth capability of 20 ft. in 1990. Pitch and roll capability to track the bore head added in 1991.
- Change in focus to tracking the drilling head (rather than being a cable locator)
- John Mercer and Peter Hambling founders of DCI

Trenchless Innovation

Pipe Bursting

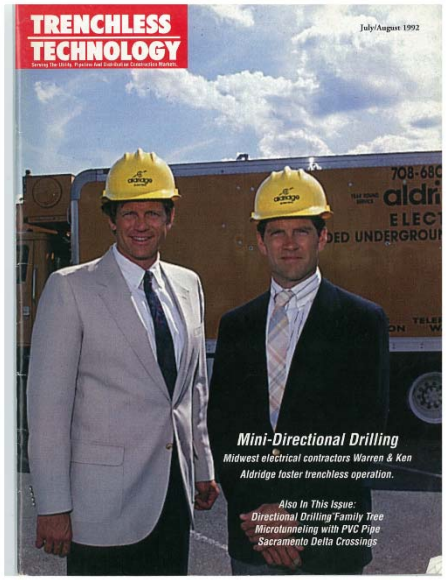
Pipe Bursting

- Invented by British Gas in late 1970's
- Original application – Cast Iron Pipe
- Initial licensing to Elizabethtown Gas, NJ
- Expansion from cast iron to clay to concrete pipes
- Many key players: Jim Hopwood, Chris Brahler, Collins Orton, Dave Holcomb



Trenchless Innovation

Trenchless Media



Great Southern Press 45 YEARS 1972 - 2017

Trenchless Technology Center

Trenchless Innovation

Trenchless Media – Promoting & Influencing the Industry

- Underground Construction circulation increased from 20,000 in 1992 to 45,000 today
- UCT conference attended by over 2,000 people each year
- Trenchless Technology Magazine circulation grew from 12,000 in 1992 to 38,000 today
- Trenchless online.com – About 17,000 visitors / month
- Trenchless webinars: Over 400 attendees per session (84 since 1984)

Trenchless Innovation
Microtunneling

Microtunneling US History

- Developed in Japan in the 1970's.
- The first US Microtunnel job in Florida in 1985.
- Major Advancement in US during Houston Waste Water Program starting in 1987.
- Three major Equipment manufactures in the late 1990's.
  - Iseki
  - Soltau
  - Herrenknecht

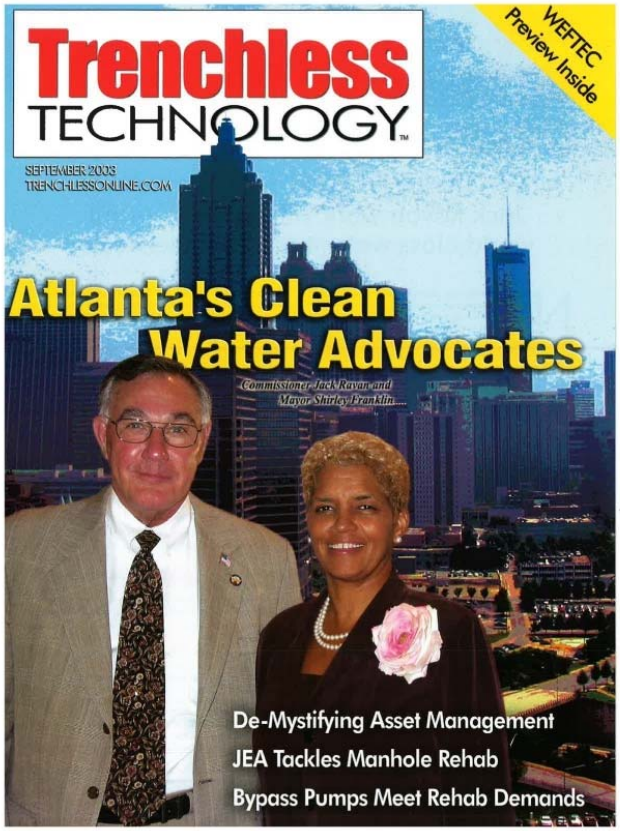
Trenchless Innovation

Microtunneling

- **Alex Mikki:** The first person to represent Iseki in the US.
- **Mike Garver:** The first Microtunnel project done in Houston was the River Oaks Project.
- **Paul Nicholas:** The president of Soltau Microtunneling Inc. & made Soltau the market leader in US in the 1990s.
- **David Abbott:** President - Herrenknecht Corporation USA Inc. July 1996 – March 1999

Trenchless Innovation

ISTT, NASTT, ICTIS, ASTT, UCTA, & BAMI-I



Trenchless Innovation

ISTT, NASTT, ICTIS, ASTT, UCTA, & BAMI-I

The International Society for Trenchless Technology (ISTT)

- Ted Flaxman: The founder of the ISTT; ISTT's first Chairman, and Chairman Emeritus.
- Ted organized the first international trenchless conference in London - "No-Dig 1985"
- ISTT has 33 Affiliated Societies

Trenchless Innovation

ISTT, NASTT, ICTIS, ASTT, UCTA, & BAMI-I

The North American Society for Trenchless Technology (NASTT)

- Founded in 1990
- The first International No-Dig Show: In Washington, D.C. in 1992
- Has a network of 11 regional chapters and 15 student chapters throughout North America

Founders of NASTT

- Dr. Tom Iseley
- Richard Thomasson
- Norm Sirna
- Mike Argent
- Stephen Cordes

Trenchless Innovation

ISTT, NASTT, ICTIS, ASTT, UCTA, & BAMI-I

Instituto Colombiano de Tecnologías para la Infraestructura subterránea (ICTIS)

CONGRESO MUNDIAL DE TECNOLOGÍA SIN ZANJA
25-27 SEPTIEMBRE 2017
MEDELLÍN, COLOMBIA

Trenchless Innovation

ISTT, NASTT, ICTIS, ASTT, UCTA, & BAMI-I

Australasian Society for Trenchless Technology (ASTT)

- ASTT was formed in 1991 as the Australian Society, expanding in 1994 to serve also New Zealand.
- 4 International NO-DIG's have now been held in

✓ Perth (2000),
✓ Brisbane (2006),
✓ Sydney (2013), and
✓ Queensland (2017).

Trenchless Innovation

ISTT, NASTT, ICTIS, ASTT, UCTA, & BAMI-I

The Underground Construction Technology Association (UCTA)

UCTA has three regional chapters in:

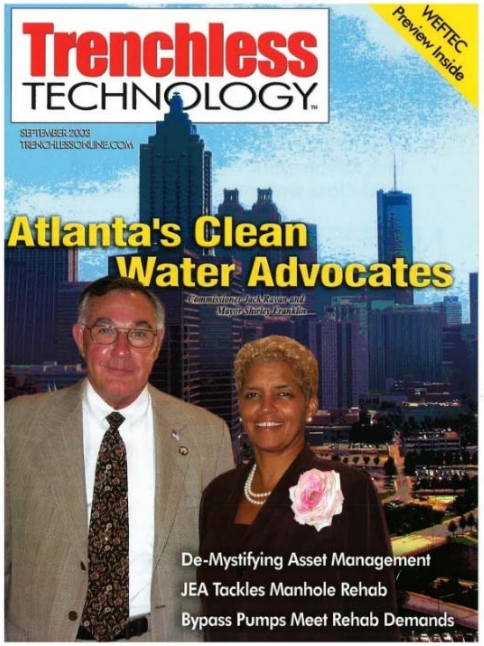
- The state of Texas - the Gulf Coast Chapter (Houston area),
- The North Texas Chapter (Dallas-Fort Worth area), and
- The South Texas Chapter (San Antonio area)

