Closed Circuit TV (CCTV) and Cured in Place Pipe (CIPP) Applications in Pima County

International Boundary and Water Commission

December 12, 2019

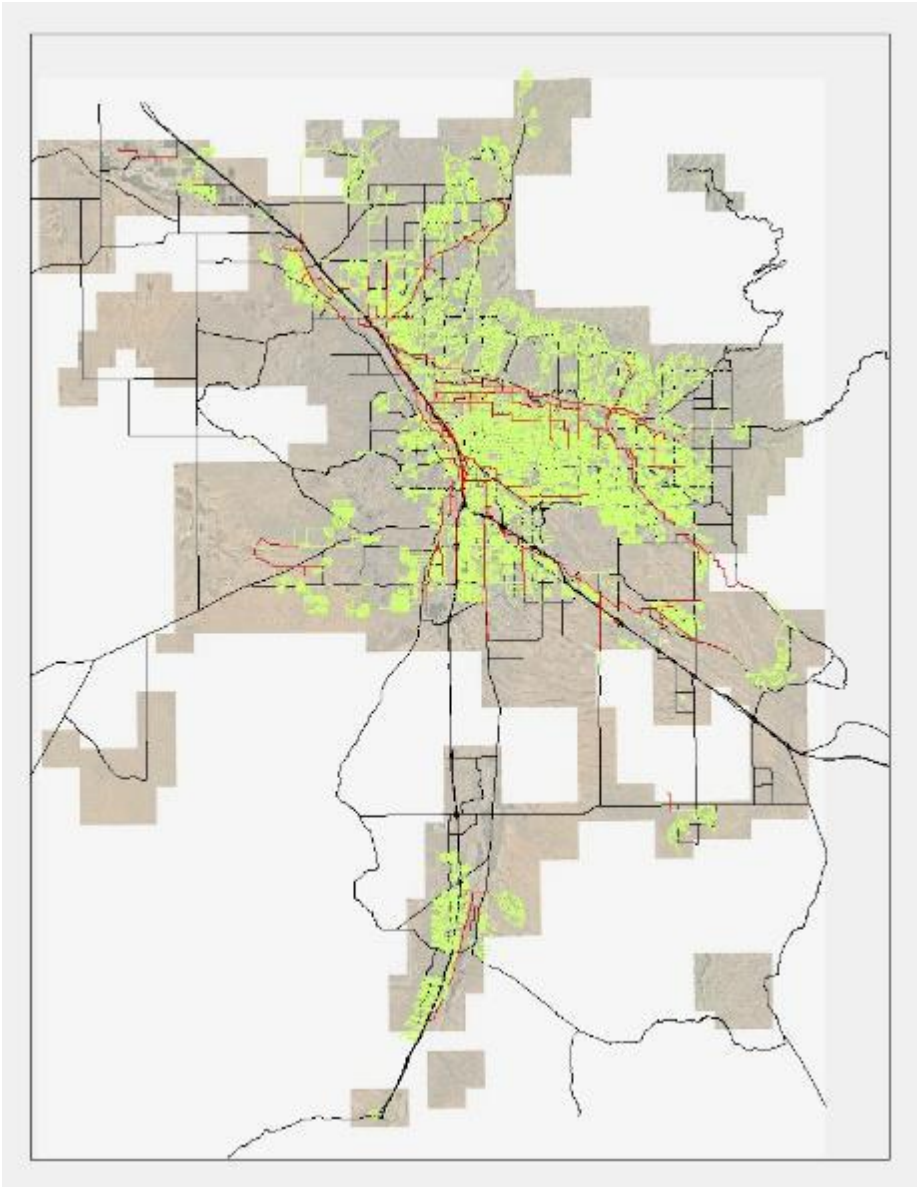
PIMA COUNTY
WASTEWATER RECLAMATION

Pima County Wastewater System

Conveyance System

- Manholes: 66,506
- Cleanouts: 8,302
- Pipe length: 3,503 miles (18,495,840 ft)
- Lift Stations: 23

Conveys close to 60 million gallons of sewage to 8 Water Reclamation Facilities each day



