Trenchless Pressure Pipe Rehabilitation

2021 FACERS Annual Meeting

June 30, 2021

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Why Consider Trenchless Renewal Technologies?

Traditional Open-cut Replacement

If you have…

- Easements/easy site access
- Minimal utility conflicts
- Local contractor availability/experience
- Comfort level of utility owner

Desired Outcome…

- Eliminate infiltration and exfiltration
- Restore structural integrity
- Improve water quality
- Protect pipes from corrosion
- Reduce maintenance

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Trenchless Renewal

If you have…

- Easements/difficult site access
- Multiple utility conflicts
- Congested area

Resulting Outcome…all and more!

- Extends life of existing underground assets
- Cost-effectiveness
- Volume pricing
- High production rates
- Fewer social costs to open-cut
- *Minimally disruptive*

Common Trenchless Renewal Technologies

Slip lining

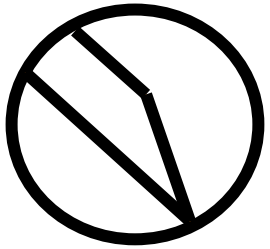
Installation of a smaller “carrier pipe” into a larger host pipe

Pipe bursting

A method of fracturing the host pipe and pulling in a new pipe that is equal to or greater in size

Coatings

Utilizing spray applied materials to renew the surface of the existing pipe



Directional Drilling

Installation of new pipe through a bored hole under an obstacle

Emerging Trenchless Renewal Technologies

Sliplining
Installation of a smaller “carrier pipe” into a larger host pipe

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A method of fracturing the host pipe and pulling in a new pipe that is equal to or greater in size

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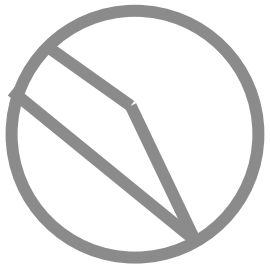

Directional Drilling
Installation of new pipe through a bored hole under an obstacle

Cured-in-place Pipe (CIPP)
A jointless, seamless resin saturated tube that is installed in the existing host pipe and cured

Hose Lining
A modified type of sliplining that involves installing a high-pressure hose product inside a larger host pipe

Which Technology Should I Consider?

CIPP

Spray Applied

Slip Lining
(conventional)

FRP

Pipe Bursting

Slip Lining
(modified)

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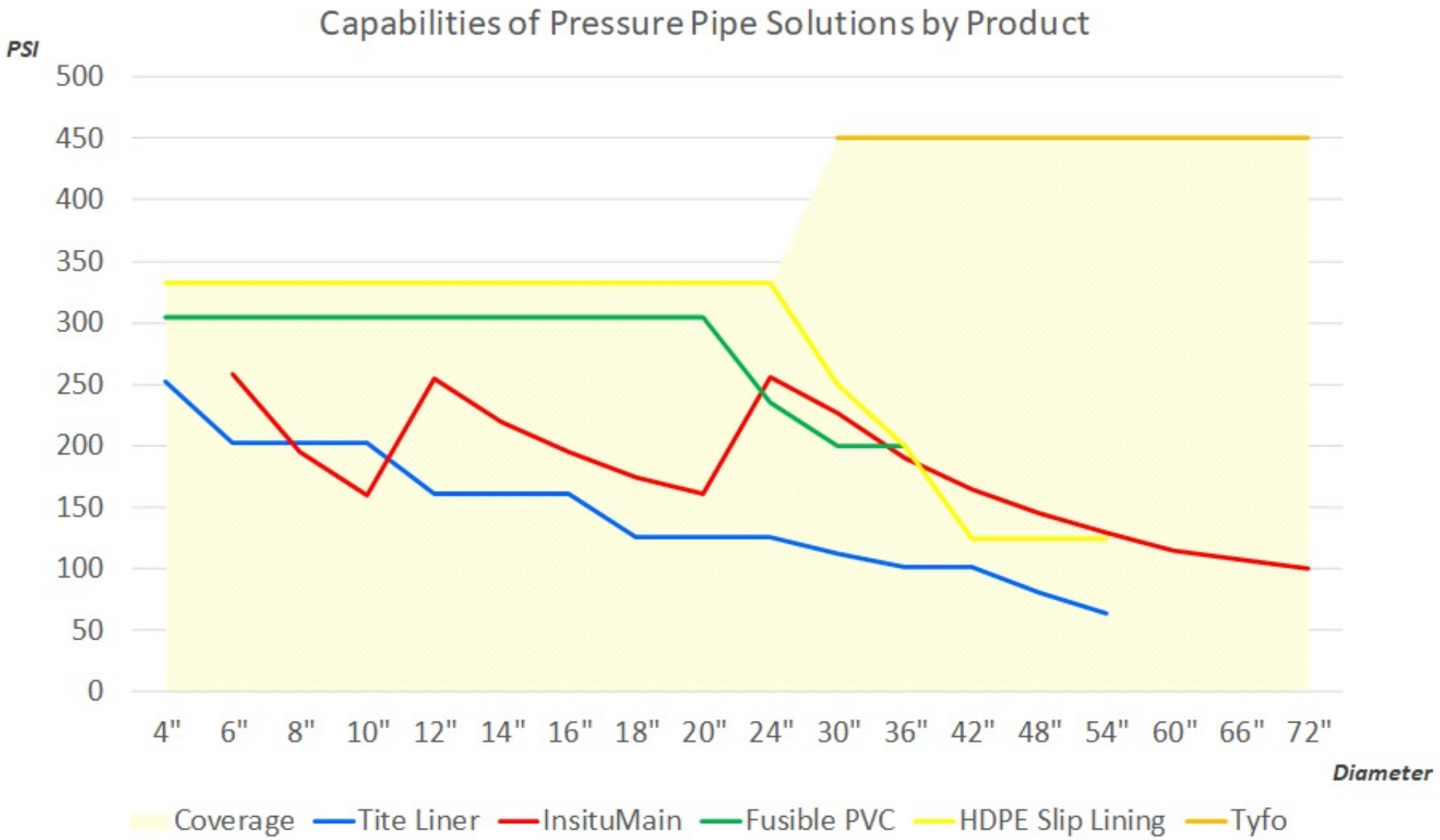
Technology Matrix