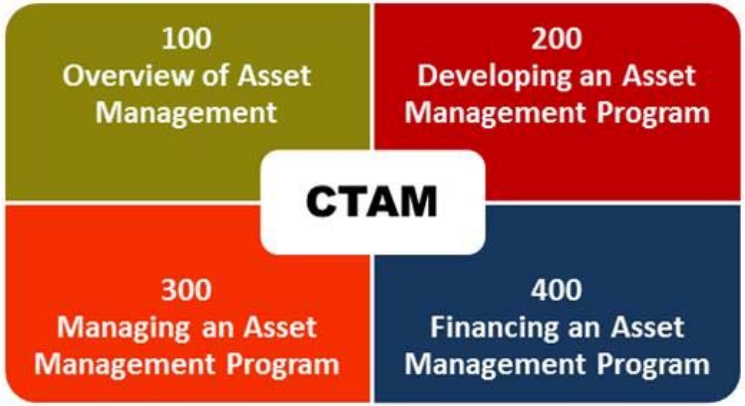
Trenchless Innovation

ISTT, NASTT, ICTIS, ASTT, UCTA, & BAMI-I

BAMI-I
Buried Asset Management Institute - International

- In 2003, formed in Atlanta's Department of Watershed Management as a result of inspiration & leadership by Mayor Shirley Franklin & Commissioner Jack Ravan.
- In June 2004, formed as non-profit organization.
- Serves to provide a center of excellence for owners of underground water infrastructure to join with industry and researchers:





Trenchless Technology Center

Trenchless Innovation
CCTV

Closed-Circuit Television (CCTV) Inspection

Norman A. Sirna: Beginning as an employee of the Metropolitan St. Louis Sewer District in 1956. President of the NASSCO in 1991 and 1992.

CUES: has been in business since the early 1960s.

Sandy Mille – President – in 1991 to Present

RedZone Robotics: Founded with a commercial focus on condition assessment robots in support of mining, nuclear and other industries in 1987.

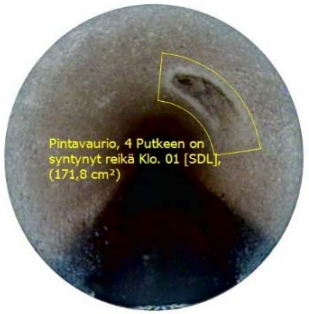
Hand winch skid mounted camera
Source: Cues archival history

Trenchless Innovation
CCTV

Future Scan
Pipe Penetrating Radar
for…
-- Void Detection
&
-- Pipe Inspection

Automated sewer pipe inspection

Side view

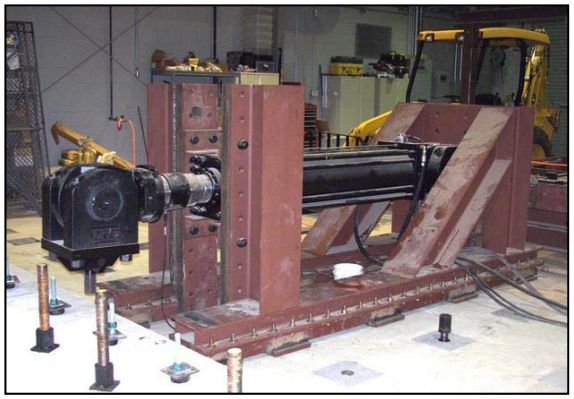


Front camera


National Trenchless Technology Research Facility (NTTRF)
NATIONAL TRENCHLESS
TECHNOLOGY RESEARCH FACILITY
LOUISIANA TECH UNIVERSITY

Facilities

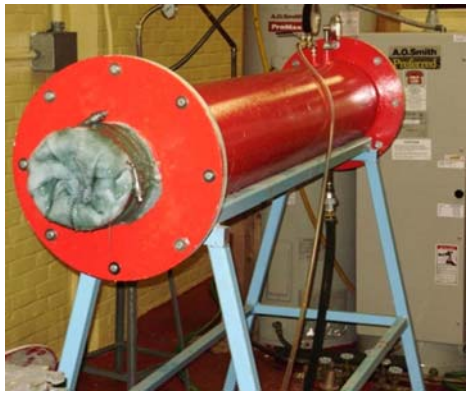
Inside NTTRF



Servo-controlled hydraulic ram, large

Soil box (small 12’x6’x6’, large 10’x20’x11’)

Extruder for cementitious samples

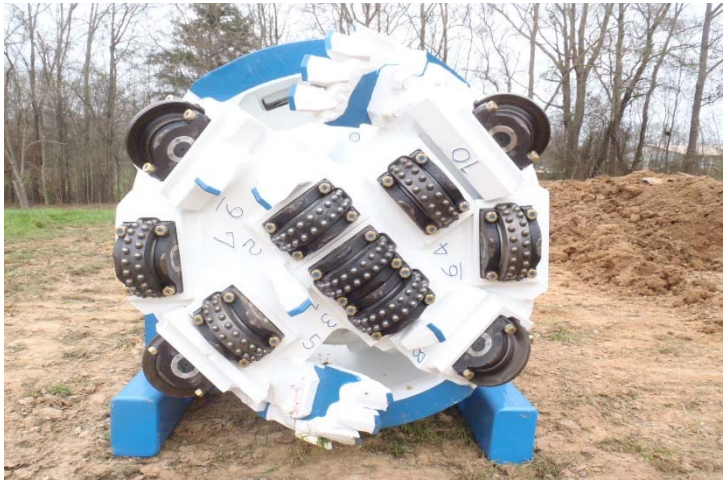


Liner Inversion Chamber

Field Testing Site

Approximately 70,000 sq. ft. for a variety of field tests related to HDD, pipe bursting or other trenchless method research

TTC Auger Boring School



Trenchless Technology Center

Site Preparation

Site Preparation

The 3rd Annual TTC

Auger Boring (AB), Pipe Jacking (PJ) &

Pilot Tube Microtunneling (PTMT) School

Feb 5-9, 2018

Trenchless Technology Center

The 2nd TTC Utility Investigations School (UIS)

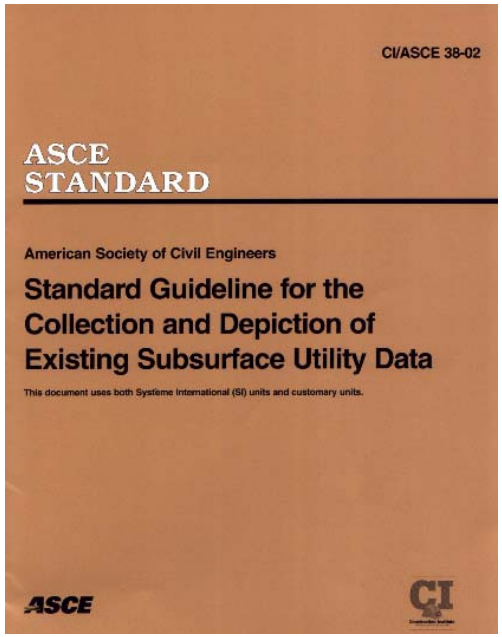
February 27-March 2, 2018

TRENCHLESS TECHNOLOGY CENTER

UESI

DEPARTMENT OF LAND SURVEYING AND GEO-INFORMATICS
土地測量及地理資訊學系

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學




STOP

TTC Subsurface Utility Locating with GPR
August 23, 2017

TTC Mini-Seminars Fall 2016

Trenchless Technology Center

TTC Mini-Seminars Fall 2016

https://ucononline.com/2016/09/12/trenchless-technology-center-present-mini-seminars/

http://trenchlessonline.com/ttc-offering-mini-seminars-part-fall-trenchless-technology-course/

TTC Pipeline Condition Assessment and Integrity Management (PCA&IM) Mini-Seminars Fall 2017


Trenchless
TECHNOLOGY
SEPTEMBER 2003
TRENCHLESSONLINE.COM
WEFTEC Preview Inside
Atlanta's Clean Water Advocates
Commissioner Jack Ryan and Mayor Shirley Franklin....
De-Mystifying Asset Management
JEA Tackles Manhole Rehab
Bypass Pumps Meet Rehab Demands

