High-Profile Pressure Pipe Rehab (CIPPP) in Virginia

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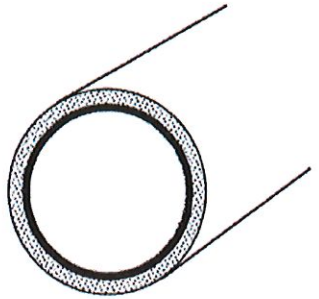
WHAT TO EXPECT

- **Pressure Liner Classifications**
  - AWWA
- **CIPP Pressure Liners**
  - Tube Construction
  - Gravity vs. Internal Pressure
  - QA/QC
- **Difficult Run Force Main Rehabilitation**
  - Project Overview
  - Access Challenges

PRESSURE LINER CLASSIFICATIONS

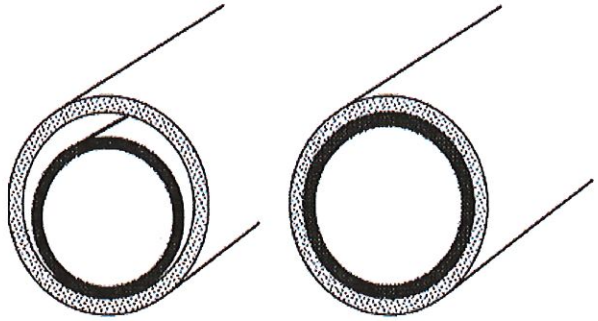
Two Categories of Pressure Pipe Liners:

- **Interactive**
  Liner relies on radial support from host pipe to handle internal loads without failing



INTERACTIVE

- **Independent**
  Liner is designed for all applicable loads independent of the host pipe



INDEPENDENT

Loose-fitting and close-fitting

AWWA LINER CLASSIFICATIONS

Industry Classification	Non-Structural	Semi-Structural		Fully Structural
AWWA Classification	Class I	Class II	Class III	Class IV
Trenchless Products	Cement Mortar Lining ——— Epoxy/ PU lining	CIPP ——— Modified Epoxy Lining	CIPP ——— Modified Sliplining	CIPP ——— Sliplining ——— Modified Sliplining ——— Polyester-Reinforced Polyethylene

CLASS IV LINER

Structurally independent of host pipe for internal loading

- **Addresses:**
  - **Host pipe failure**
  - **Corrosion**
  - **Pin holes**
  - **Gaps**
  - **Joint leaks**