Applications

Product/Process	Potable Water	Non-potable Water	Diameter	Max. Install Length	Max. Pressure	AWWA Classification
Cement mortar lining	x	x	4" - 36"	2,000'	N/A	I/II
Epoxy lining	x	x	4" - 36"	1,000'+	N/A	I/II/III
CIPP	x	x	6" - 96"	1,000'+	250+ psi	III/IV
FRP	x	x	> 30"	Unlimited	450+ psi	III/IV
Pipe bursting	x	x	4" - 36"	1,000'+	305 psi	IV
Slip lining (conv.)	x	x	> 4"	4,000'+	305 psi	IV
Slip lining (mod.)	x	x	2" - 54"	4,000'+	140 psi	III/IV

Our Portfolio Addresses All Major Diameters and Pressures



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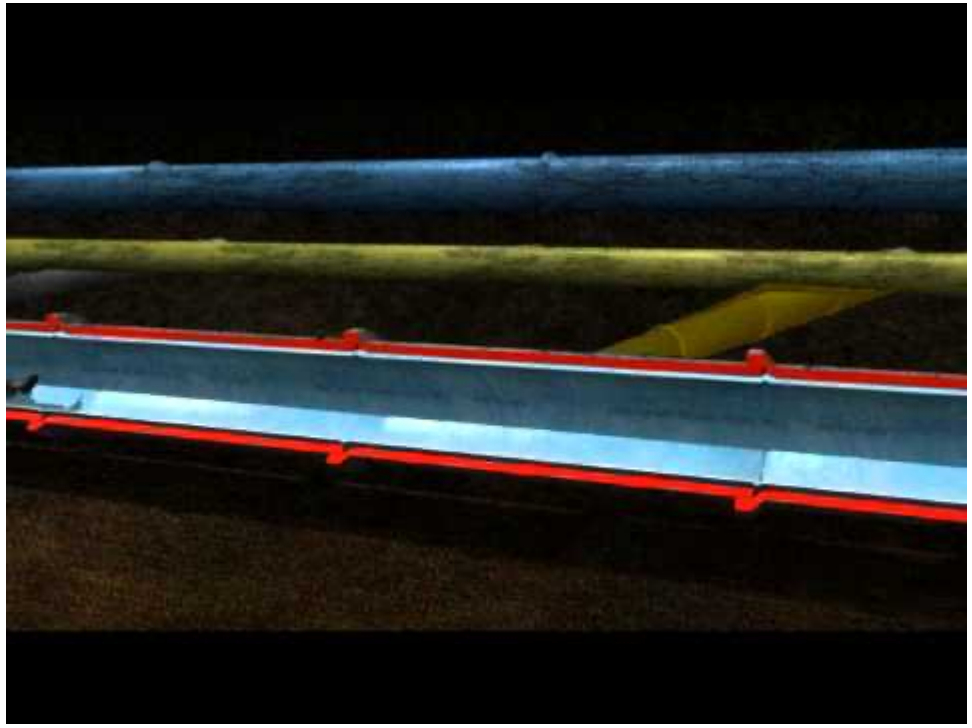
Coordination with Roadway Projects + More

- Minimal Traffic Control
- Scheduling of different projects
- Minimize new material waste



Not Just Pressurized Pipelines

- Storm
- Sewer
- Water

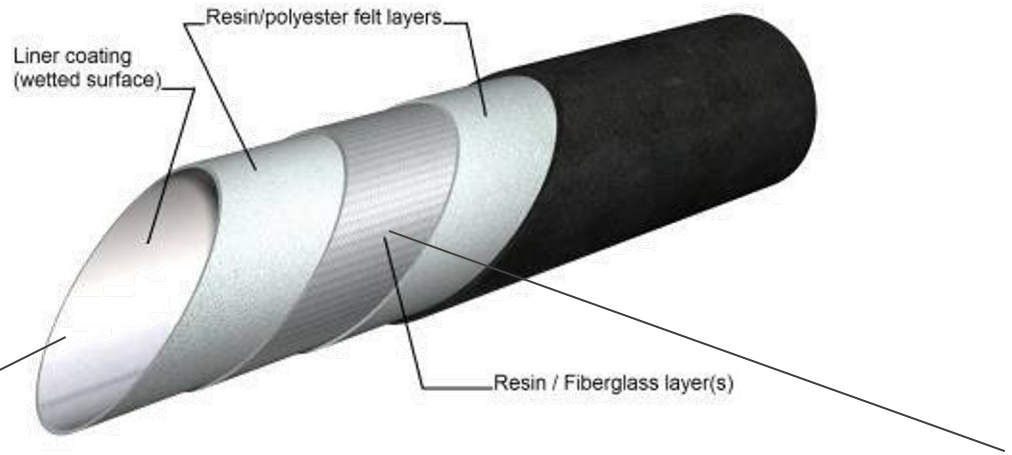
Pressure-rated CIPP

Epoxy/polyester felt structure

- Provides for external load capacity
- Layer thickness can be varied depending on loading conditions
- Utilizes epoxy resin system instead of polyester resin (drinking water safe)

Hazen-Williams Coefficient

- C=140



PP/TPU coating

- Water contact surface
- Coating also provides water barrier for installation processes & handling

Epoxy/fiberglass structure

- Provides high tensile/hoop strength
- Number of layers varies depending on diameter and internal pressure

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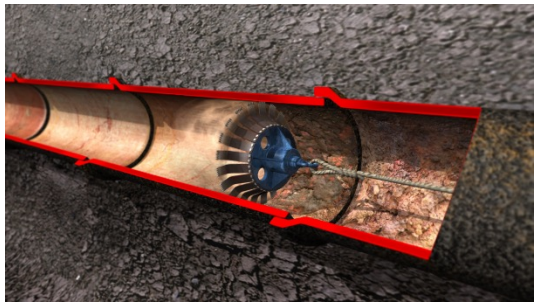
InsituMain® CIPP installation



Step 1:
If required, setup a temporary water bypass and excavate pits to provide access to the existing pipeline. Clean the pipeline and inspect using closed circuit TV (CCTV) in order to ensure the host pipe is free of any potential hazards.

Step 2:
Install the InsituMain® liner into the host pipe using:

- Air (steam cure)
- Water (water cure)
- Pull-in (steam or UV cure)

After curing, the pipe is cooled and the ends are cut. Following hydrostatic pressure testing, post-installation CCTV inspections are also completed.

