Overcoming Design and Construction Challenges in Deep Underground Infrastructure

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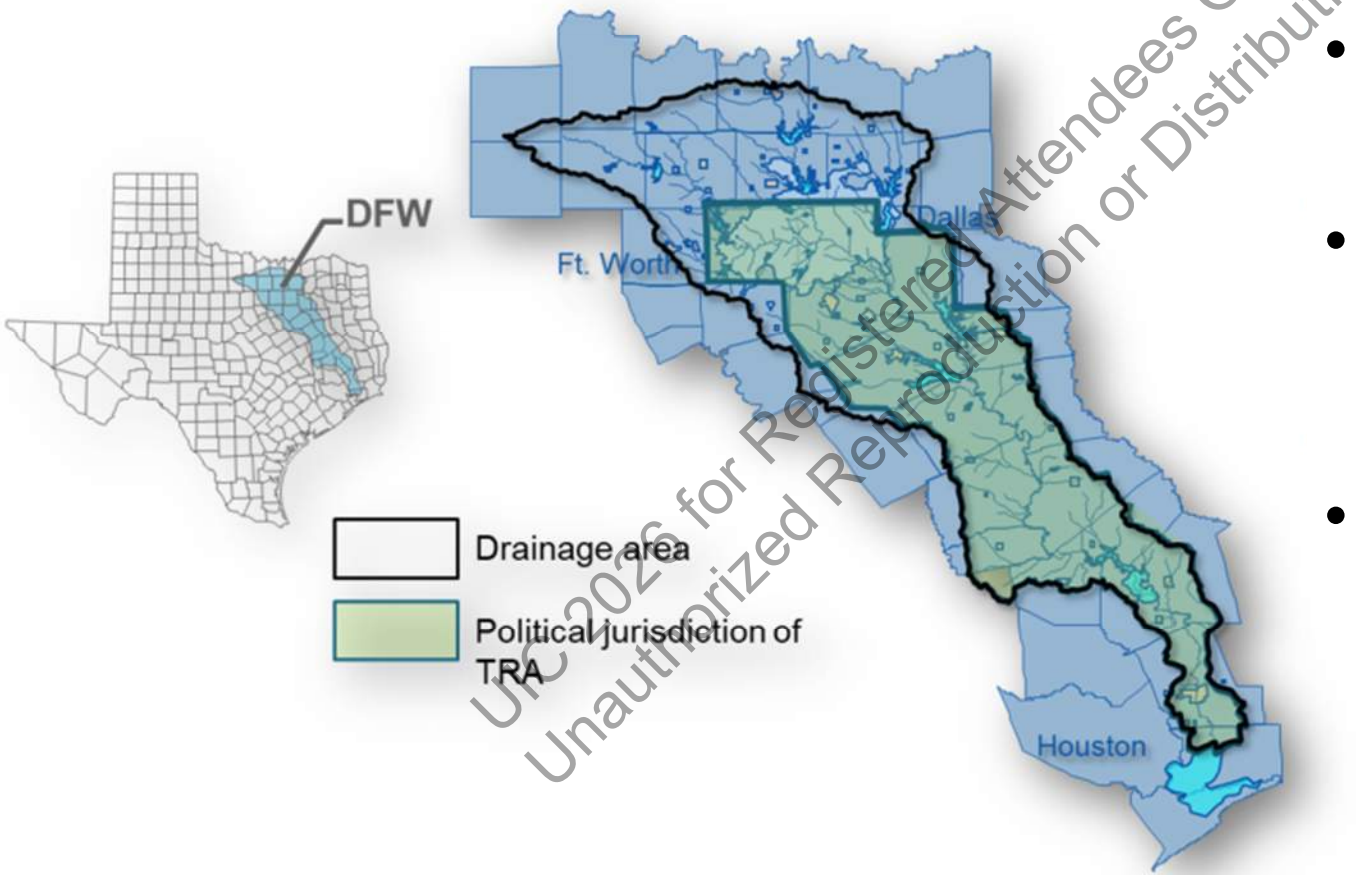
Agenda