- **Design life of 50+ years**

PRESSURE PIPELINE CONCERNS

Interior Corrosion and Sedimentation Buildup

- Poor water quality
- Decreased flow capacity

QUALITY/PERFORMANCE ISSUES

Structural Integrity

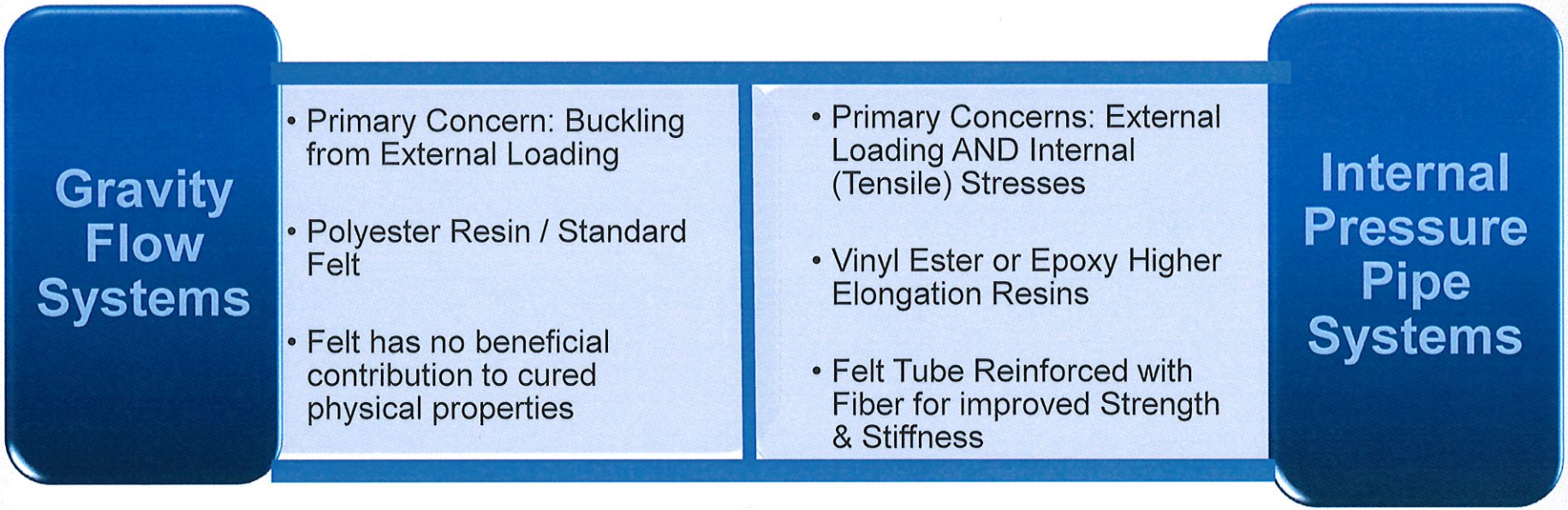
- Leakage
- Pinholes, pitting, thinning walls, etc.
- Severe deterioration

LIFESPAN ISSUES

CIPP LINERS – GRAVITY vs. PRESSURE

CIPP Liners are Comprised of:

1. **Thermoset Resin**
2. **Tubes**



Emphasis on Resin **Emphasis on Resin AND Tube**

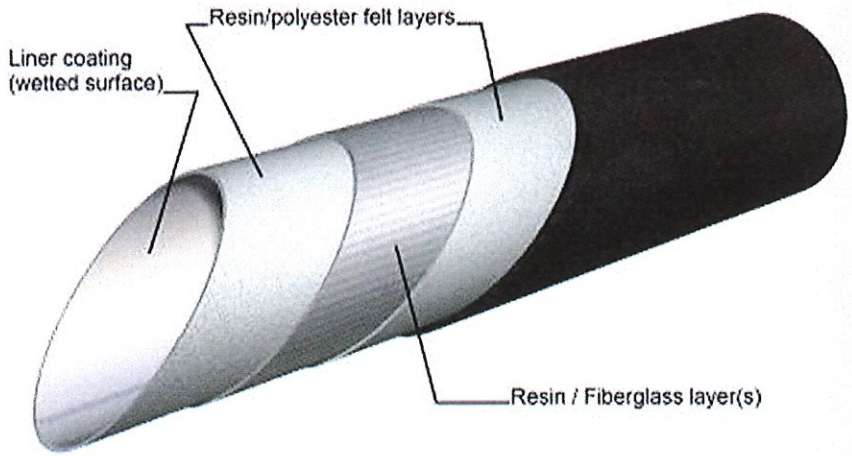
REINFORCED TUBE

InsituMain® Reinforced Tube:

Greater resistance to hydrostatic loading and internal pressures (including surge)

Custom Engineered:

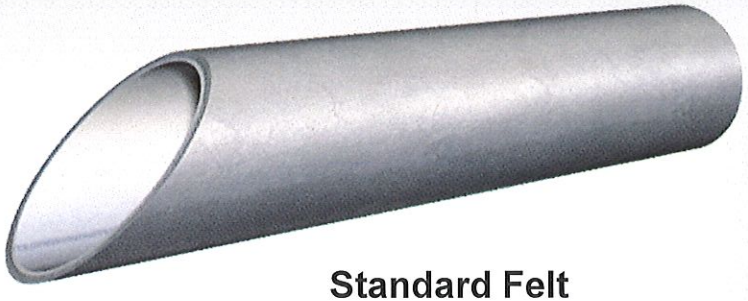
- **Felt and fiberglass layers are project specific**