Water & Sewer Champion

Mayor Shirley Franklin – Atlanta's Sewer Mayor

- Atlanta Journal-Constitution – July 15, 2002

Atlanta eager to develop world-class sewer system

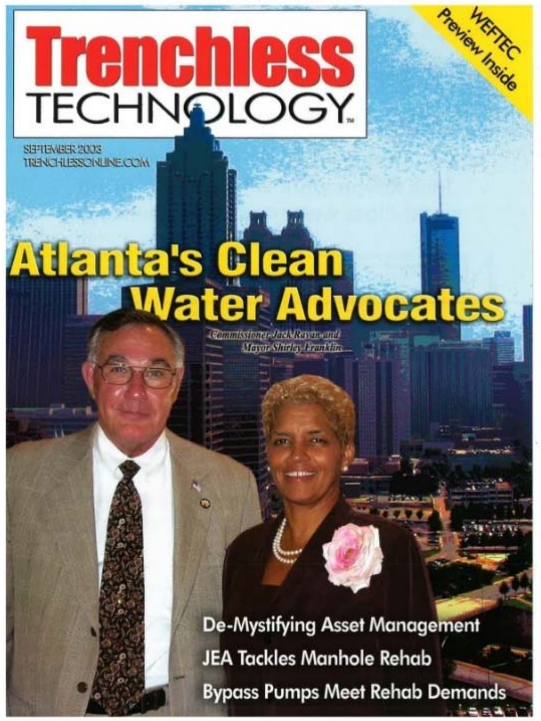
- People worldwide dream of living in a community with clean water, plentiful jobs and affordable housing. Over the Next 12 years, Atlanta will make its largest investment ever in such a dream. To assure high water quality and long-term economic stability for ourselves, our children and grandchildren, we are embarking on a $3B sewer improvement program.
- Most of this investment is required under a federal court order --- **it is our opportunity to develop a world-class sewer system (water program)**

The Roadmap to Accomplish the Challenges of Water Utilities Requires AM for Assuring Sustainability

Requires:

- Innovation
- Validation
- Education

BAMI-I
Buried Asset Management Institute - International

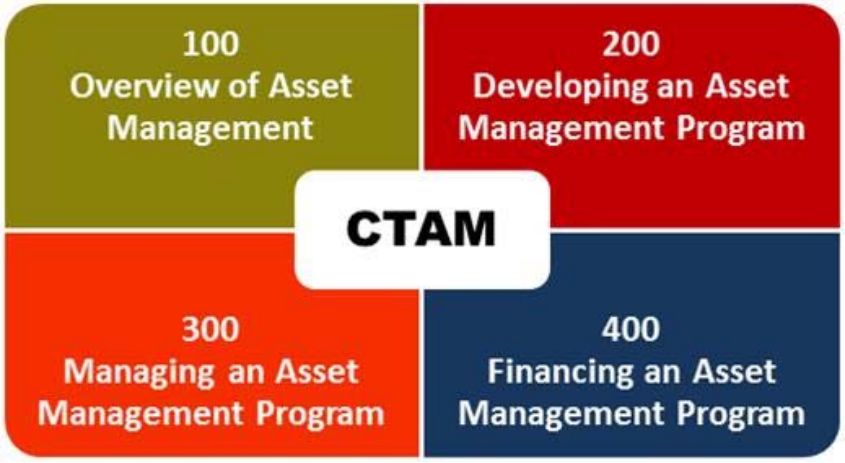


What is CTAM?

- Certification of Training in Asset Management
- Exclusive four-part series training

Levels of Certification

- **Associate Water Asset Manager (AWAM)**
- **Professional Water Asset Manager (PWAM)**



Trenchless Technology Center

Online Asset Management Training for Water Utility Professionals

Exclusive Four-Part Series in Asset Management Certification

1. CTAM-100 – Overview of Asset Management
2. CTAM-200 – Developing an Asset Management Program
3. CTAM-300 – Managing an Asset Management Program
4. CTAM-400 – Financing an Asset Management Program

Why offer courses in Asset Management?

The Buried Asset Management Institute-International (BAMI-I) created the Certification of Training in Asset Management (CTAM) program to increase awareness and train utility personnel on the best way to implement and use asset management to extend the life and efficiency of their water and wastewater systems. CTAM is an online educational series for obtaining certification of training in management of underground asset infrastructure.

Levels of Certification

I. **Certificate of Completion** – requires completion of each course

II. **Associate Water Asset Manager (AWAM)** – requires completion of CTAM 100-400 and an application submitted to BAMI-I Asset Management Certification Board

III. **Professional Water Asset Manager (PWAM)** – requires completion of CTAM 100-400, four years of relevant asset management experience and an application submitted to BAMI-I Asset Management Certification Board

Benefits of the CTAM Series

- Expand your knowledge and access to resources to enable you to initiate, continue or improve your own asset management program
- Earn internationally recognized certification in the field of asset management
- Earn 1 CEU / 10 PDHs for each course

CTAM
Certification of Training in Asset Management

CTAM-100 At-a-Glance:

- Sharing Asset Management Knowledge Globally
- Asset Management Overview & Technologies
- Introduction to Appropriate Websites & Tools
- Risk Management
- Government Regulations
- Case Study Examples

CTAM-200 At-a-Glance:

- Underground Infrastructure Asset Management
- Advantages, Rewards, Obstacles & Planning
- Asset Inventory, Organization Strategies & Tools
- Water & Wastewater Condition Assessment
- Data Content, Analysis, Sharing & Distribution

CTAM-300 At-a-Glance:

- Organizational, Legal & Budgeting Considerations
- Developing Priorities & Key Performance Indicators
- Infrastructure Inspection, Mapping & Rehab Methods
- Capacity, Management, Operation & Maintenance
- Asset Worth Value & Life-Cycle Analysis
- Risk-Based Budgeting

CTAM-400 At-a-Glance:

- Financial Challenges & Developing Strategies
- Accounting Principles, Reporting & Budgeting
- Strategic Internal & External Financing Tools
- Public-Private Partnerships and Design-Build
- Level of Service and Capital Improvement Plans
- Life-Cycle Costing
- Case Study Examples

BAMI-I | Trenchless Technology Center | UIM

The CTAM program was developed by BAMI-I (Buried Asset Management Institute International) in conjunction with the Trenchless Technology Center at Louisiana Tech and Indiana University-Purdue University at Indianapolis, in partnership with UIM: Water Utility Infrastructure Management, and is hosted by the Trenchless Technology Center at Louisiana Tech.

For more information and to register, call 330.467.7588, or
e-mail vminer@benjaminmedia.com
Conference.com/Benjamin/CTAM/CTAM_Home.html

Highlights

- **CTAM-100** has 510 registrants from 15 countries;
- **CTAM-200** has 185 Registrants
- **CTAM-300** has 145 Registrants
- **CTAM-400** has 130 Registrants