- Project Background
- Design and Construction Challenges
- Key Takeaways

Trinity River Authority of Texas

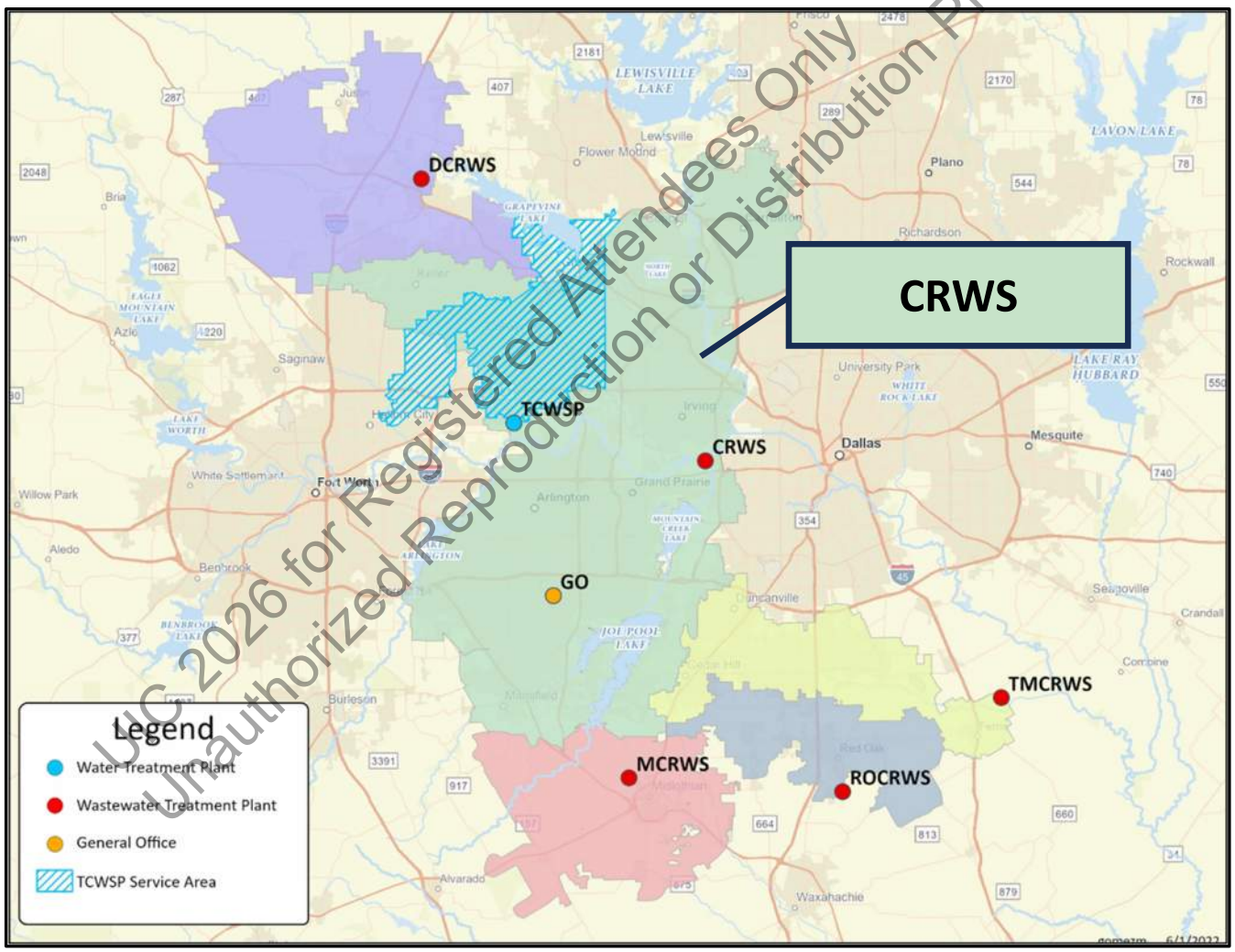


- Created by State of Texas in 1955
- 25 Board members appointed by Texas Governor
- 18,000-square-mile Trinity River basin

TRA Northern Region Operating Systems

Wastewater Systems

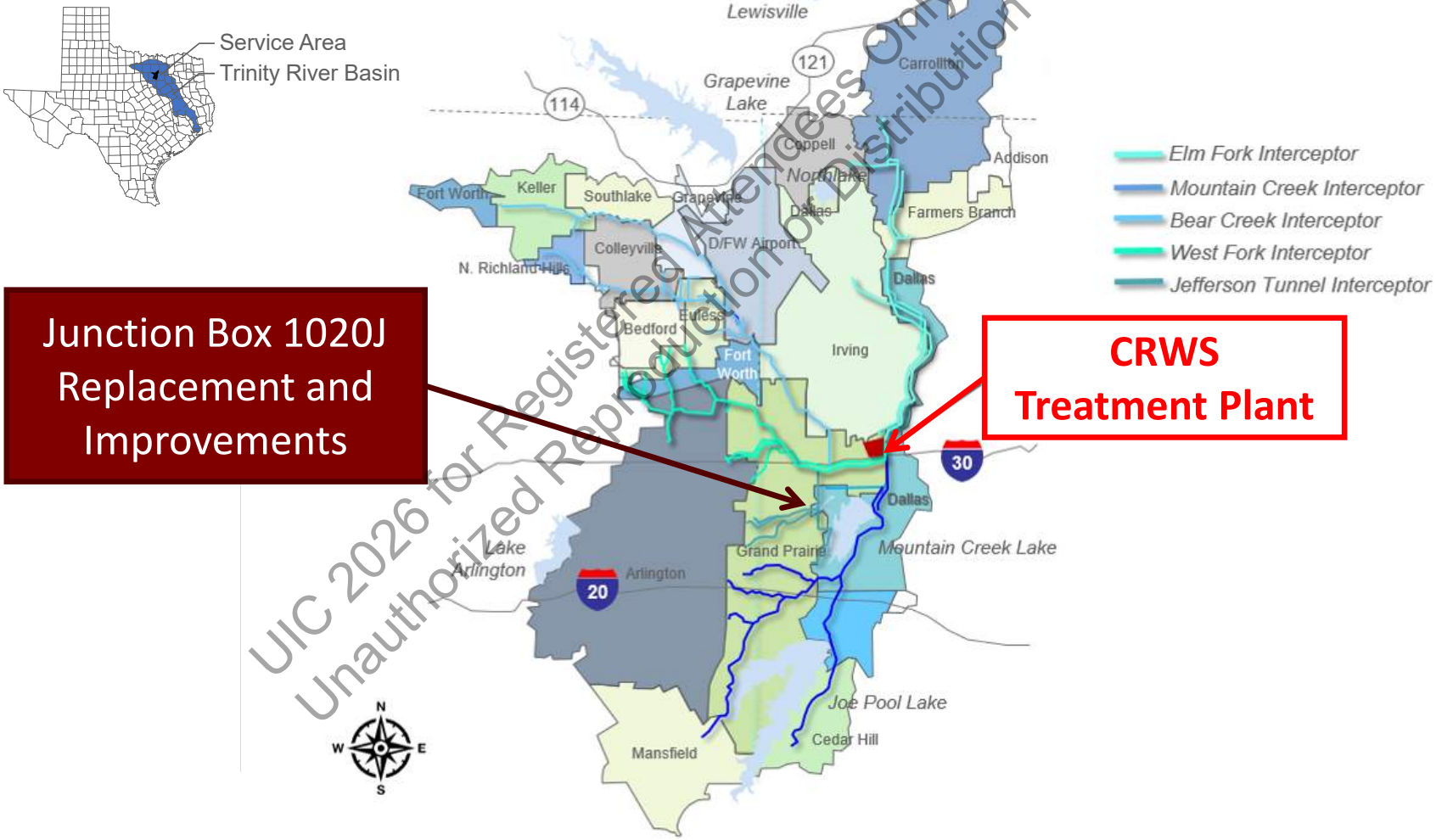
- CRWS
- DCRWS
- MCRWS
- ROCRWS
- TMCRWS