InsituMain® Glass Reinforced Composite Felt Liner

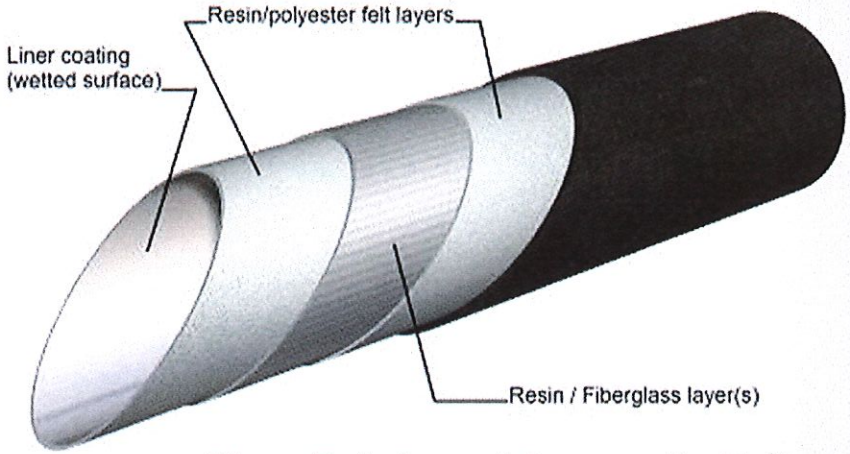
REINFORCED TUBE

In-house and third-party testing have independently concluded that standard felt tube with the use of epoxy or vinyl ester resin is insufficient for higher pressure/increased diameter applications.



Standard Felt
(Gravity Systems)

VS.



Glass Reinforced Composite Felt
(Pressure Systems)

The use of standard felt tube in pressure pipe applications above 10 psi is an outdated practice

CIPP PRESSURE LINING CONSIDERATIONS

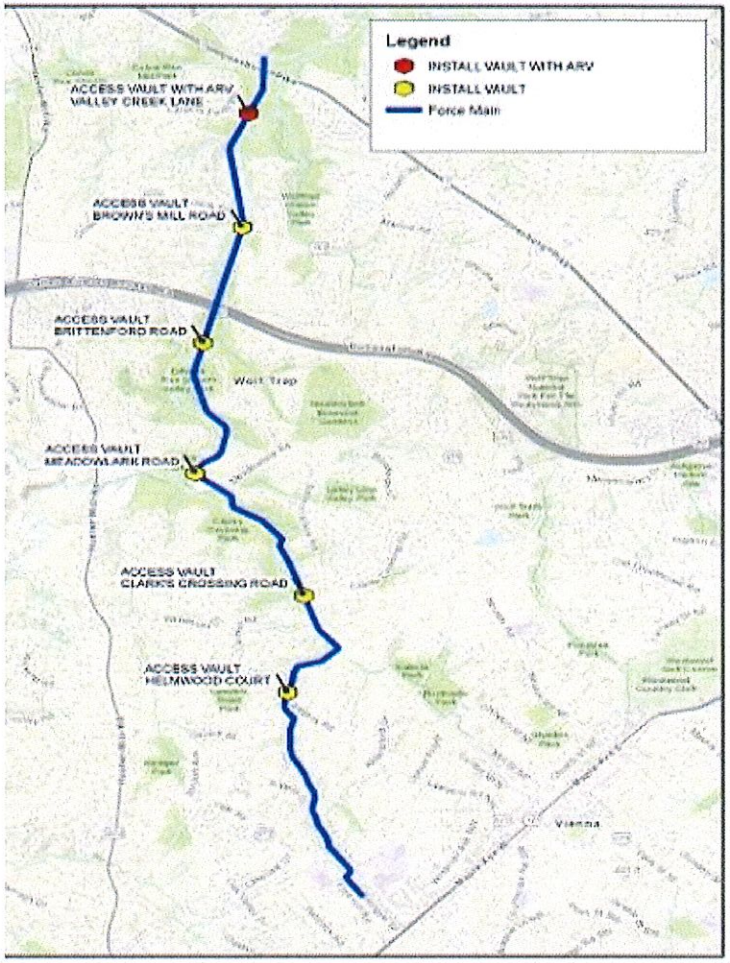
- Technical Envelope
  - 6-inch to 96-inch diameters
  - Operating pressures: Up to 150-psi (diameter dependent)
- Less invasive/smaller footprint than open-cut
- Cost-effective
- Efficient