Step 3:
Reinstate service connections (if present) and/or reconnect lined sections to the existing system using standard pipe fittings. Finally, restore excavation pits and remove temporary bypass, if applicable.

CIPP Lining – West Palm Beach, FL

Project Description

- Owner: West Palm Beach, FL
- Pipe Material: PCCP
- Diameter: 48-inch
- Length: 5,700 LF
- Pressure: 25 psi
- Type: Sewer Force Main

WPB SM
WEST PALM BEACH

Problem Statement

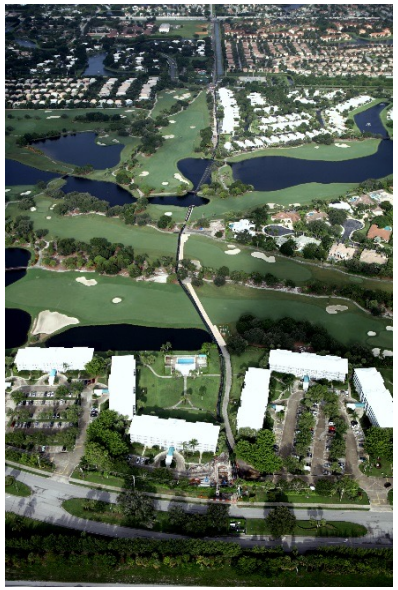
- Located near canal, county club and high-end residential homes
- High social costs
- Difficult site access
- Deteriorated pipe with pre-stressed wire breaks

CIPP Lining – West Palm Beach, FL

Renewal Technology Selection

- Fully Structural (AWWA Class IV)
- Full sewer bypass
- Long installation lengths (Averaged 1,000 LF)
- Minimal internal diameter loss

INSITUMAIN® CIPP LINING



Trenchless TECHNOLOGY

REHAB WINNER 2017 PROJECT OF THE YEAR

CIPP Lining – El Dorado Springs Canyon, CO

Project Description

- Owner: City of Lafayette, CO
- Pipe Material: Steel
- Diameter: 12-inch
- Length: 1,200 LF
- Pressure: 45 psi
- Type: Raw water

Problem Statement

- Catastrophic flooding damaged water structures
- Pitting and holes in 50-year old pipeline
- Difficult site access
- Numerous 11-degree bends
- 75-foot elevation change

City of Lafayette

CIPP Lining – El Dorado Springs Canyon, CO

Renewal Technology Selection

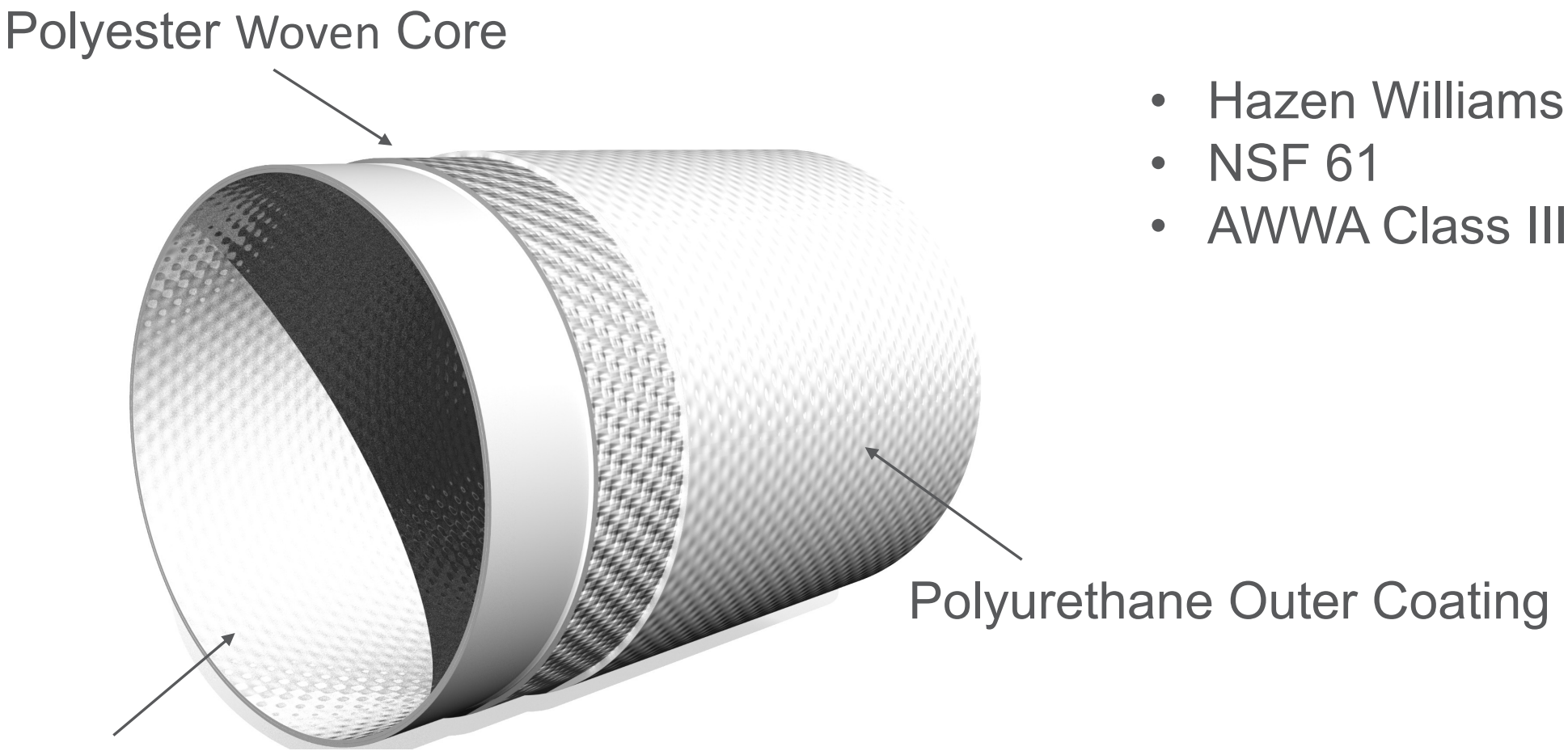
- Fully Structural (AWWA Class IV)
- Span holes in host pipe
- Survive host pipe failure
- NSF/ANSI 61 Standard
- Minimal site footprint

