DelDOT Lessons Learned Workshop

Pipe Liners: Maintenance Perspective

Presented by:
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Excellence in Transportation

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Every Mode.

We provide safe choices for travelers in Delaware to access roads, rails, buses, airways, waterways, bike trails, and walking paths.

Every Dollar.

We seek the best value for every dollar spent for the benefit of all.

Everyone.

We engage our customers and employees with respect and courtesy as we deliver our services.

AGENDA

- Intro
- Pipe Repair Methods (Maintenance – pipes less than 60”)
  - CIPP
  - Joint repairs
  - Spray Lining
  - Full replacement
- Pipe Repair Methods (Bridge – pipes greater than 60”)
  - CIPP
  - Spray Lining
  - Full Replacement

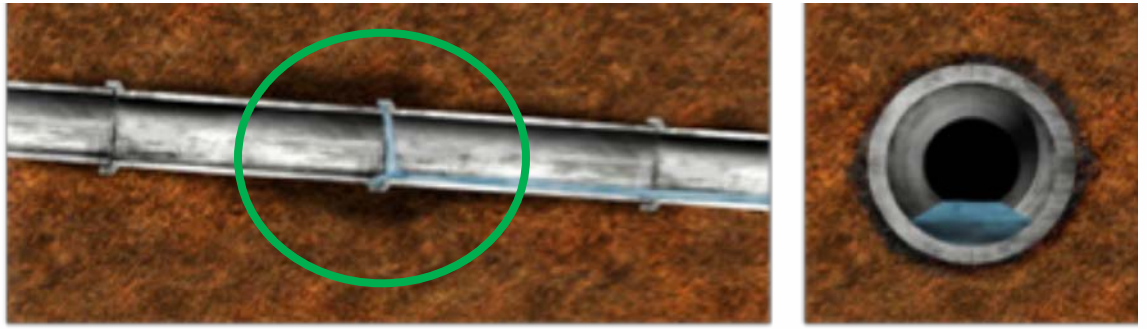
INTRO

Multiple methods of repairing in-service pipes:

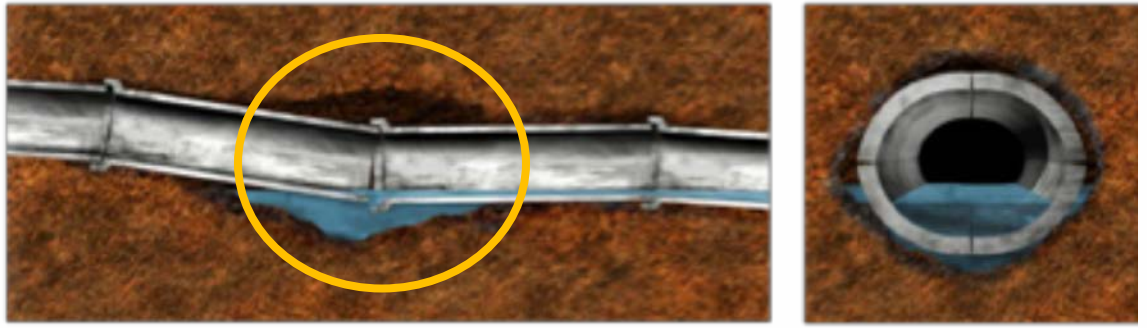
- Cured-in-place Pipe (CIPP)
- Joint repairs
- Spray Lining
- Full replacement

PROCESS OF PIPE FAILURE

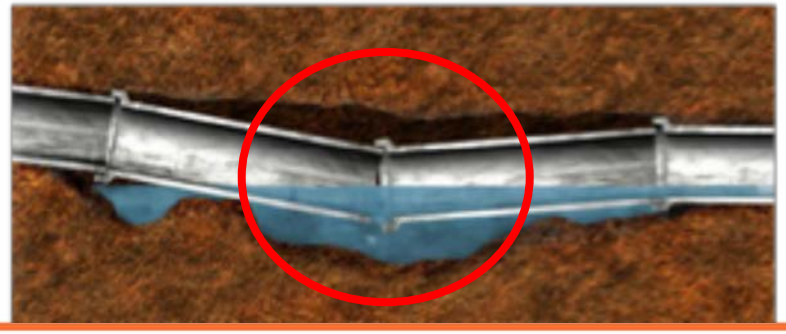
Stage 1: Initial defect, but sewer remains held in position by the surrounding soil.