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- September 2002
- 42” RCP
- 28 MGD
- $20M impact
- 78 Days to repair

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- **CMOM** plan implemented in November 2005 under Arizona Administrative Code (AAC) R18-9-C305. The CMOM Program consists of a set of best management practices that have been developed by the industry and are applied over the entire life cycle of the sewage collection system

Capacity:

- monitor and assure current system capacity and capacity for future growth and identify existing capacity problems

Management:

- Up-to-date Asset Management System, organizational structure, staff training, assure the efficient use of funds; ID design, construction and operational deficiencies

Operations & **M**aintenance:

- Adequate resources are available; O&M programs monitoring, optimization and tracking with the goal of preventing overflows

"The Division's Closed Circuit TV (CCTV) Inspection and Condition Assessment Program goal is to inspect the sanitary sewer system using video recording equipment to create the inspection record, every 10 years."

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Closed Circuit TV Program

- Closed Circuit Television (CCTV) inspection are conducted in accordance with international National Association Of Sewer Service Companies (NASSCO) standards

- Our CMOM plan stipulates that all pipes within the conveyance network be cleaned and visually inspected within a 10-year cycle

- Based on the findings of these inspections, defects are prioritized and scheduled for repair

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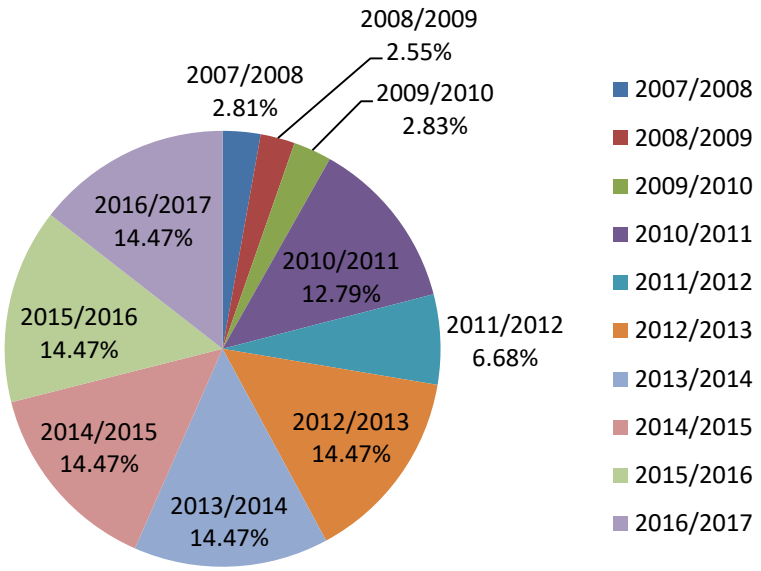
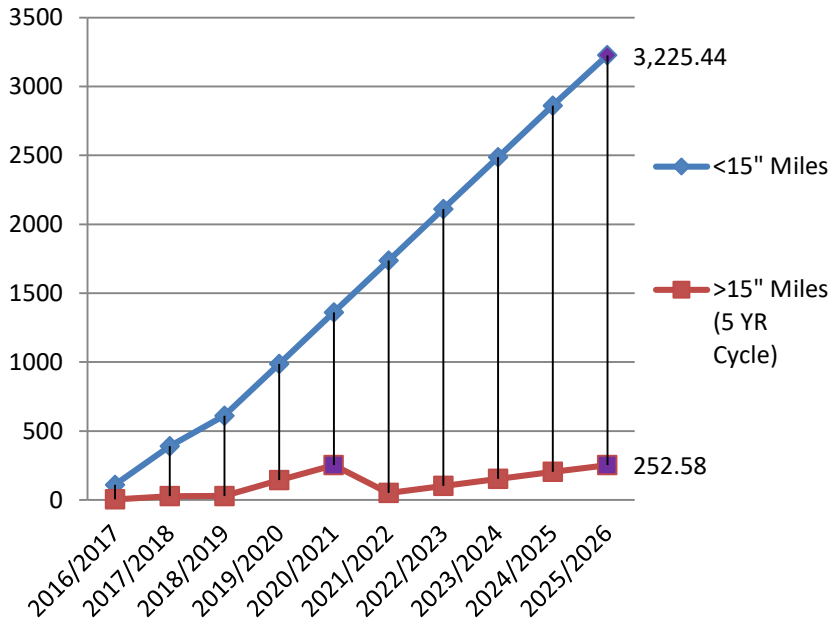
Closed Circuit TV Program