INSITUMAIN® CIPP LINING

Trenchless TECHNOLOGY

Project of the Year 2016
Rehabilitation Runner Up

Hose Lining



- Hazen Williams = 150
- NSF 61
- AWWA Class III

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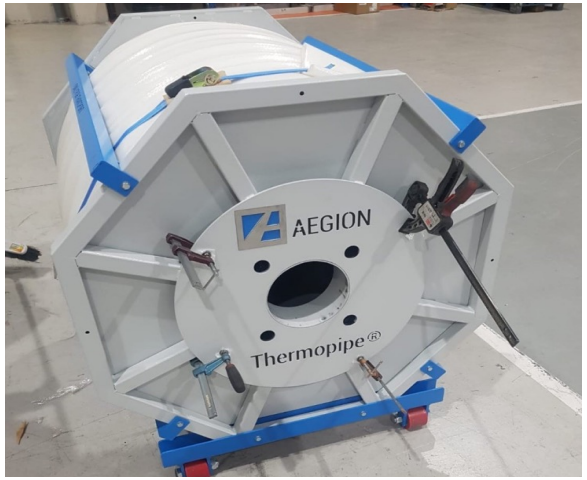
Installation Steps



Step 1

Set up Reel on site for unwinding.

Step 2

Attach pull head, connect to cable and use winch for pull in.

Step 3

Inflate Thermopipe® with compressed air to expand hose and break tape.

Step 4

Simple mechanical end connections and reconnect with standard waterworks fittings.

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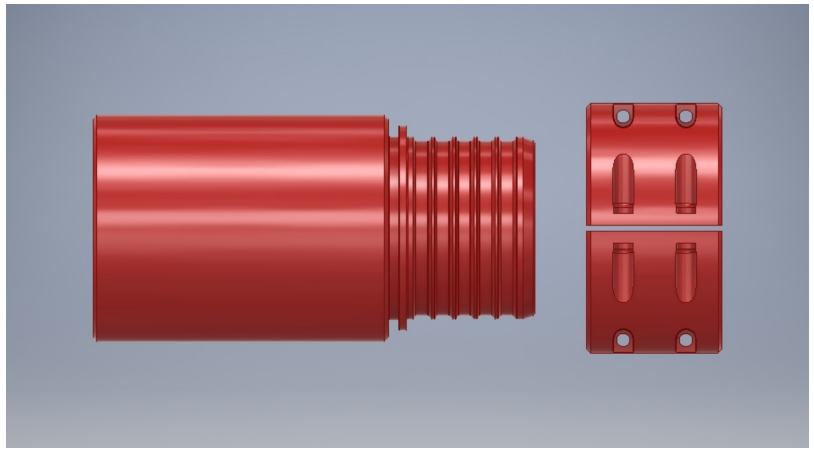
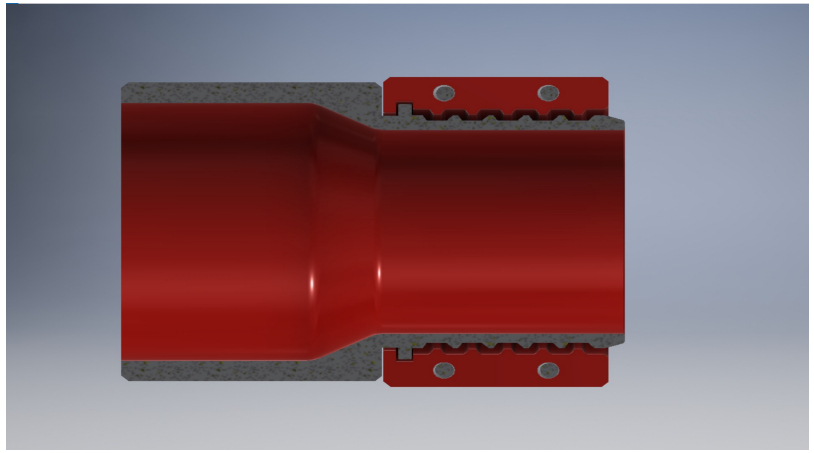
EndConnect™ TP





- Epoxy Coated Steel
- Ease of Reconnection
- Plain End Connection

Lake Worth, FL- Water Main Rehabilitation

Project Description

- Owner: Lake Worth
- Pipe Material: HDPE
- Diameter: 12-inch
- Length: ~400 LF
- Pressure: 60 psi
- Type: Water Main

Problem Statement

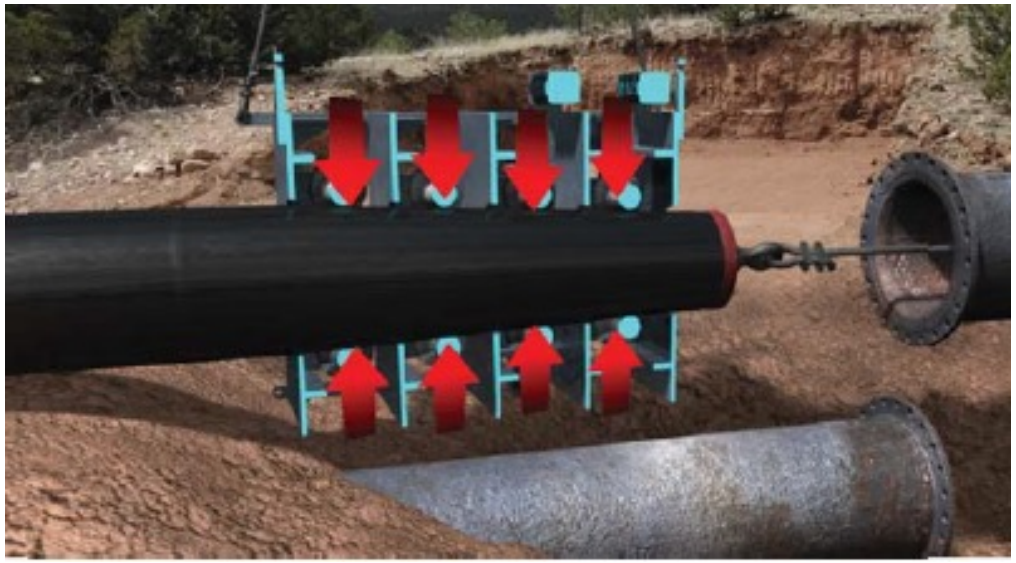
- Located along a roadway crossing a canal
- Difficult open cut replacement
- Minimal workspace
- Leaking joints