CTAM
Certification of Training in Asset Management

Trenchless Technology Center

Highlights

- **AWAM Certificates**

  101 Issued

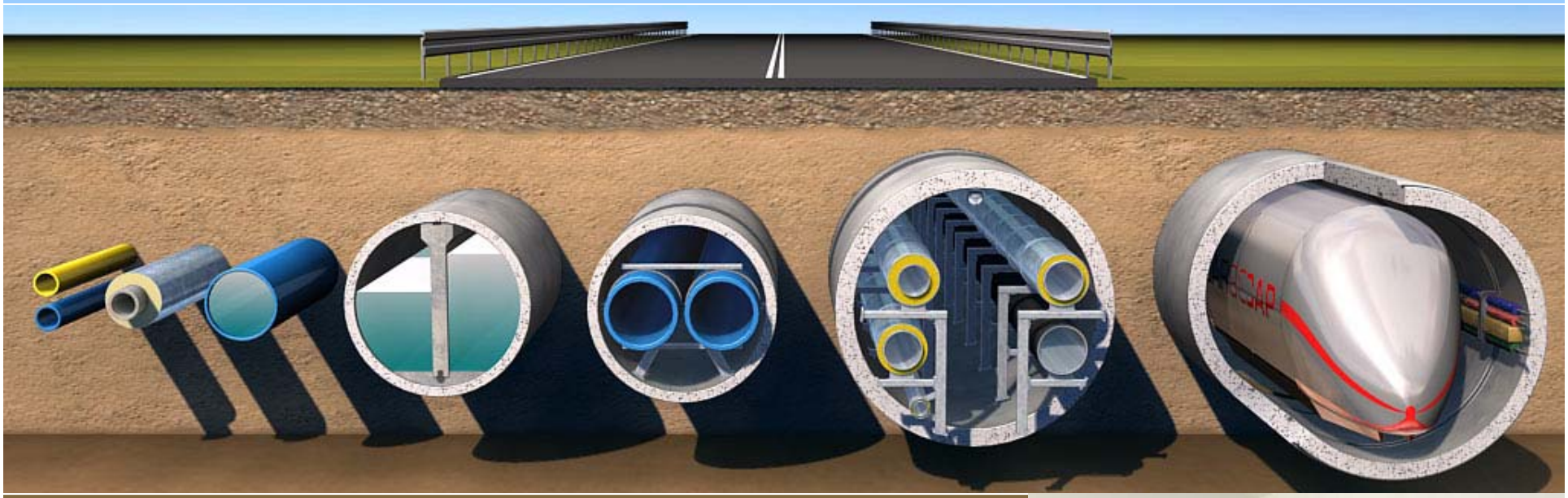
- **PWAM Certificates**

  12 Issued

TTC AND BAMI-I LAUNCH A COMPREHENSIVE ASSET MANAGEMENT CERTIFICATION PROGRAM

Columbus, OH - May 16 – 19, 2017

UNITRACC
The Future is in the Underground



Tom Iseley, Ph.D., P.E., Dist. M. ASCE, PWAM
UNITRACC International Director
CETF Professor of Civil Engineering
Director of the Trenchless
Technology Center Louisiana Tech University

Trenchless Technology Center Report

TTC Expands Global E-Learning Options For Water Professionals

The Trenchless Technology Center (TTC) at Louisiana Tech University, Ruston, LA, and Stein & Partner GmbH (S&P) based in Bochum, Germany, recently entered into an agreement to expand the awareness of the Underground Infrastructure Training and Competence Centre (UNITRACC) training and learning programs. This joint initiative will be led by Dr. Tom Iseley, director of TTC and Dr. Robert Stein, CEO for S&P.

The UNITRACC e-learning program is a unique knowledge portal which utilizes a huge library of media such as photos, animations, videos, graphics, simulations, etc. to provide support for professionals throughout their careers. This network has been developed over a 20-year timeline and is designed for professionals in all segments of the water sector. It is a demand-oriented knowledge transfer platform to provide immediate support for decision-making responsibilities in all job-related situations including design, construction, operation and maintenance, and management.

Iseley will serve as the international director for UNITRACC.com. He is well-known for his global leadership related to underground infrastructure. TTC has strengthened its international leadership during the past few years, for example, establishing agreements in China with The China University of Geoscience, Xi'an Jiaotong University, Institute of Geosciences and Environment and Tianjin Qingcheng Water.

Iseley believes this joint initiative is a major milestone in filling the considerable lack of knowledge about solutions for construction, rehabilitation and management. "The more qualified and informed the decision maker, the higher the chances for the selection of the most appropriate techniques and concepts," Iseley said.

It will also have significant impact on advancing the underground infrastructure industry by making sure the right amount of money is being spent on doing the right things at the right time.

Other initiatives

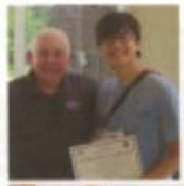
Currently, the TTC has established the following educational and training programs:

- Provides technical and administrative services to the Buried Asset Management Institute-International (BAMI-I) and manages the BAMI-I CTAM (Certification of Training for Asset Management) program. (bami-i.com/)
- A partnering agreement with the Colorado School of Mines for the development of the next generation of four professional development courses. The first will be offered in November 2016 on Geotechnics for Trenchless Construction. (csmspace.com/events/trenchless/)
- Specialty School programs which consist of three to five days of extensive training on topics such as Auger Boring and Utility Investigations. (ttc.latech.edu)
- Global Pipeline Internship Program that in 2016 sent two graduate students from Louisiana Tech to HK Polytechnic University and hosted two students from HK Polytechnic University who helped in the Aug. 15-19 Utility Investigations School (UIS).

TTC Mini-seminar series

The Trenchless Technology Center at Louisiana Tech University has launched a series of special educational programs aimed at providing detailed information about modern trenchless construction, rehabilitation and asset management.

The TTC Trenchless Mini-seminar program was launched during the spring of 2016 as part of a senior-level undergraduate capstone project driven course at Louisiana Tech. The subject selected was a large microtunneling project in Canada. Industry leaders from eight organizations provided instruction. This program was expanded in the fall semester of 2016 for a graduate\undergraduate introduction to trenchless technology, where 15 organizations, representing 18 industries, conducted seminars.



Clockwise from top left: Dr. Tom Iseley and Oliver, (POLYU HK intern); Dr. Iseley and Dr. Stein signing the agreement. From left to right: Gary Young, James H. Anspach, Brian Tooley, Dr. Cesar Quiroga, John Campbell, and Philip J. Meis; Jeff Boschert, Eric Boudreaux, and Ralph Carpenter

The objective of the seminars is to prepare attendees to demonstrate sound engineering judgment for managing the construction, repair and maintenance of underground infrastructures. These seminars are being instructed by the foremost experts in the trenchless industry. The sessions began on Sept. 15 and run through Oct. 27. Registration is complimentary.

Iseley said that "it is very exciting to see how the trenchless industry is partnering with TTC to provide our industry's future decision makers with maximum exposure to the trenchless industry."

The TTC Mini-Seminars are sponsored by the National Clay Pipe Institute, Akkerman, Brierley Associates, Portland Utilities Construction Co., Avanti International, Pure Technologies, Underground Imaging Technologies, American Ductile Iron Pipe, Thompson Pump, NASSCO, Hasted Tunneling, Derrick Equipment Company, CDM Smith, Plastics Pipe Institute and Hobas USA.

FOR MORE INFORMATION:

TTC: Dr. Tom Iseley

Mini Seminars:

October-November Mini-seminar schedule:

Oct. 11 – Cured-in-Place Pipe (CIPP)
Lynn E. Osborn, Development Manager, NASSCO

Oct. 13 – MTBM Equipment & Shaft Construction Process – Slurry Separation
Ray Post, Vice President, Hasted Tunneling LLC; Matt Wiggins, Technical Service Representative/Solids Control School Instructor, Derrick Equipment Company

Oct. 18 – Shreveport's Consent Decree and the Trenchless Technology Program
Walter Carpenter, Project Manager, CDMSmith

Oct. 20 – Design and Installation of PE4710 Water Mains per ANSI/AWWA C906-15 and AWWA M55-06 – PPI BoreAid Software
Camille Rubeiz, Director of Engineering, Plastic Pipe Institute