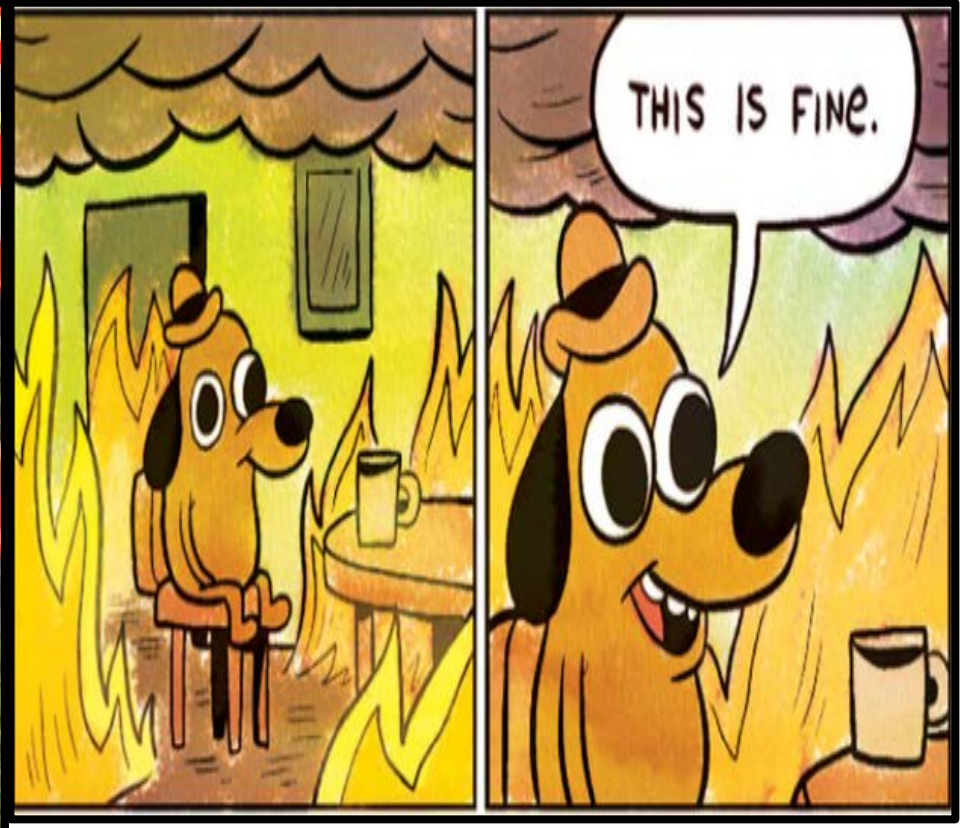


Stage 2: Development of zones of loose ground or voids caused by the loss of ground into the sewer.



Stage 3: Failure of the sewer pipe.





Stage 3 Pipe Failure

METHODS OF INTERNAL PIPE REPAIR

JOINT REPAIR

- Injection/hand grouting
- Ideal for joint separations/leaky joints/isolated areas
- Not effective for offset joints
- Short term

POINT REPAIR

- Cured-In-Place spot repair
- Ideal for larger joint separations or offset joints
- Not effective for warped or crushed pipe
- Short term

CIPP LINING

- Cured-In-Place Pipe
- Ideal for intact pipe runs with obstructions preventing open cut
- Not Ideal for crushed or warped pipe
- Long term