Lake Worth, FL- Water Main Rehabilitation

Renewal Technology Selection

- Semi-structural (AWWA Class III)
- No bypass required
- Flexible work zone
- Minimal internal diameter loss (tight-fit liner)

Tight-Fit HDPE Lining: Radial Compression



- Diameter is temporarily reduced by radial compression
- Timing is important: liner will begin to grow back once tension is released
- Can be used for structural or non-structural
- Entire liner section is installed in a single and continuous “pull”

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Tight-Fit HDPE Site Installation Layout: Layton, UT

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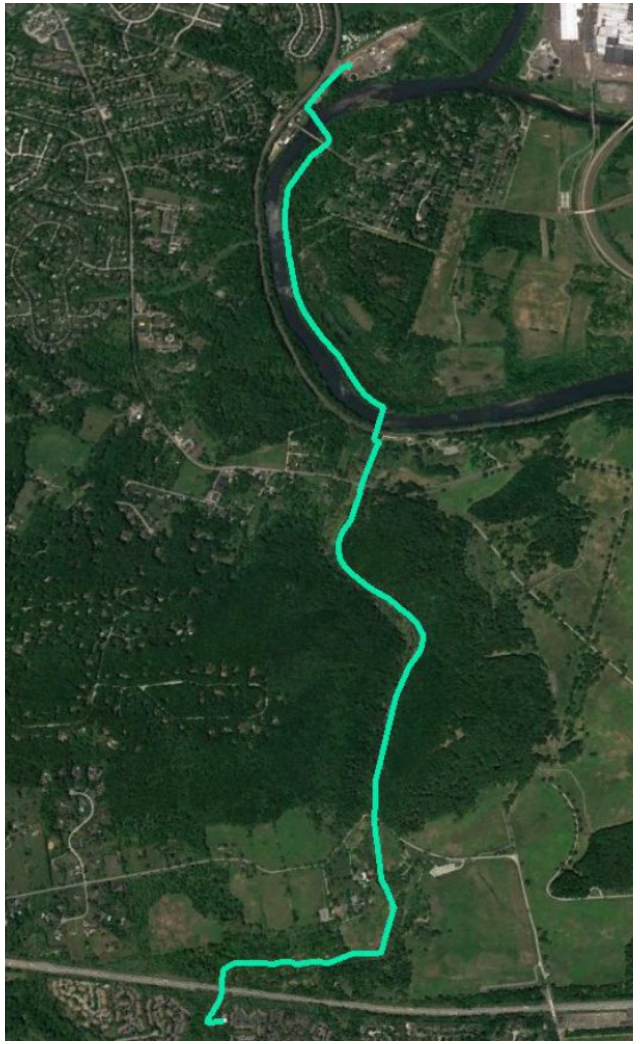
Modified Slip Lining – Valley Forge, PA

Project Description

- Owner: Tredyffrin Township, PA
- Pipe Material: PCCP
- Diameter: 30-inch
- Length: 18,000 LF
- Pressure: 50 psi
- Type: Sewer Force Main

Problem Statement

- Three pipe failures on 40-year old pipe
- Difficult site access
- Two river crossings
- High social costs
- Traversed historic Valley Forge National Park



Modified Slip Lining – Valley Forge, PA

Renewal Technology Selection

- Fully Structural (Class IV)
- Full sewer bypass
- Long installation lengths (Longest 1,500 LF)
- No loss in pipeline capacity