Cycle 1 Program
2007-2016



Cycle 2 Program
2017-2026



- In-house resources not enough, contractor help needed
- Aim for 10%+ every year
- Accelerate interceptor inspection frequency to 5 years

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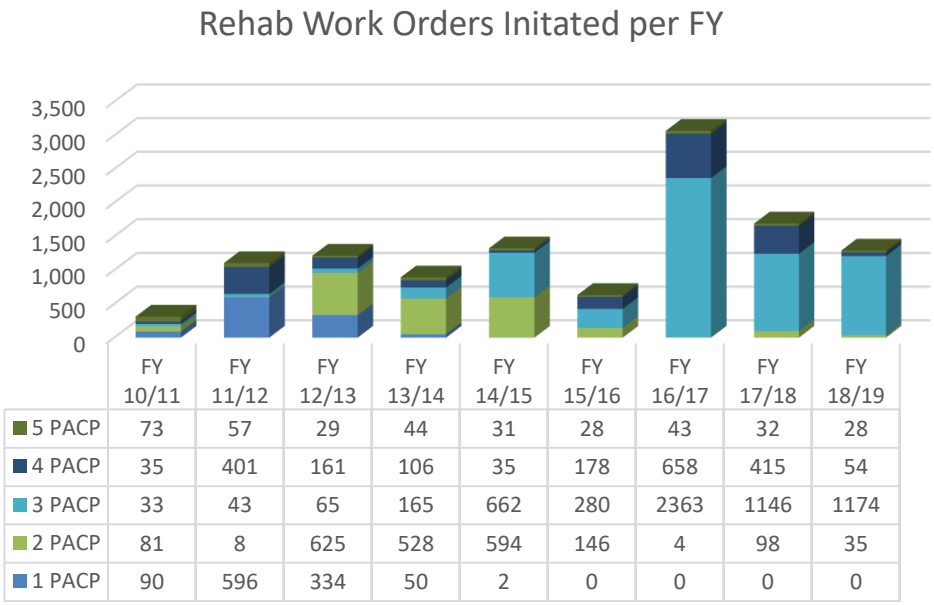
Closed Circuit TV Program

- Results of the first CCTV Cycle
  - 84,749 inspections / condition assessments
  - 68,653 lines cleaned
  - 8,123 repair work orders prioritized and issued
    - Grade 5 scheduled for repair as soon as identified
    - Grade 4 as budget allows
    - Grade 3 monitored
      - repaired if close to a grade 5 or 4



	FY 10/11	FY 11/12	FY 12/13	FY 13/14	FY 14/15	FY 15/16	FY 16/17	FY 17/18	FY 18/19
5 PACP	73	57	29	44	31	28	43	32	28
4 PACP	35	401	161	106	35	178	658	415	54
3 PACP	33	43	65	165	662	280	2363	1146	1174
2 PACP	81	8	625	528	594	146	4	98	35
1 PACP	90	596	334	50	2	0	0	0	0