Oct. 27 – FRP Pipe
Rick Turkopp, Vice President, Engineering, Hobas Pipe

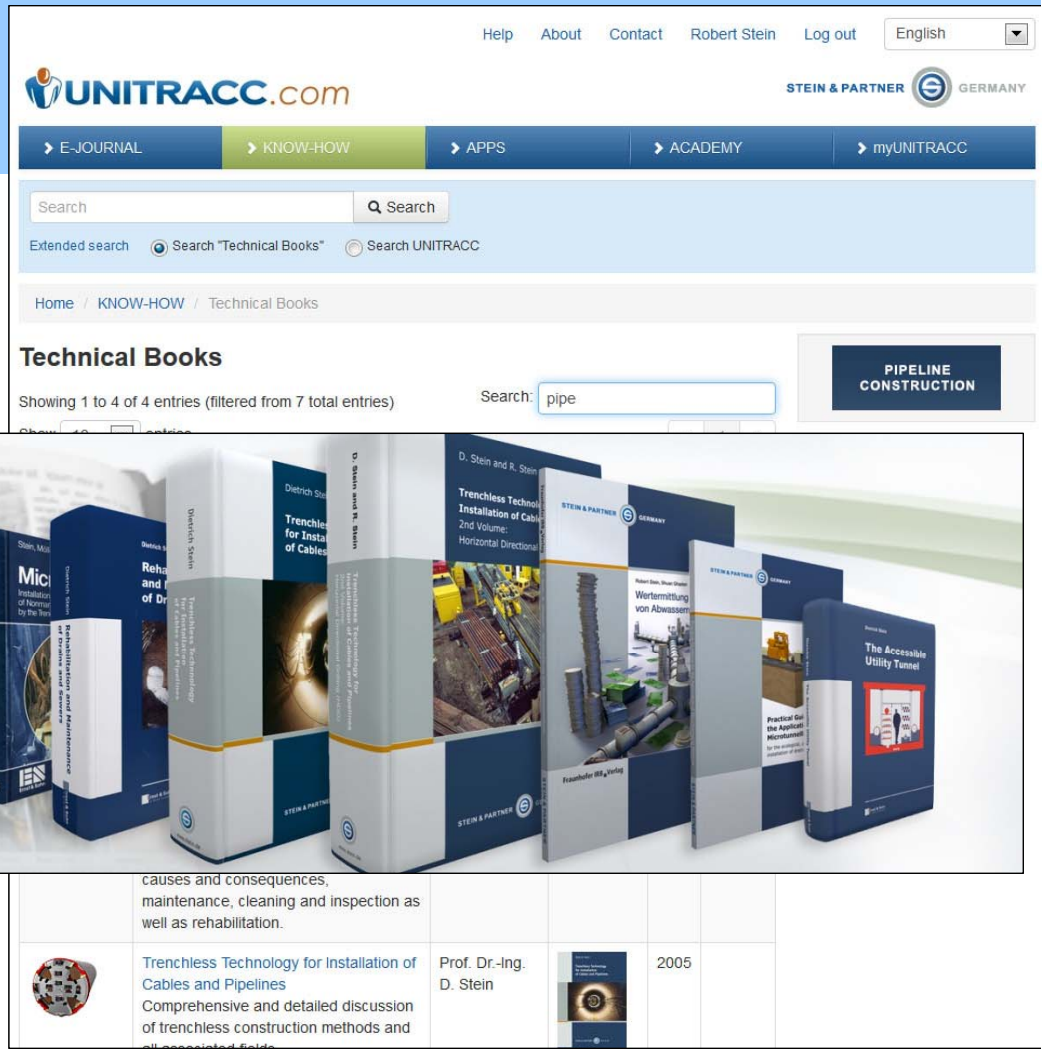
The seminars are held from 10 – 11:50 a.m. on the Louisiana Tech campus.

48 ucononline.com

Underground Construction October 2016

UNITRACC Reference Books

Multimedia Reference Books



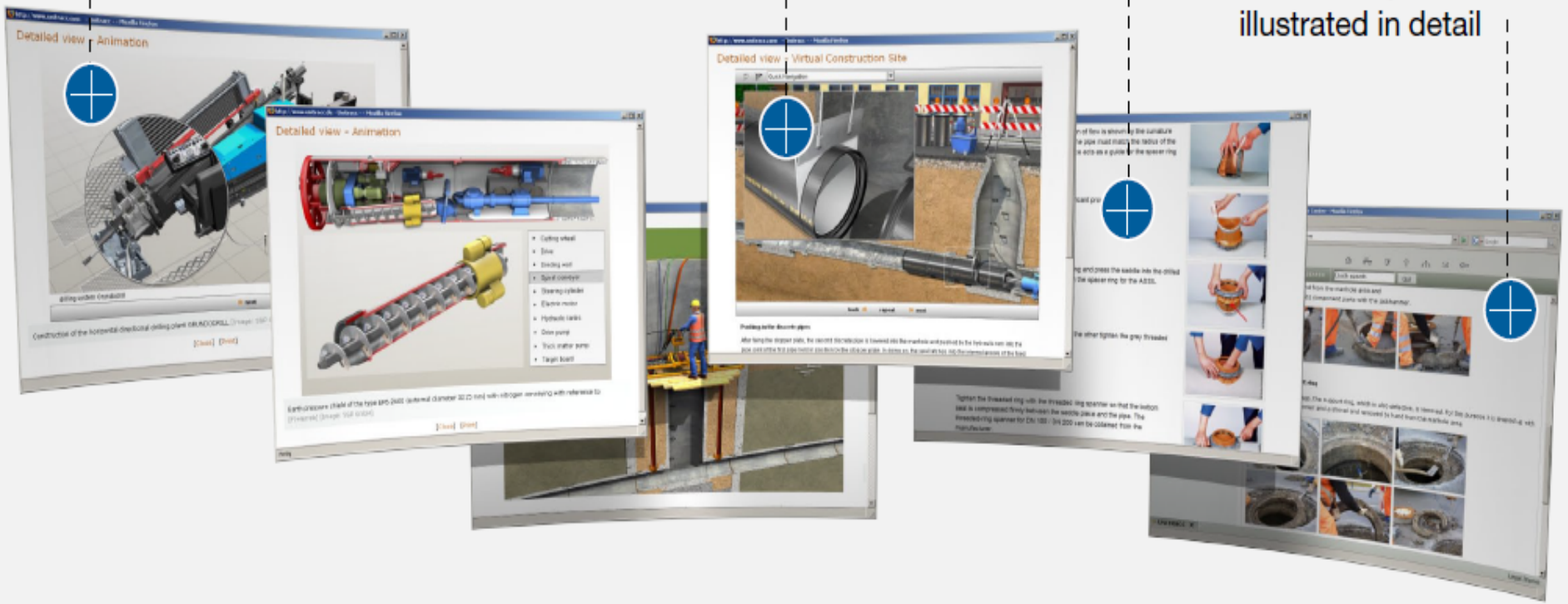
The UNITRACC method

3D illustrations
animations
videos

Virtual construction sites
Interactive visualization of complex processes in the daily routine of a construction site

Instructions
Developer and supplier explain step by step the use of procedures and techniques