TITE LINER® HDPE MODIFIED SLIP LINING

Trenchless TECHNOLOGY

Project of the Year 2017 Rehabilitation Honorable Mention

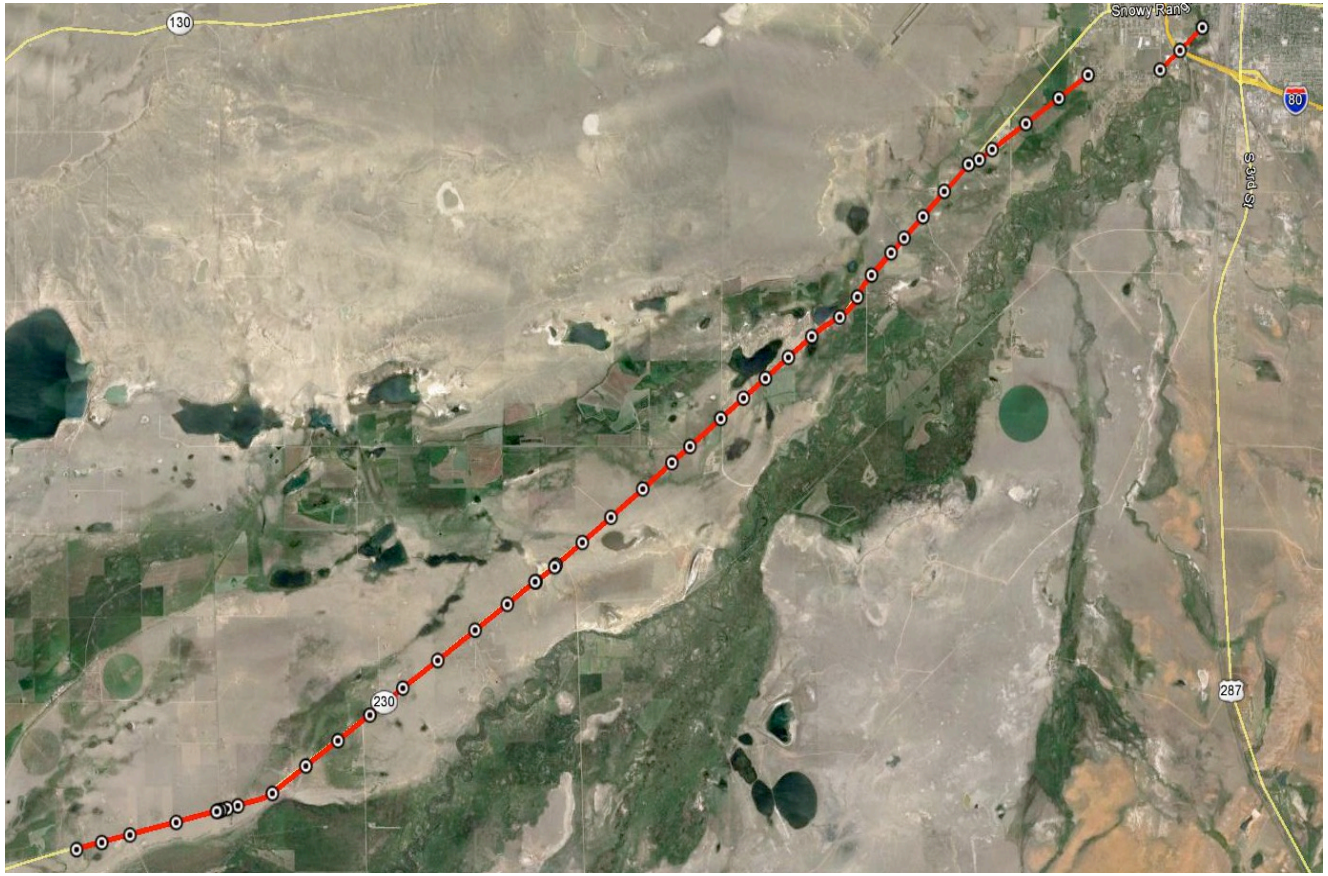
Modified Slip Lining – Laramie, WY

Project Description

- Owner: Laramie, WY
- Pipe Material: Steel
- Diameter: 20-inch
- Length: 95,000 LF
- Pressure: 0 to 70 psi
- Type: Potable Water

Problem Statement

- Pipe built in 1940’s
- No reduction in flow allowed
- Fully structural host pipe with leakage
- Coal tar lining impacted water quality
- Limited access



Modified Slip Lining – Laramie, WY

Renewal Technology Selection

- Semi-structural (Class III)
- 18 service laterals reinstated
- Long installation lengths (Longest 3,100 LF)
- No loss in pipeline capacity

TITE LINER® HDPE MODIFIED SLIP LINING

Carbon/Glass Fiber (FRP)

- Carbon Fiber Reinforced Polymers (CFRP)
- Glass Fiber Reinforced Polymers (GFRP)

INTRODUCTION TO FRP

- Composite structure
  - Polymer Matrix = Epoxy
    - Bonds filaments to share loads
  - Reinforcement = Carbon and/or Glass
    - Continuous Strands
- Excellent strength to weight ratio
- Directional Strength
- Non isotropic
  - Complex shapes

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When does the Tyfo® Fibrwrap® system make sense?

Diameter range:

- Large-diameter pipe (internal)
  - 36” to ≥ 216”
- Small-diameter pipe (external)
  - Less than 36”

Pressure range:

- Up to 400+ psi
- Vacuum pressure (to 14.7 psi)

External loads:

- Earth cover
- Traffic loads
- Water table
- General surcharge

Designed as either an independent/stand alone or an interactive/composite system

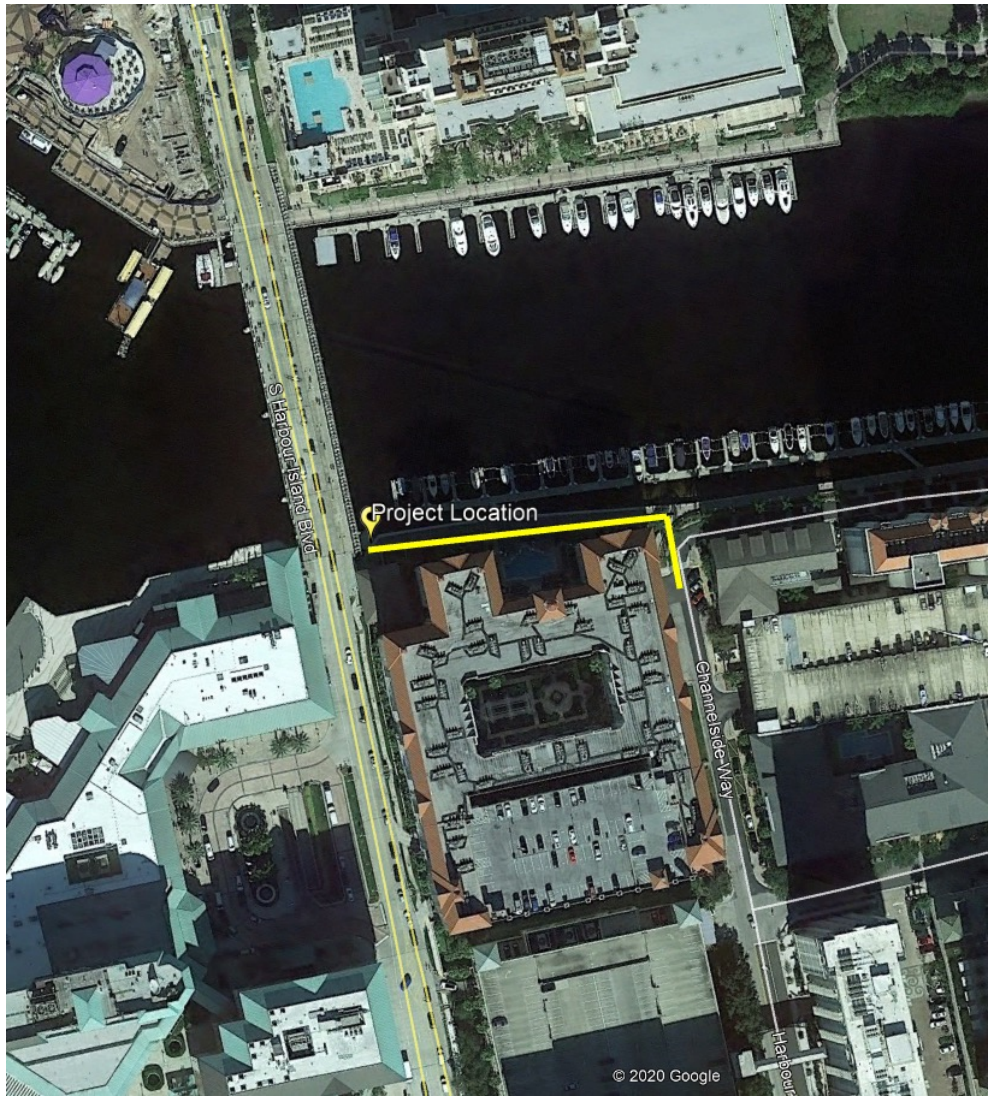
Fiber Reinforced Polymer – Harbour Island, FL