CEMENTITIOUS LINING

- Structural pipe Lining
- Ideal for large intact pipe runs
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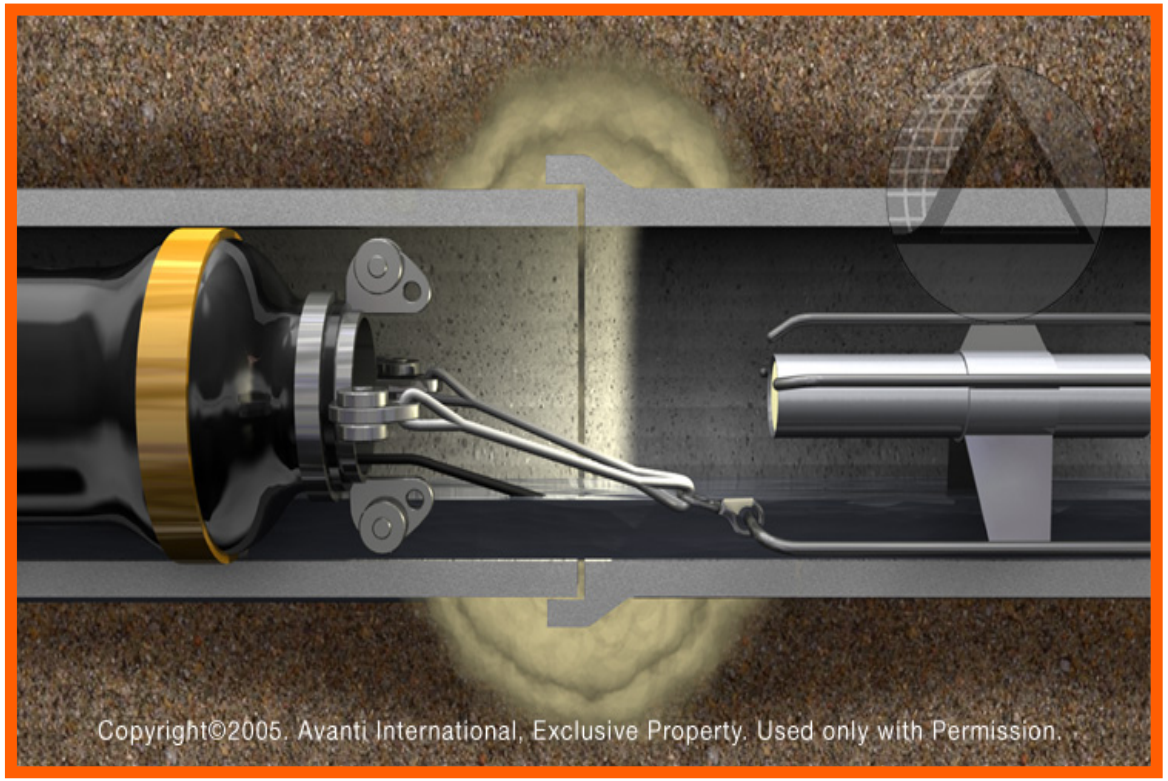
INJECTION/HAND GROUTING

- $400 - $600 per joint
- Avoids invasive excavation
- Effective for spot repairs
- Not Effective on pipes that are distorted or have section loss



JOINT REPAIR

SECTION VIEW

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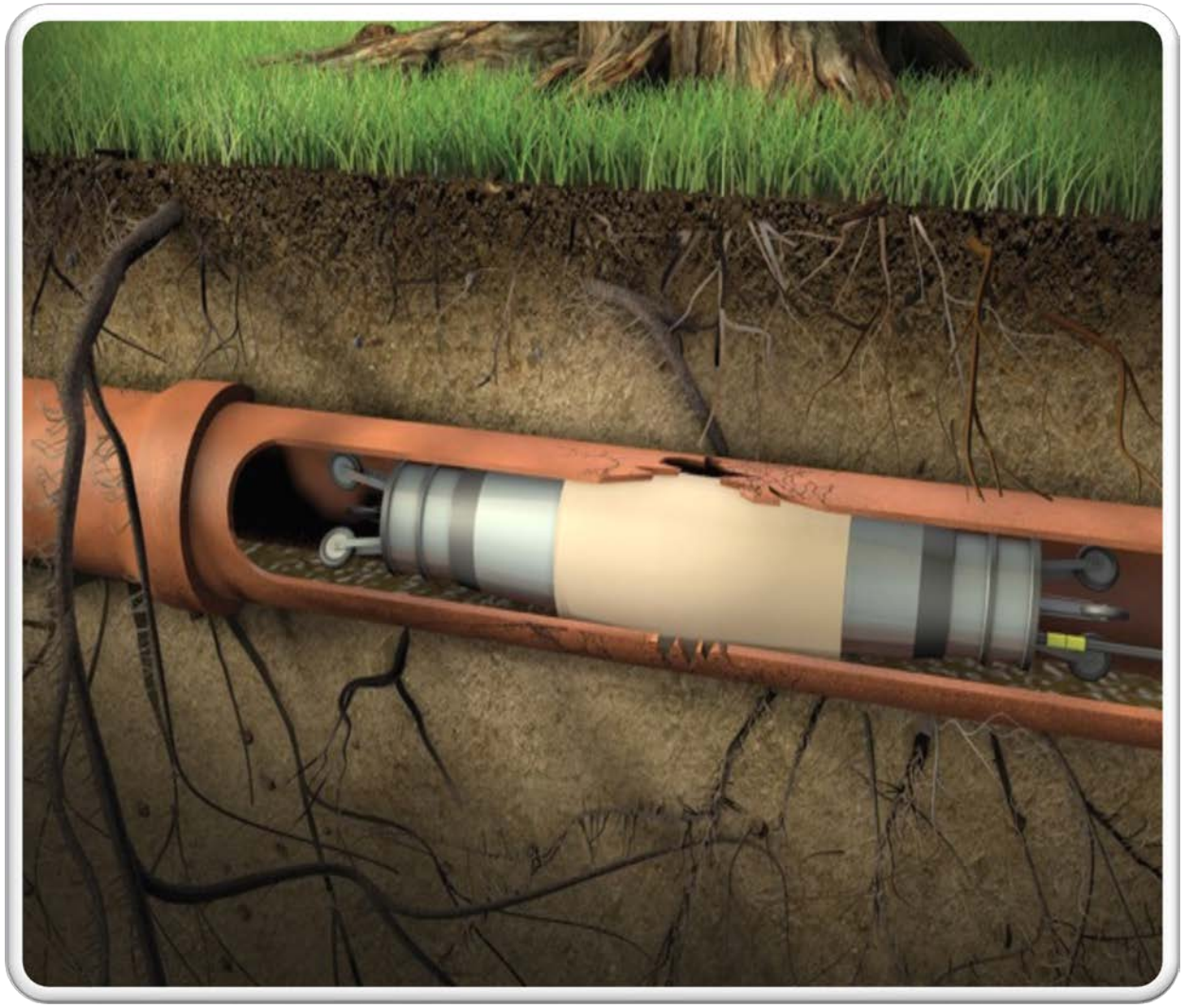