Documentations
Construction and renovation processes illustrated in detail

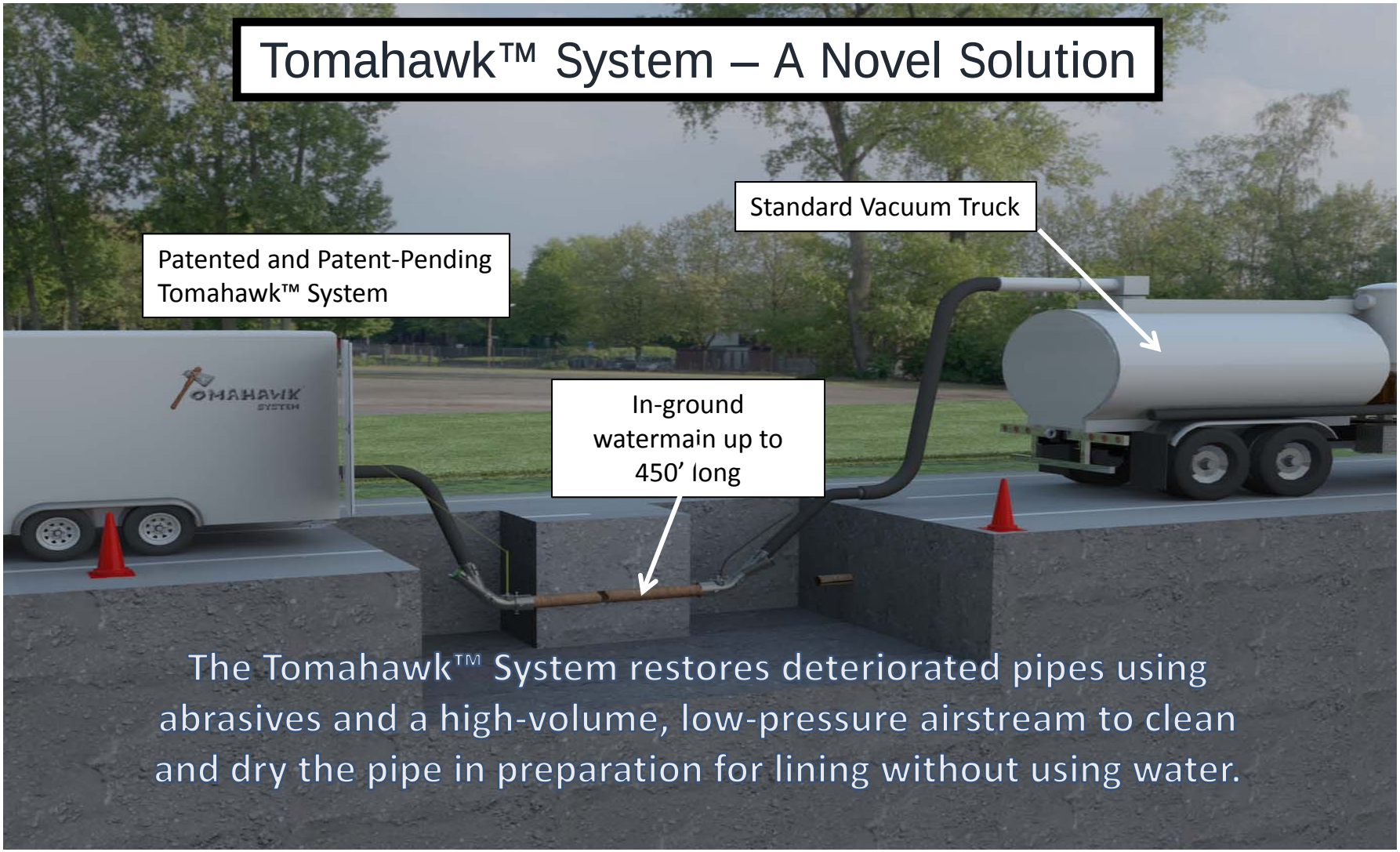


Innovation

PARADIGM SHIFT:

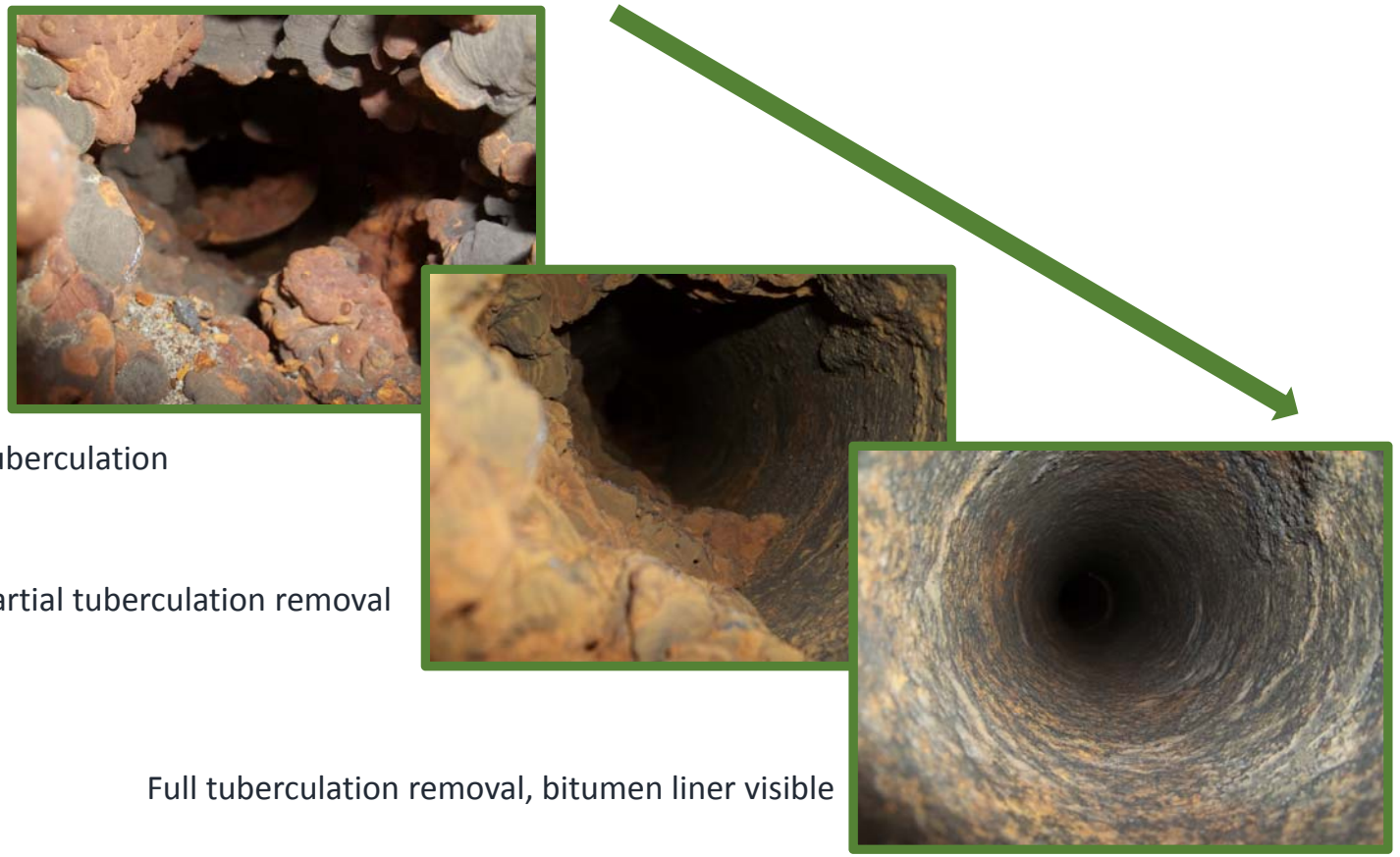
- If you could:
  - Clean and inspect pipes 50% faster,
  - Dry them for 100% superior liner bond,
  - Not use a drop of water,
  - Reduce waste generation by 98%,
  - NOT damage your pipes or services,
  - Capture all waste in a closed, filtered system; and
  - Meet NACE surface preparation standards,
- …would this technology be of interest?