FAIRFAX, VA OVERVIEW

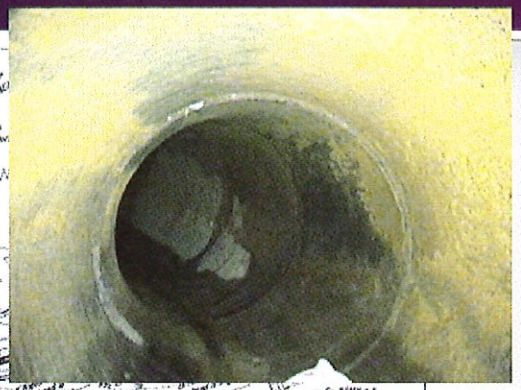
- Washington, D.C. Metro Area
- 1.1M Residents in County of Fairfax
- Highly Affluent Community- 2nd highest median income in USA
- Scenic & Historic
  - 1st Land Engagement Battle of the Civil War
  - National Firearms Museum
  - Mount Vernon
  - Difficult Creek Force Main

DIFFICULT RUN FORCE MAIN

- 4,000 LF of 36-inch ductile iron force main
- Consulting Engineer: Hazen & Sawyer of Fairfax, VA
- General Contractor: Garney Construction
- Location: Fairfax, VA
  - Difficult Run Stream Valley
- CIPP Bid Price $2,306,600
- Operating pressure: 50 psi/Test 100 psi
- CIPPP tube thickness: 15mm
- Resin: extended pot life epoxy
- Class IV fully-structural solution



Multi-family, school, residential and wooded stream access



Installations had from 6 to 25 feet of grade change and multiple bends: 11-1/4 to 45 degrees. (23 bends in project)