Project Description

- Owner: City of Tampa, FL
- Pipe Material: Steel and PCCP
- Diameter: 48 and 54-inch
- Length: 350 LF
- Pressure: 100 psi
- Type: Sewer Force Main

Problem Statement

- Vertical and horizontal 90 degree bends
- Difficult site access with high water table
- Deteriorated pipe
- High social costs
- Remove and replace not feasible

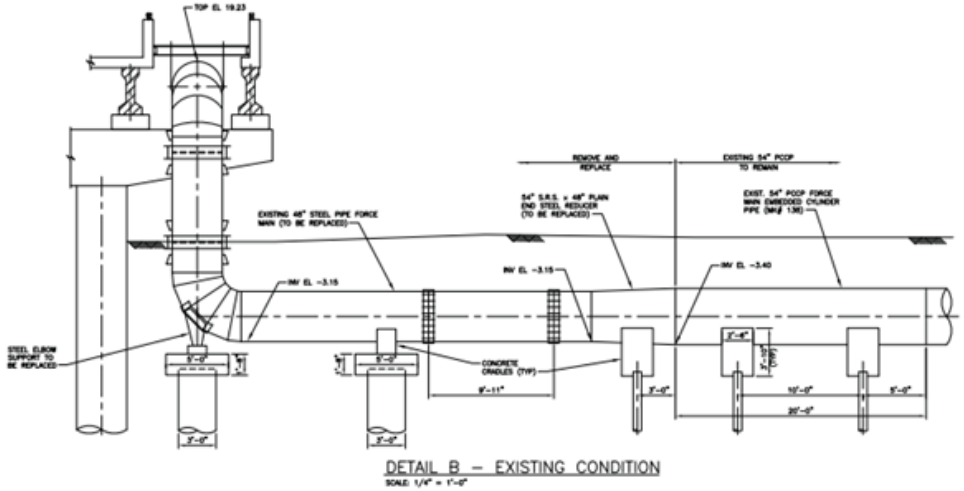


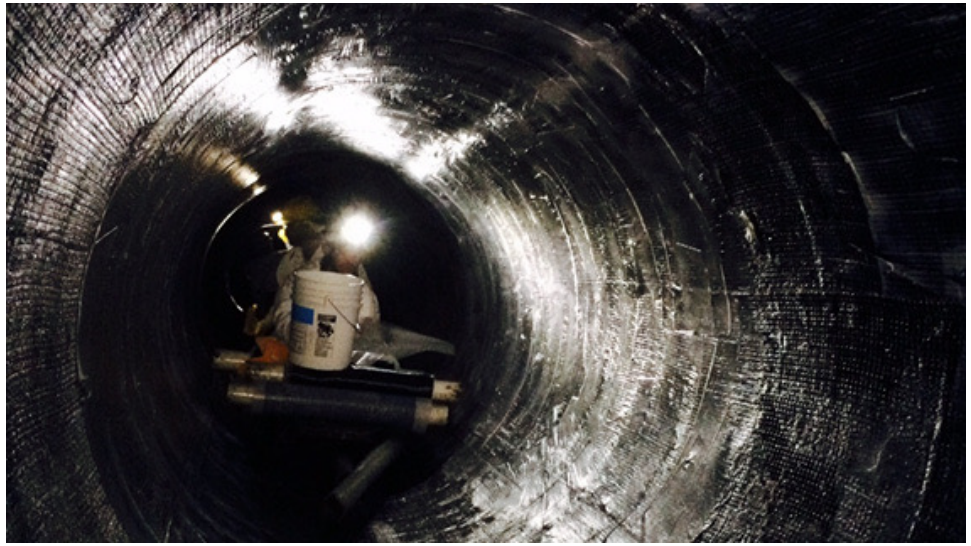
Fiber Reinforced Polymer – Harbour Island, FL

Renewal Technology Selection

- Fully Structural (Class IV)
- Shortened construction schedule
- Minimal cure time with immediate return to service
- Single point of access/small jobsite footprint
- No loss in pipeline capacity

TYFO® FIBRWRAP® FRP LINING

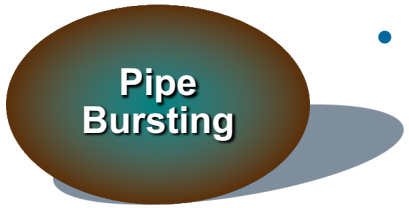




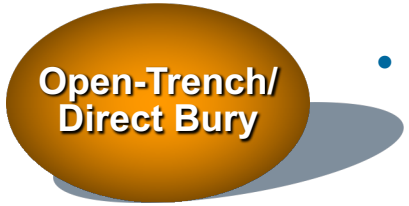
Fusible PVC Pipe Applications

- **55% of UGSI Fusible PVC® pipe installed by directional drilling techniques**
  - Pulls of over 7,000 ft accomplished with 30” pipe

- **25% of UGSI Fusible PVC® pipe installed in slip lining applications**
  - Pull of over 7,000 ft accomplished with 14” pipe



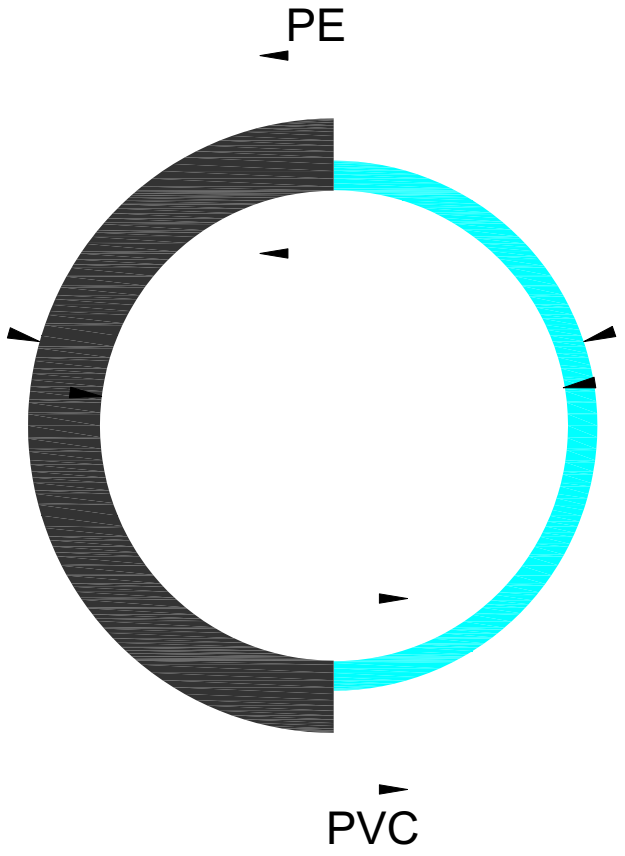
- **5% of UGSI Fusible PVC® pipe installed in pipe bursting applications**
  - Pulls of over 2,000 ft accomplished with 8” and 10” pipe



- **15% of UGSI Fusible PVC® pipe installed in direct-bury applications**

HDD w/ Fusible PVC®: Overview

10” DR7.3 HDPE (IPS)
Press Cap = 255psi
Weight/ft. = 18.66 lb./ft.