Tomahawk™ System – A Novel Solution



Tomahawk™ System Process

Cleaning progression……

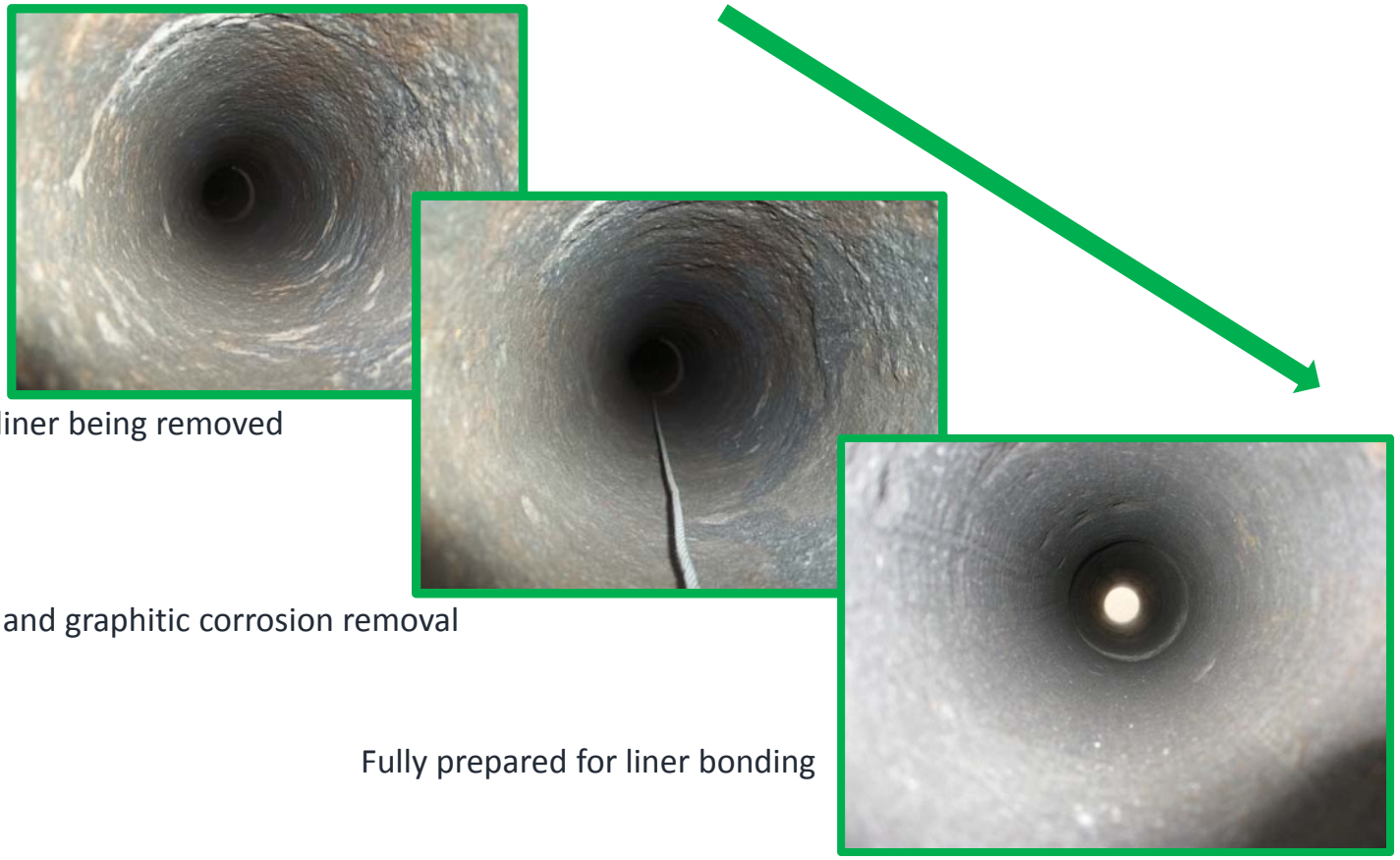


Tuberculation

Partial tuberculation removal

Full tuberculation removal, bitumen liner visible

Preparation progression……



Bitumen liner being removed

Partial liner and graphitic corrosion removal

Fully prepared for liner bonding

Tomahawk Value Proposition:

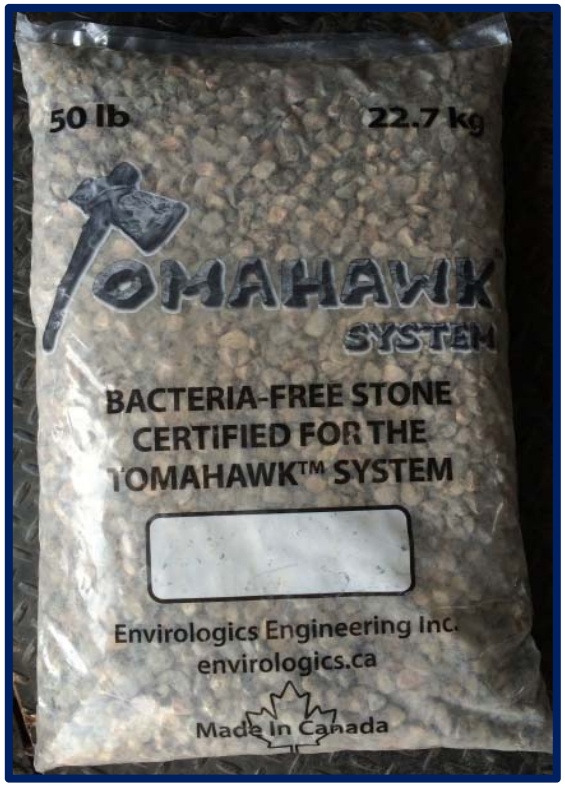
- ✓ Cleans pipe to bare metal (4” – 12”)
- ✓ Waterless, dust-free process
- ✓ Dries the pipe for best bond
- ✓ No damage to pipe or service connections
- ✓ Very fast (enables same-day return to service)
- ✓ Used on metallic, AC, & concrete pipes
- ✓ Reduced construction footprint


OMAHAWK SYSTEM
MWD
MSD
✓ Trenchless water main rehab
✓ Minimal disruption to local residents
✓ Dry, dust free process
✓ Small footprint vs dig and replace
✓ No service bypass present

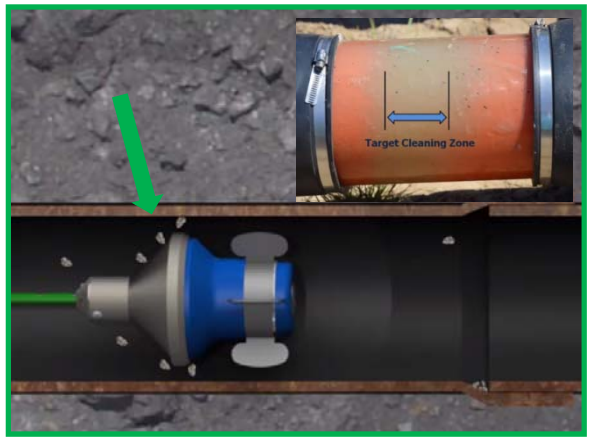
Reduced Project Footprint

Abrasives: Stone

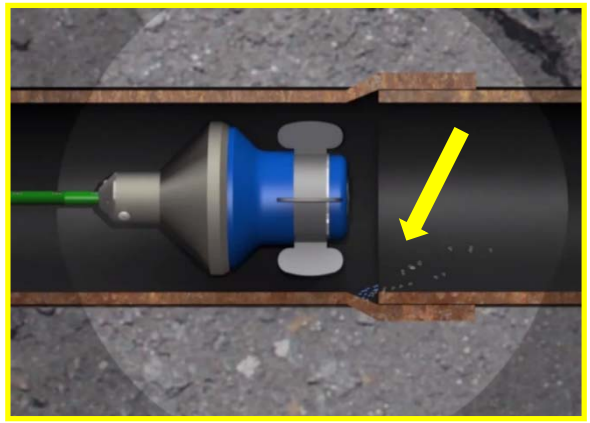
- Various calibers used
- Stone is triple-washed and dried at high temperature
- Verified bacteria free



Concurrent Cleaning, Drying and Inspection



Inspect and target clean along pipe, at joints, around service connections for improved liner bond



Inspect and draw trapped water and debris from joints, crevices and service connections