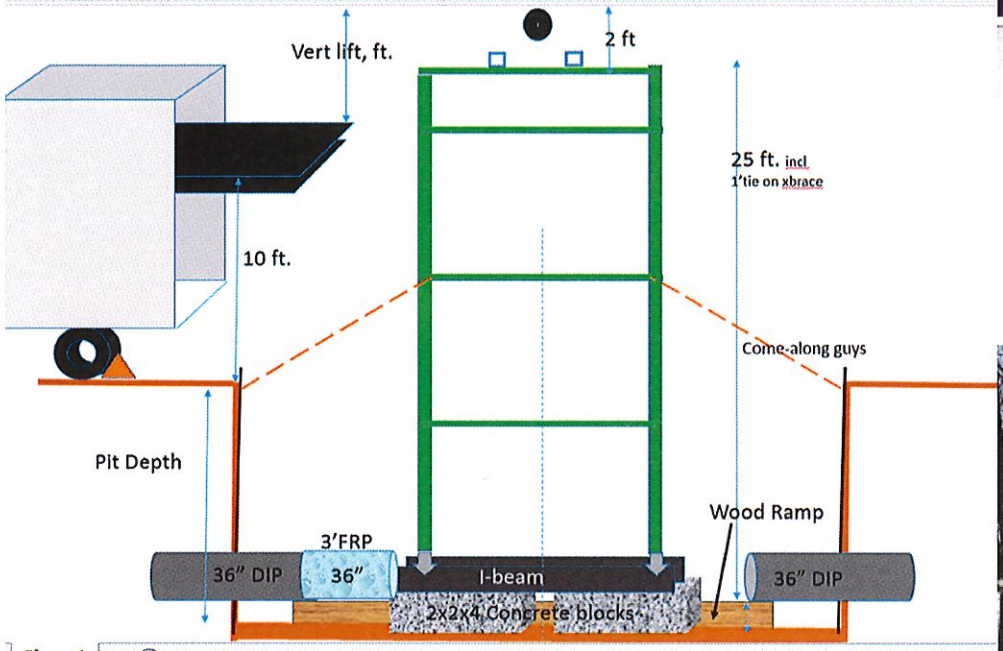
CIPPP in host pipe with bends

- 22-1/2 degree bend
- Circumferential coated felt fins
- Oriented on the inside, downstream radius of the pipe
- Sharp orientation of the fin is only the single, coated layer.