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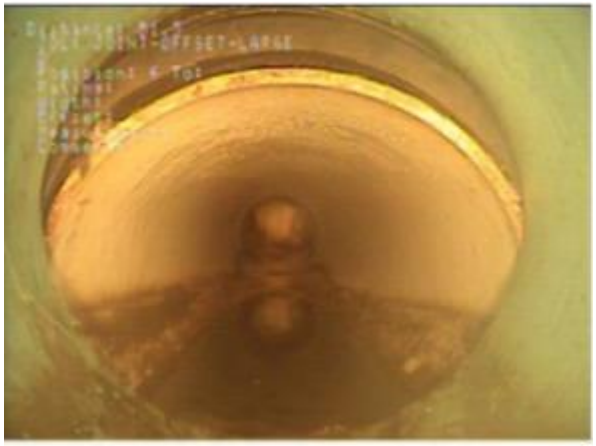
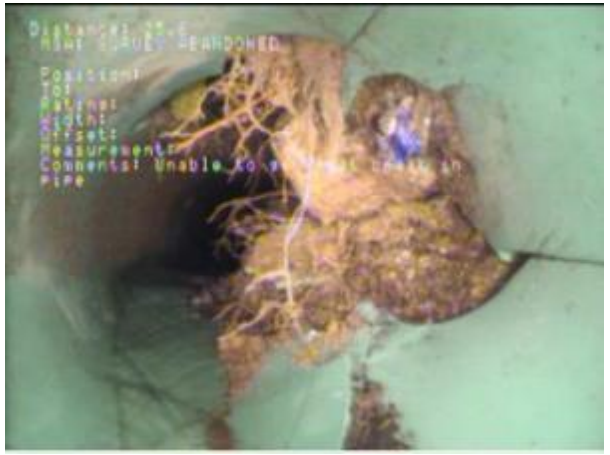
Closed Circuit TV Program Findings

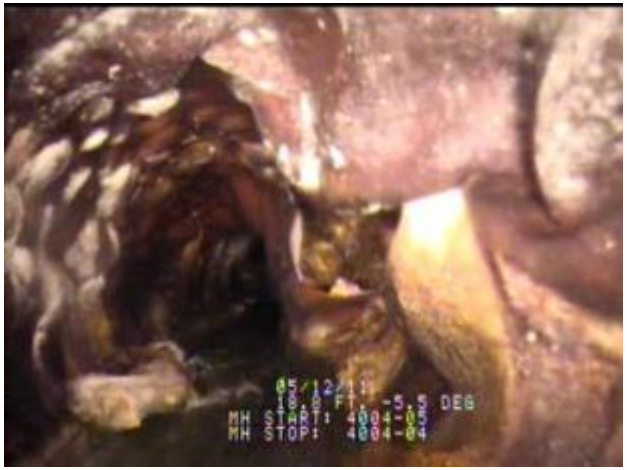
- Offset joint



- Break in pipe with roots



- Failed DIP Coating



- Broken pipe with void

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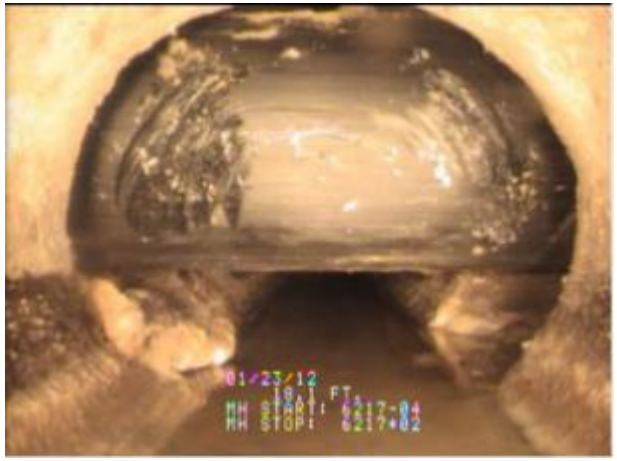
Closed Circuit TV Program Findings

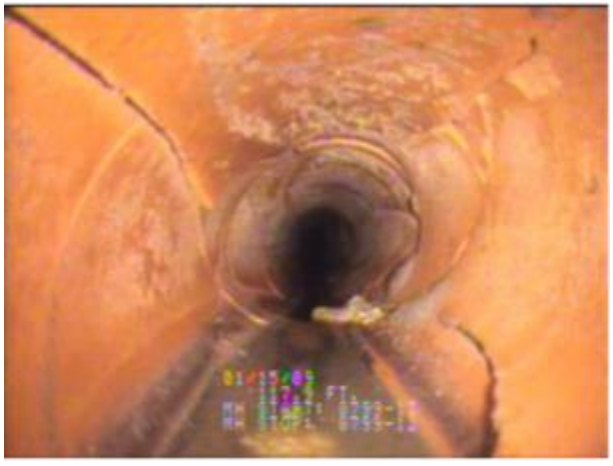
- Utility conflict



- Corroded concrete pipe

- Collapsed pipe

- Fractured pipe



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Repair options – Open Cut Repair