8” DR14 PVC (DIPS)
Press Cap = 305 psi
Weight/ft. = 11.03 lb./ft.

69% more lbs./ft
- Same hydraulic capacity

**PVC is stronger and requires less wall thickness!

Loose-Fit Fusible PVC® Sliplining Case Study: East St. Louis, IL

- Illinois American Water
- Host Pipe – 24” PCCP Water Main
- 20” DR 18 Fusible C905® Pipe ~ 3,420 LF Sliplined through existing water main

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Fusible PVC® Pipe Bursting Case Study: Moorhead, MN

- Moorhead Public Service (MPS) hires bursting contractors and self performs the excavations and connections
- They work closely with the City of Moorhead to pipe burst in advance of mill & overlay projects to minimize pavement patching costs

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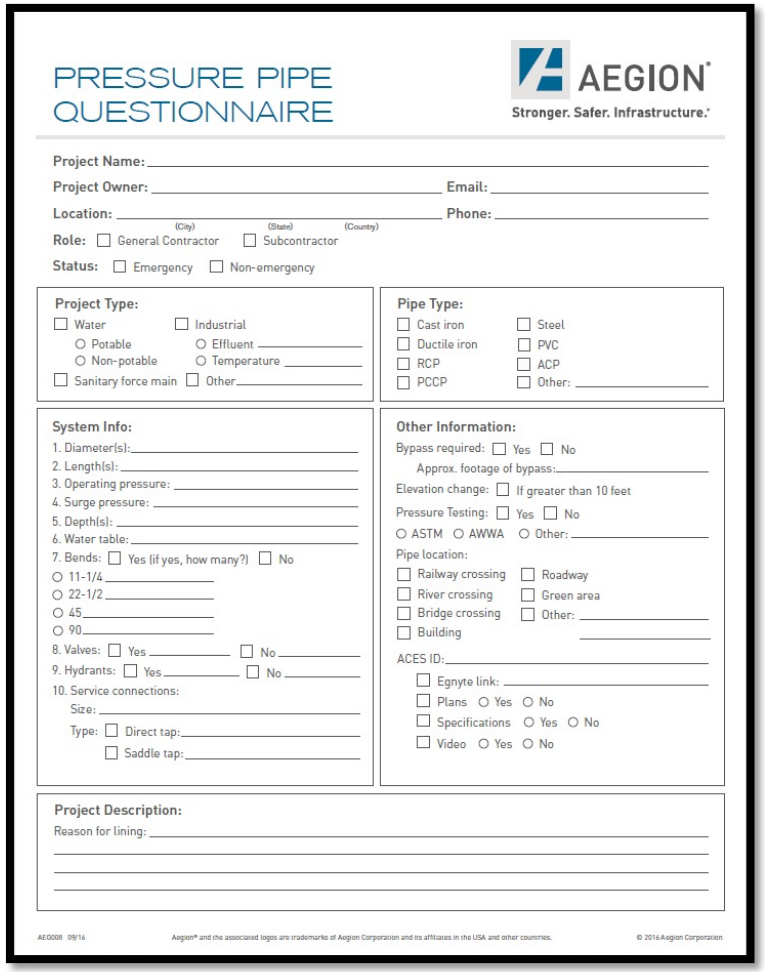
We Have to Ask the Proper Questions

- What type of problems is the pipeline system experiencing?
  - Structural or non-structural?
- How much longer do I need this asset?
  - Product/Process type as well as designs can be modified accordingly
- Do I need additional capacity in this pipeline?
  - Future commercial or residential expansion
  - Originally under designed
- Can I accept less capacity in this pipeline?
- Are there multiple services and/or bends present in the pipeline?
- Can pipeline access be created easily and cost effectively?



PRESSURE PIPE QUESTIONNAIRE

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Project Name: _____

Project Owner: _____ Email: _____

Location: _____ (City) (State) (Country) Phone: _____

Role: ☐ General Contractor ☐ Subcontractor

Status: ☐ Emergency ☐ Non-emergency

Project Type:
☐ Water ☐ Industrial
○ Potable ○ Effluent _____
○ Non-potable ○ Temperature _____
☐ Sanitary force main ☐ Other _____

Pipe Type:
☐ Cast iron ☐ Steel
☐ Ductile iron ☐ PVC
☐ RCP ☐ ACP
☐ PCCP ☐ Other: _____

System Info:
1. Diameter(s): _____
2. Length(s): _____
3. Operating pressure: _____
4. Surge pressure: _____
5. Depth(s): _____
6. Water table: _____
7. Bends: ☐ Yes (if yes, how many?) ☐ No
○ 11-1/4 _____
○ 22-1/2 _____
○ 45 _____
○ 90 _____
8. Valves: ☐ Yes _____ ☐ No _____
9. Hydrants: ☐ Yes _____ ☐ No _____
10. Service connections:
Size: _____
Type: ☐ Direct tap: _____
☐ Saddle tap: _____

Other Information:
Bypass required: ☐ Yes ☐ No
Approx. footage of bypass: _____
Elevation change: ☐ If greater than 10 feet
Pressure Testing: ☐ Yes ☐ No
○ ASTM ○ AWWA ○ Other: _____
Pipe location:
☐ Railway crossing ☐ Roadway
☐ River crossing ☐ Green area
☐ Bridge crossing ☐ Other: _____
☐ Building _____
ACES ID: _____
☐ Egnyte link: _____
☐ Plans ○ Yes ○ No
☐ Specifications ○ Yes ○ No
☐ Video ○ Yes ○ No

Project Description:
Reason for lining: _____

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Thank you for your time! Any questions?

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Find me on LinkedIn!

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