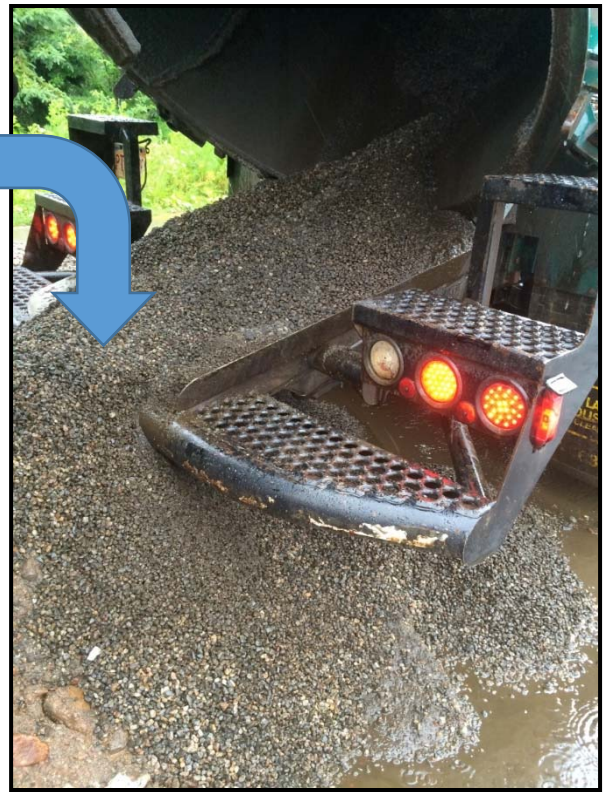
Waste Capture

- Cleaning process uses closed loop
- Dust, debris and cleaning stone are 100% captured, maintaining a dry, clean and safe worksite

- Eliminates the sensory impacts (visual, smell) of the waste released from aging, fouled water mains
- Minimizes cost and provides ease of disposal

Dry Versus Wet Waste:

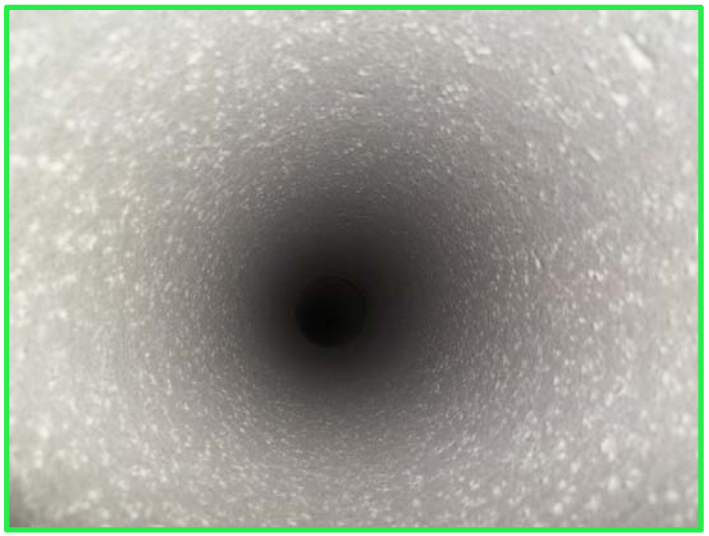
- Stone and debris captured by vac truck after cleaning 6 pipe sections
- Represents 30 to 50% of average truck capacity
- **Result:** Less waste by volume means vac truck can stay on-site working for much longer periods



Cleaning Results

Corrosion and Coal Tar Liner Removed

Before



After

Tuberculation Removed From Unlined Pipe

Before

After

Tuberculation Removed From Unlined Pipe

Before

After

Tuberculation and bitumen removed from water main using the Tomahawk™ System followed by a 3M™ Scotchkote™ Pipe Renewal Liner 2400 application

Achievements:

- Improved water quality
- Hydraulic capacity restored
- Reduced power consumption to pump water
- Decades of additional service

Tomahawk Cleaning – Street View

Trenchless Watermain Rehabilitation - Tomahawk™ Cleaning
150mm - 120 meter long watermain - cleaned and prepared for lining in 2 hours

Click here to view video

Projects Completed

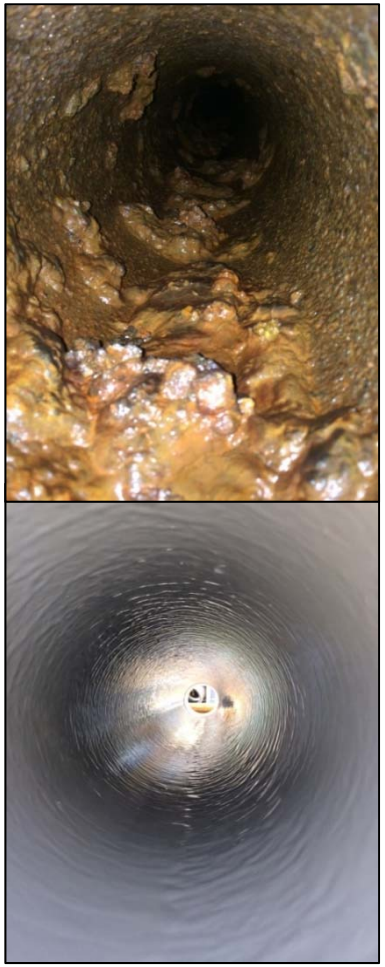
- Napanee, ON
- Peterborough, ON
- Cambridge, ON
- St. John, NB (2)
- Moline, IL
- Waterloo, ON
- Montreal, QC
- Quebec City, QC
- Victoria, BC
- Vancouver, BC

In-Development: Tomahawk Airborne Lining

Tomahawk Airborne Lining

Pressure Water Pipes:

- Low cost, NSF61, non-structural barrier coat lining system for metallic pipes
- AWWA M28, Class I coating to prevent future interior corrosion, deposit build-up and water quality problems
- Large percentage of pipes require barrier protection only



Above: 6” tuberculate pipe
Below: cleaned and lined
Photos by Envirologics

Tomahawk Lining Process – In-Pipe View

Video of lining process as viewed from a Tee looking towards the mainline

Distributive body removed from video as patent is pending

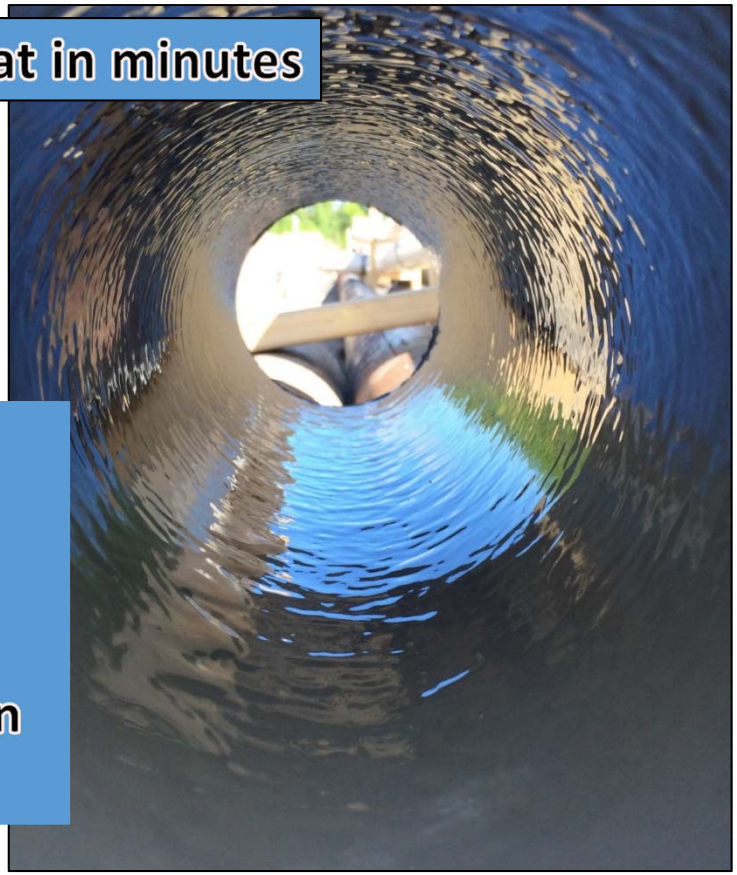
Water main before cleaning - inspection video

Water main after Tomahawk cleaning and lining - inspection video

Tomahawk Airborne Lining

Clean then apply barrier coat in minutes

TOMAHAWK SYSTEM



Low cost barrier coat to:

- Extend pipe life
- Restore flow capacity
- Improve water quality
- Encapsulate lead found in pipe and joints

Photos by Envirologics

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Trenchless Technology Center

Thanks for your attention!

Questions?

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