Advantages

- Economical in unpaved surfaces
- Repair of severely damaged pipes
  - Collapsed
  - Offset
  - Utility conflicts

Disadvantages

- Traffic and resident inconvenience
- Permitting requirements
  - ROW
  - Environmental
- Not economical in paved surfaces or where encroachments need to be removed and replaced
- Time consuming

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Repair options – Cured in Place Pipe

Advantages

- Minimum to no excavation required
- Minimum impact to traffic or residents
- Reduce or eliminate pavement replacement cost
- Joint less pipe reduces future root and water infiltration

Disadvantages

- Can be more expensive than open cut in unpaved locations
- Roots and debris must be removed prior to lining
- Not applicable for collapsed, Offset, Utility conflicts

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Repair options – Cured in Place Pipe

- CIPP is a fabric liner, impregnated with a thermosetting resin
  - The first known municipal use of a CIPP lining occurred in 1971 of a 230-ft, 100-year old brick egg-shaped sewer in East London.
  - Since 1971, it is estimated that about 40,000 miles (211 million ft) of CIPP liners have been installed worldwide

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CIPP process – Investigation and Preparation

- Clean, CCTV & data collection
  - Investigate the characteristics of the line
  - Diameters of 4” to 120” are candidates for CIPP
  - Depth of the pipe below the groundwater level

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CIPP process – Liner Design and Manufacture

- Resin alternatives and selection
  - Polyester
    - most commonly found resin. ~80% of CIPP
    - Lower cost, provide adequate levels of chemical resistance
  - Vinyl ester
    - Improved chemical and temperature resistance is necessary
    - Substantially more expensive than the standard polyester resins
  - Epoxy
    - Not as widespread as the other types of resins, higher cost
    - Use limited to pressure pipe and potable water applications
    - Used in lateral or service connections, no styrene odor

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CIPP process – Liner Design and Manufacture

- CIPP tube (or “bag”) material selection
  - Needled polyester felt
    - Resin is the main contributor to the strength of the liner
  - Reinforced tube
    - The reinforcing layers is a significant contributor to strength
      - fiberglass
      - aramid fibers
      - carbon fibers
- Thicknesses vary from around 0.12 in. (3 mm) in small-diameter shallow pipes to over 2 in. (50 mm) in large-diameter deep pipes

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CIPP process – Liner Design and Manufacture

- Liner wet-out process
  - Vacuum is used to allow the resin to flow more easily into the liner fabric
  - Thermally-cured liners are kept in refrigerated storage to avoid premature curing
  - Very large liners can be wet-out at the site.
    - large liner becomes too heavy or too wide to transport when wet-out

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CIPP process – Insertion of liner in host pipe

- Insertion of liner in host pipe
  - invert-in-place
    - inversion-in-place method uses gravity and either water or air pressure to insert the liner
  - winch-in-place
    - uses a winch to pull the tube through the existing pipeline

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CIPP process – Cure liner

- Thermal Curing Process
  - most widely used followed by UV
  - heat via contact with
    - hot water
    - steam
    - hot air
    - exposure to ambient temperatures
  - depending on the liner thickness, thermal curing can take 3 to 7 hours at 180°F

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CIPP process – Cure liner

- UV Curing Process
  - a seamless glass-fiber tube
  - outer film blocks UV light
  - diameters from 6 in. to 48 in
  - can be used in circular, oval, and egg-shaped pipes
- Winched into the existing pipe and inflated with air, then cured using a UV light train
- Curing is accomplish as soon as the resin is exposed to the UV light

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CIPP process – Lateral Reinstatement

- Lateral connections are restored by cutting openings
- Dimpling of the liner can aid in the identification of the position of the connection