POINT REPAIR

- $650 - $725 PER LF (3FT MINIMUM)
- Effective for large pipe separations or minor offset joints
- Moderate cost pipe life extender
- Effective as a spot repair
- Not effective if pipe is distorted or has significant section loss

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CIPP LINING

- $150-$250 PER LF
- IDEAL FOR SMALLER DIAMETER PIPE
- MORE EFFECTIVE - MAINTAIN HYDRAULIC CAPACITY
- SIMILAR SERVICE LIFE TO NEW PIPE

RELINING PROCESS

1. Inspect
2. Clean
3. Wet out
    a) Onsite
    b) Offsite facility
4. Install
    a) Water or Air inversion
    b) Drag / Pull in
5. Cure
    a) Steam
    b) Hot Water
6. Reinstate open connections

RELINE PROCESS

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CEMENTITIOUS LINING (MAINTENANCE)

- $350 - $550 per LF
  Depending on Size, Length, and type of material
- Can be cost effective for large diameter pipes
- Additional oversight required due to material sensitivity (ie. temperature, mixing, placement)

CEMENTITIOUS LINING PROCESS

1. Clean and Inspect
2. Repair invert
3. Install gauge screws
4. Install material

PIPE REPAIR METHODS (BRIDGES)

CIPP

- Pipe arches require custom size CIPP
- May not be cost effective for bridge size pipes
- No closure of roadway or impact to public

Full Replacement

- Full closure required
- Highest cost
- Biggest impact to public
- Increases hydraulic opening

SAPL

- Can be used on any sized pipe
- No closure of roadway or impact to public
- Cost effective
- Decreases hydraulic opening

PIPE LINER BUNDLE

Contract T201907401

- Pipe Rehabilitation of Bridges 1-242, 1-362 and 1-406
  - Consultant: Pennoni
  - Contractor: JJID
  - Subcontractor: EnTech
  - Material: Geotree - GeoSpray

  - Construction began **January 2022**
  - Completed **February 2022**

BR 1-406 BRICK MILL ROAD

- BR 1-406 on Brick Mill Road, Middletown, DE
- AADT = 5,257
- (3 CMPs) 14’-3” x 8’-11”
  - 2.8” Liner thickness

<u>Reasons for Liner</u>

- Utility impacts
- Cost Savings
- Minimal traffic impacts
- Full replacement requires lengthy road closure

BR 1-406 BRICK MILL ROAD (BEFORE)

BR 1-406 BRICK MILL ROAD (AFTER)