PROCESS OVERVIEW

- PIT CONSTRUCTION
- CLEANING
- CIPP LINING / CURING
- PRESSURE TESTING
- TERMINATION / CLOSURE
- BACKFILL / RESTORATION

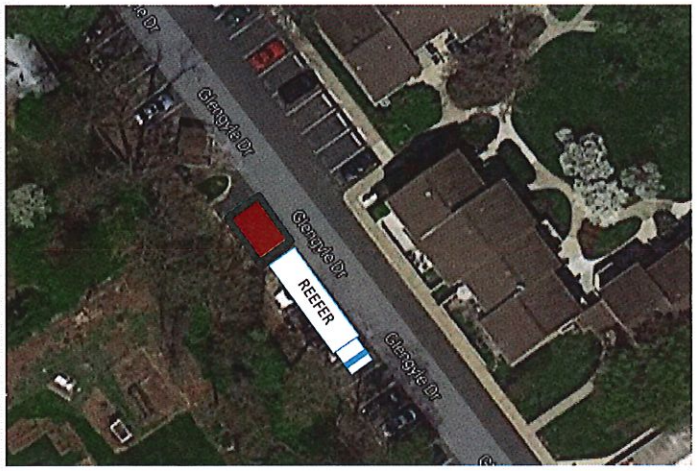
Water Inversion of CIPPP

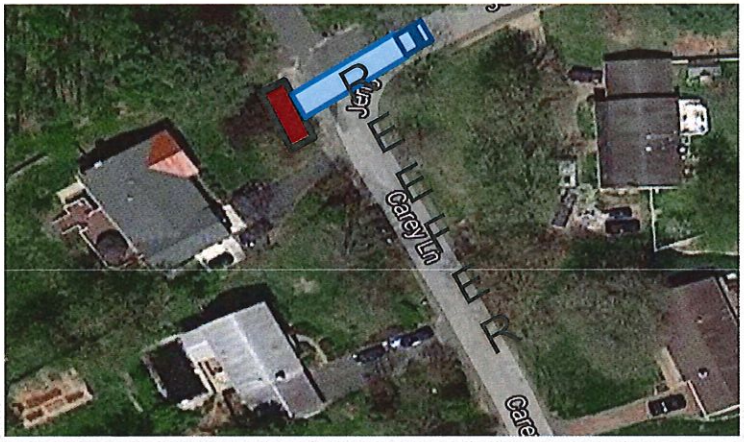


X-Sectional Inversion Pit Schematic

Creek Side Inversion

Pit Access with Tractor/Trailer Refrigerated Truck





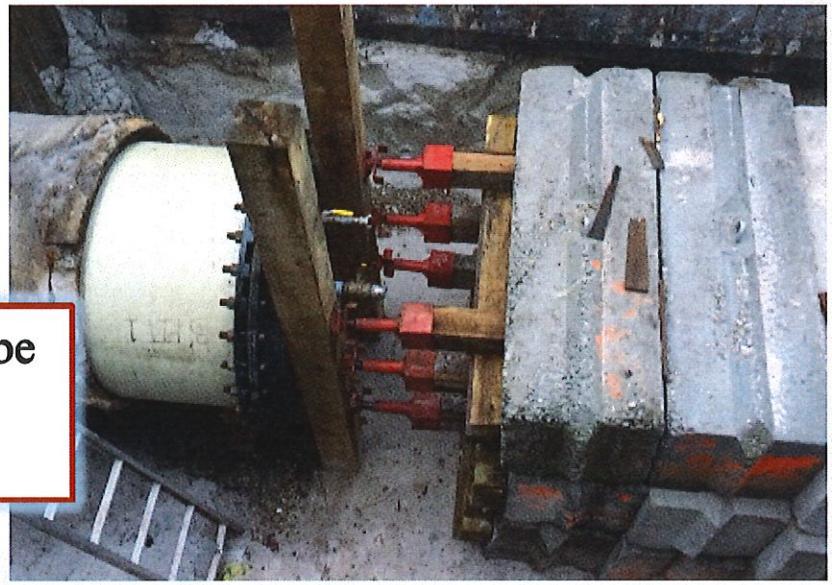
PROJECT CHALLENGES

- Equipment Access
  - Creek access was "Difficult"
- Environmental Considerations due to creek and green areas
- CIPP Curing was influenced by the slopes, metal pipe, cold flowing creek and pipe undulations
- Pressure Testing was performed using ASTM F1216 at 100-psi for one hour
  - 102,000 lbs of thrust to resist

PRESSURE TESTING

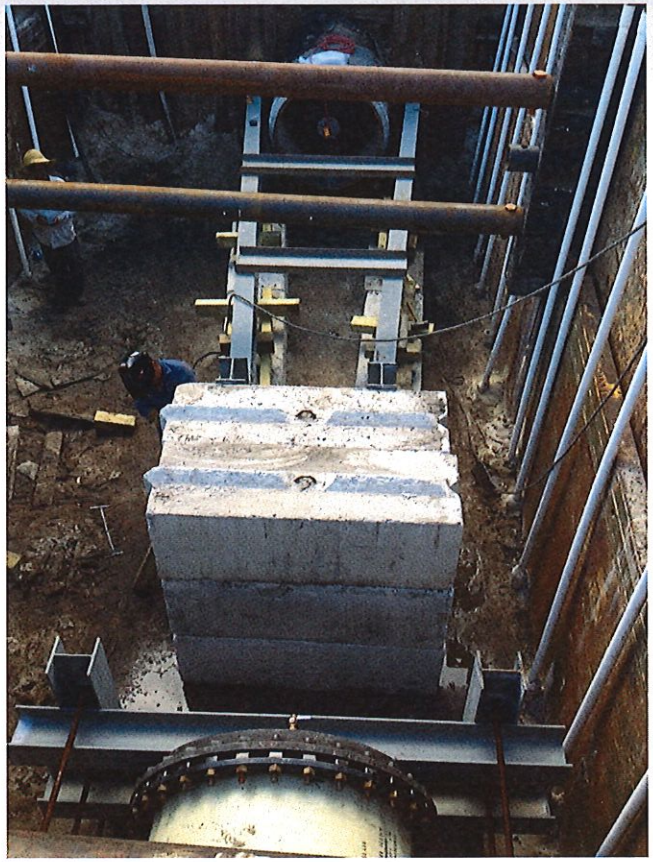
ASTM INTERNATIONAL
Standards Worldwide

ASTM
F1216-09



…recommended pressure and leakage test would be at twice the known working pressure or at the working pressure plus 50 psi, whichever is less.