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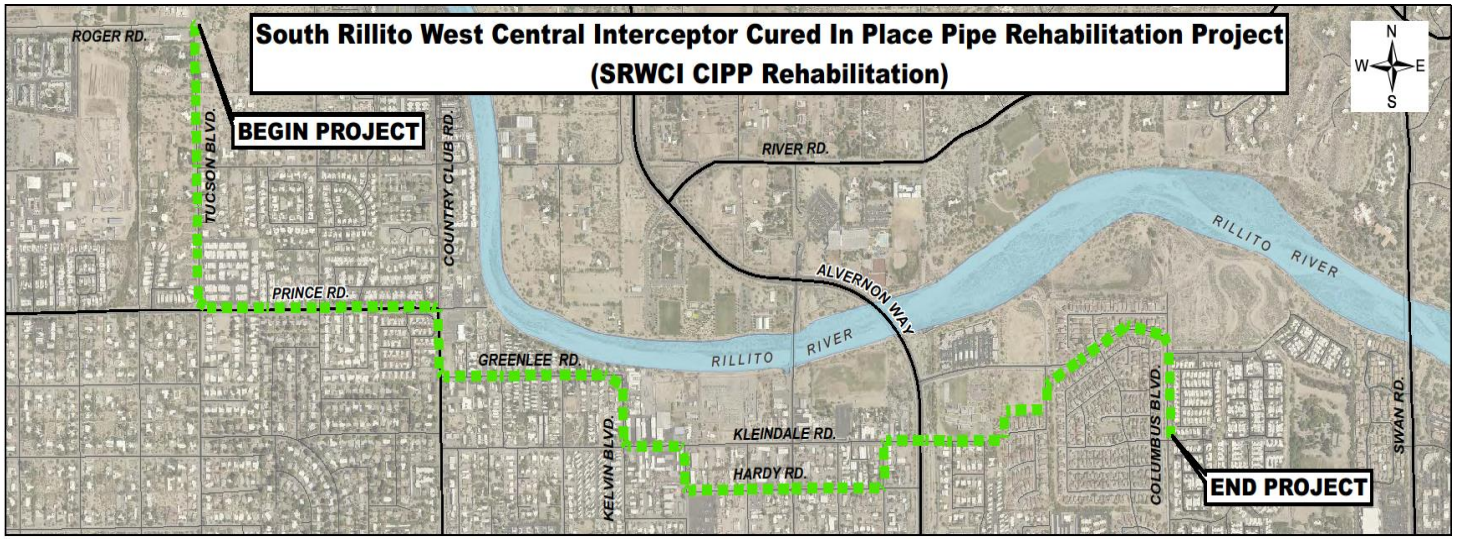
South Rillito Interceptor (SRI) CIPP project

- SRI CIPP Rehabilitation
  - Completed at $12.5M
- 3.8 miles of pipe rate as NAASCO Grade 5
  - 1 mile of 48”
  - 2.8 miles of 54”
  - 52 Rehabilitated Manholes



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South Rillito Interceptor (SRI) CIPP project

SRWC (54” Diameter)

SRWC (48” Diameter)

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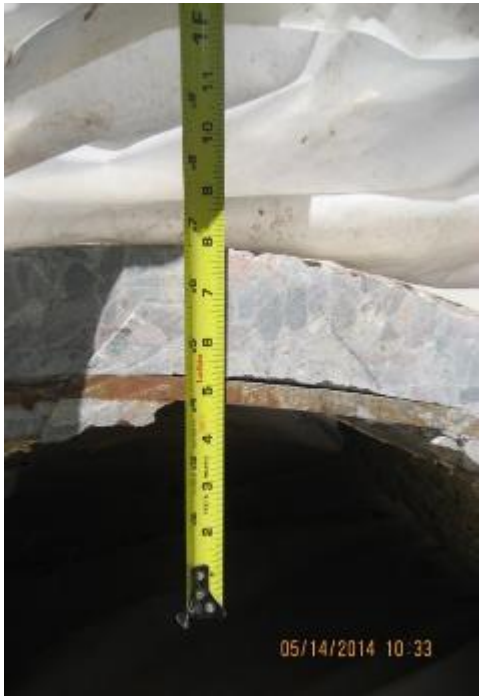
South Rillito Interceptor (SRI) CIPP project

Pipe Conditions



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South Rillito Interceptor (SRI) CIPP project

Flow Management

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South Rillito Interceptor (SRI) CIPP project

Liner insertion

Final product

Questions?