BR 1-242 RED MILL ROAD

- BR 1-242 on Red Mill Road, Newark, DE
- AADT = 23,311 per day
- (2 CMPs)16’-8” x 9’-11”
  - 3.2” Liner thickness

Reasons for Liner

- High AADT
- Utility impacts
- Cost Savings
- Minimal traffic impacts
- Full replacement requires lengthy road closure

BR 1-242 RED MILL ROAD (BEFORE)

BR 1-242 RED MILL ROAD (AFTER)

BR 1-362 LIBRARY AVE

- BR 1-362 on Library Ave in Newark DE
- AADT = 31,243
- 122.5” x 84.5” CMP
  - 2.4” Liner thickness

<u>Reasons for Liner</u>

- Utility impacts
- Cost Savings
- Pedestrian traffic
- High AADT
- Minimal traffic impacts

Research project with University of Delaware

BR 1-362 LIBRARY AVE (BEFORE)

BR 1-362 LIBRARY AVE (AFTER)

LESSONS LEARNED

Design
- Calculations must be PE stamped

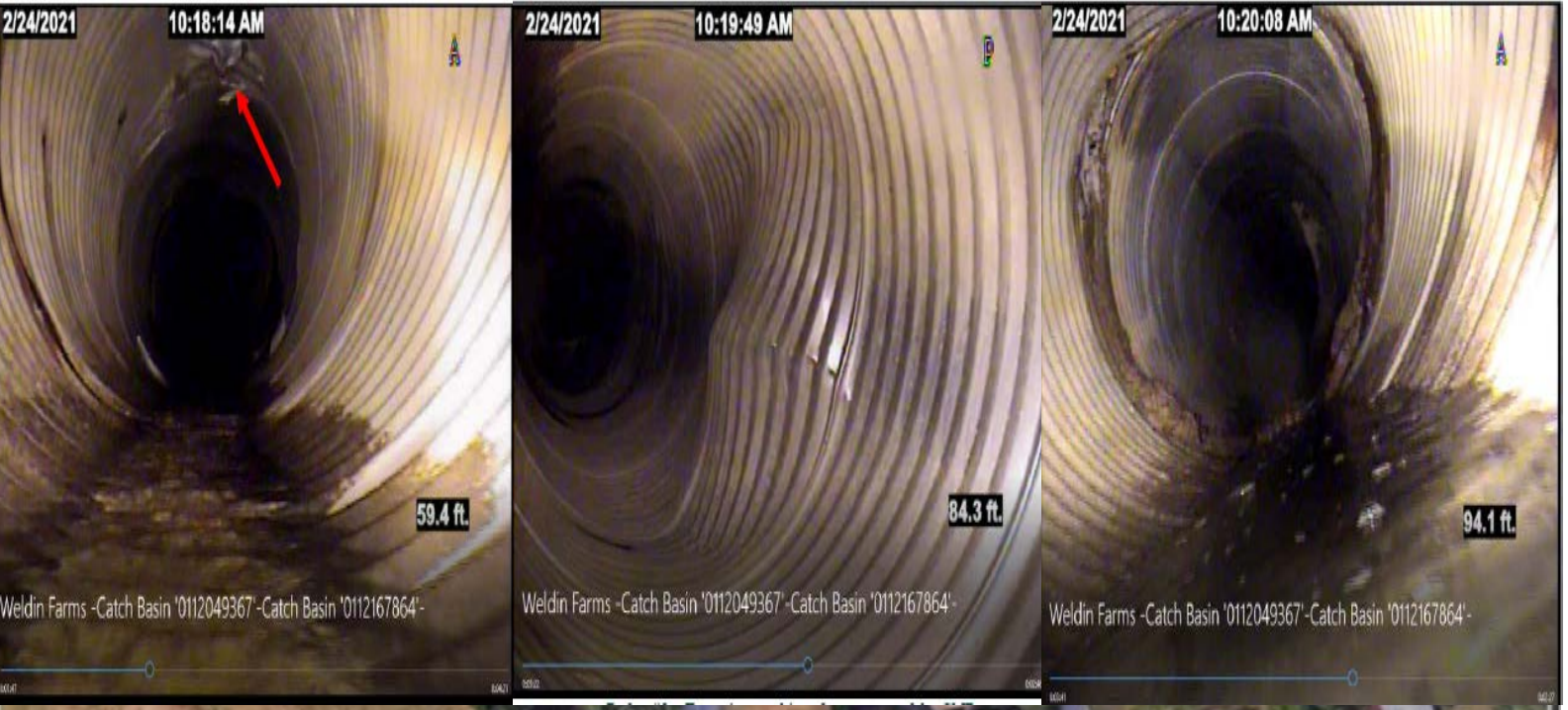
Material Specifications
- Must meet flexural and compressive strength requirements