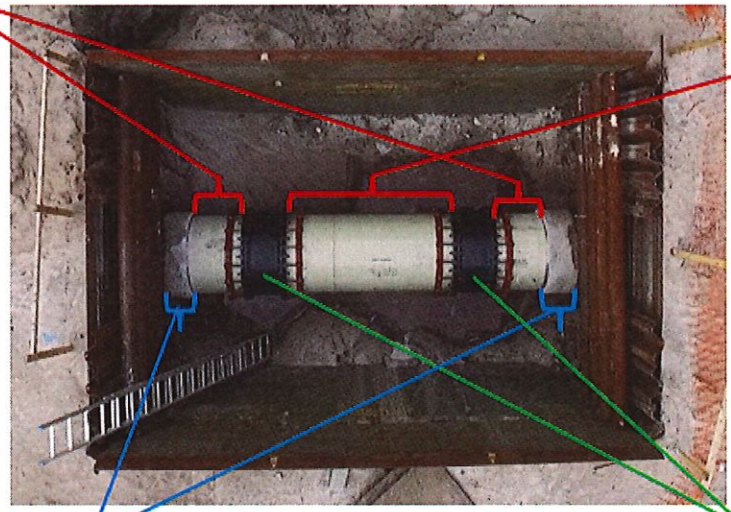
Restraining capped ends during test is a safety consideration



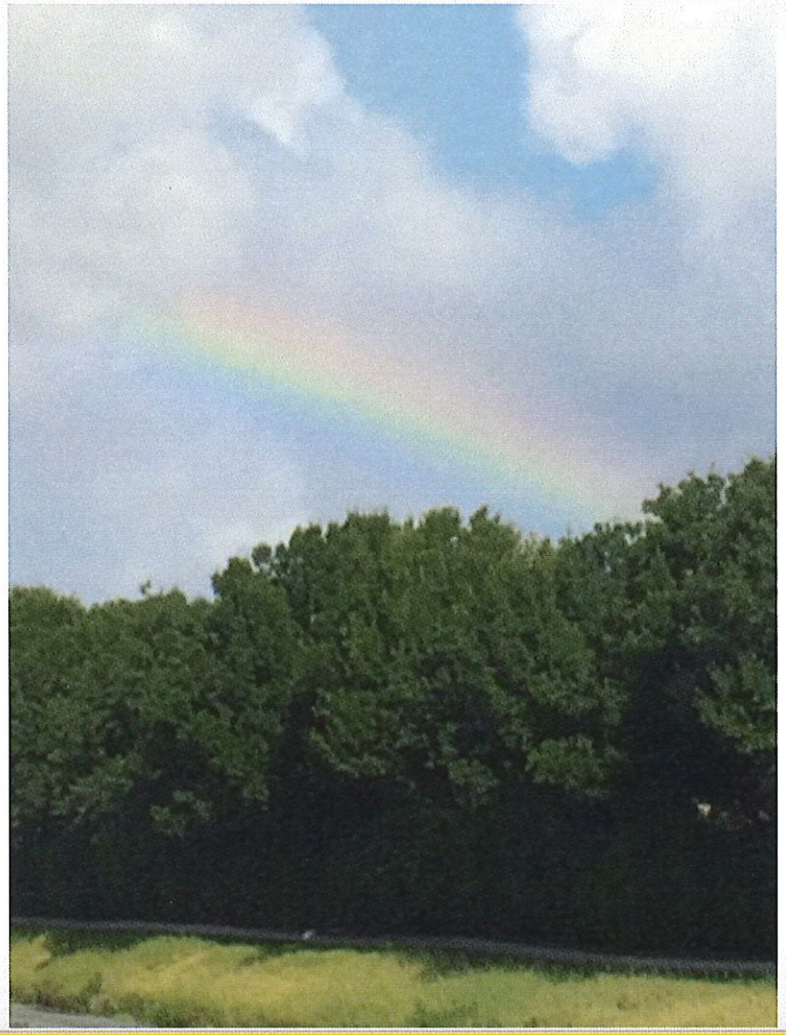
Pit size can create significant problems for pressure testing. Coupled with high thrust forces will create safety and product integrity concerns

CLOSURE DETAILS

- **Precast FRP composite pipe**
  - Interior abraded and primed with bonding agent
  - CIPP inserted through FRP and cured to obtain a watertight bond
- **Eliminates need to connect back to the host pipe**
- **Promotes the use of standard mechanical joint fittings**



When the Plan Comes Together



QUESTIONS?

THANK YOU!