Work Plan
- Must be approved prior to lining
- Any voids or section loss from host pipe must be addressed
- Pipe must be cleaned and prepared for lining

Quality Control
- Lab testing
- Must meet requirements outlined in specification
- Thickness indicators

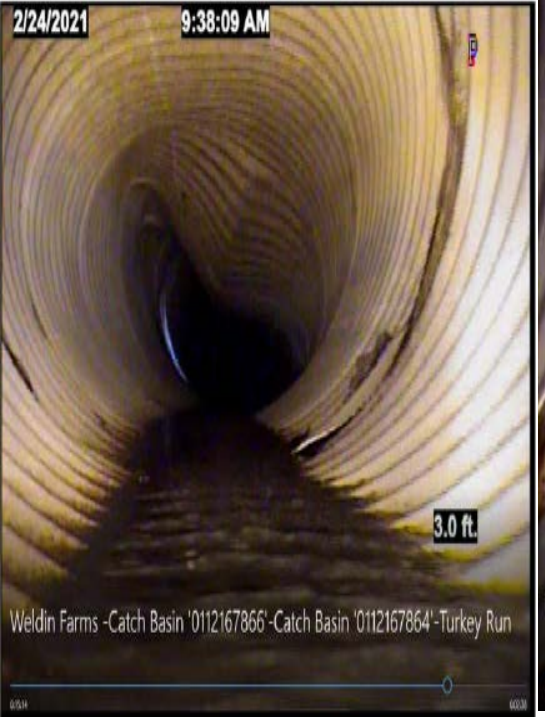
Post Inspection
- Inspect pipe, document any deficiencies
- Thickness spot checks (ie. coring and/or measuring pipe before/after lining)

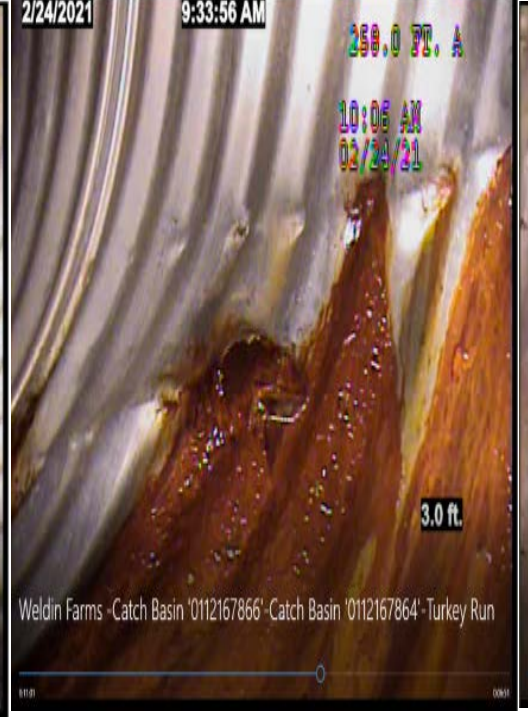
WELDIN FARMS CASE STUDY



PIPE 1

- 36” cmp
- 160 LF
- Moderate flow line corrosion with some areas of severe corrosion
- Several Areas of minor to severe distortion
- Some above ground obstructions that will require complex public outreach
- Construction access issues (20’ Easement)





PIPE 2

- 36” cmp
- 437 LF
- Moderate flow line corrosion with several areas of severe corrosion
- Single Area of severe distortion 40’ from West End
- Numerous above ground obstructions

Which is the best option to repair pipe 1?

A) CIPP (≈$65,000)

B) CEMENTITIOUS (≈$80,000)

C) OPEN-CUT (≈$73,000)

D) COMBINATION OPEN-CUT / LINE (≈$68,000)

Which is the best option to repair pipe 2?

A) CIPP (≈$200,000)

B) CEMENTITIOUS (≈$260,000)

C) OPEN-CUT (≈$150,000)

D) COMBINATION OPEN-CUT / LINE (≈$220,000)

THANK YOU