Water System

- TCWSP

Central Regional Wastewater System (CRWS)




Legend
Collection System
Tunnel (JART)
JB1020J
Flow Direction
INTERSTATE
30
15TH ST
14TH ST
JEFFERSON ST
January 2022
Failure at JB 1020J
Mountain
Creek Lake
N
W
E
S
January 27 – 28, 2026
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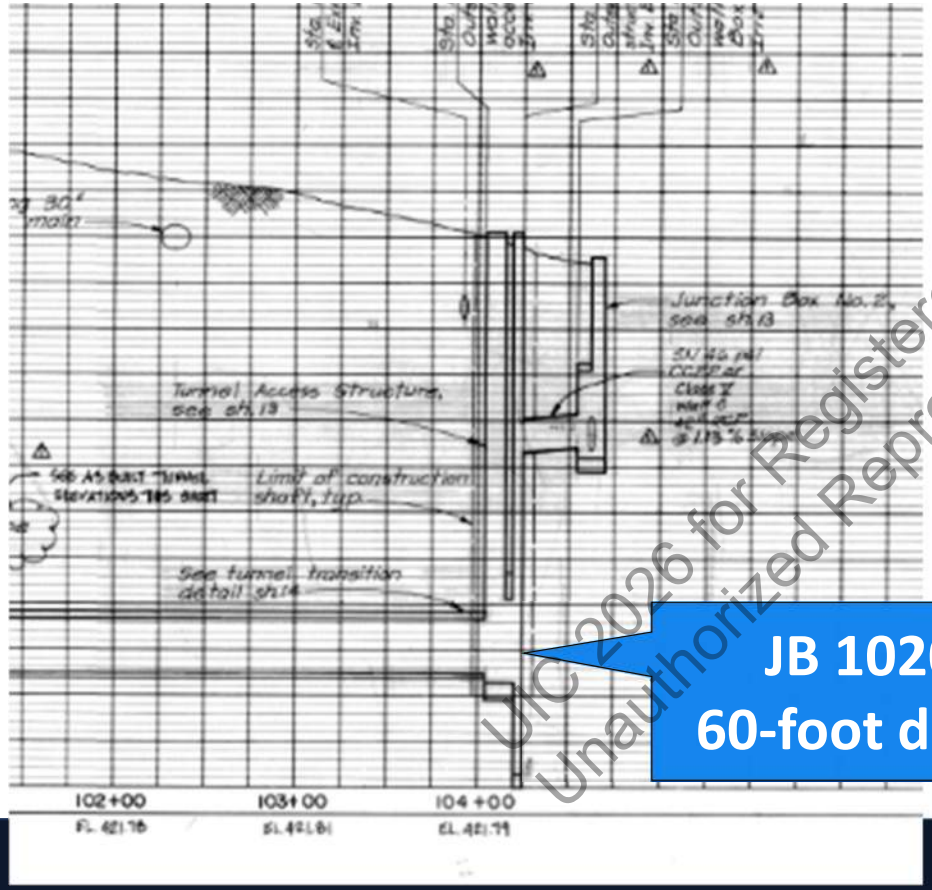
Project Background

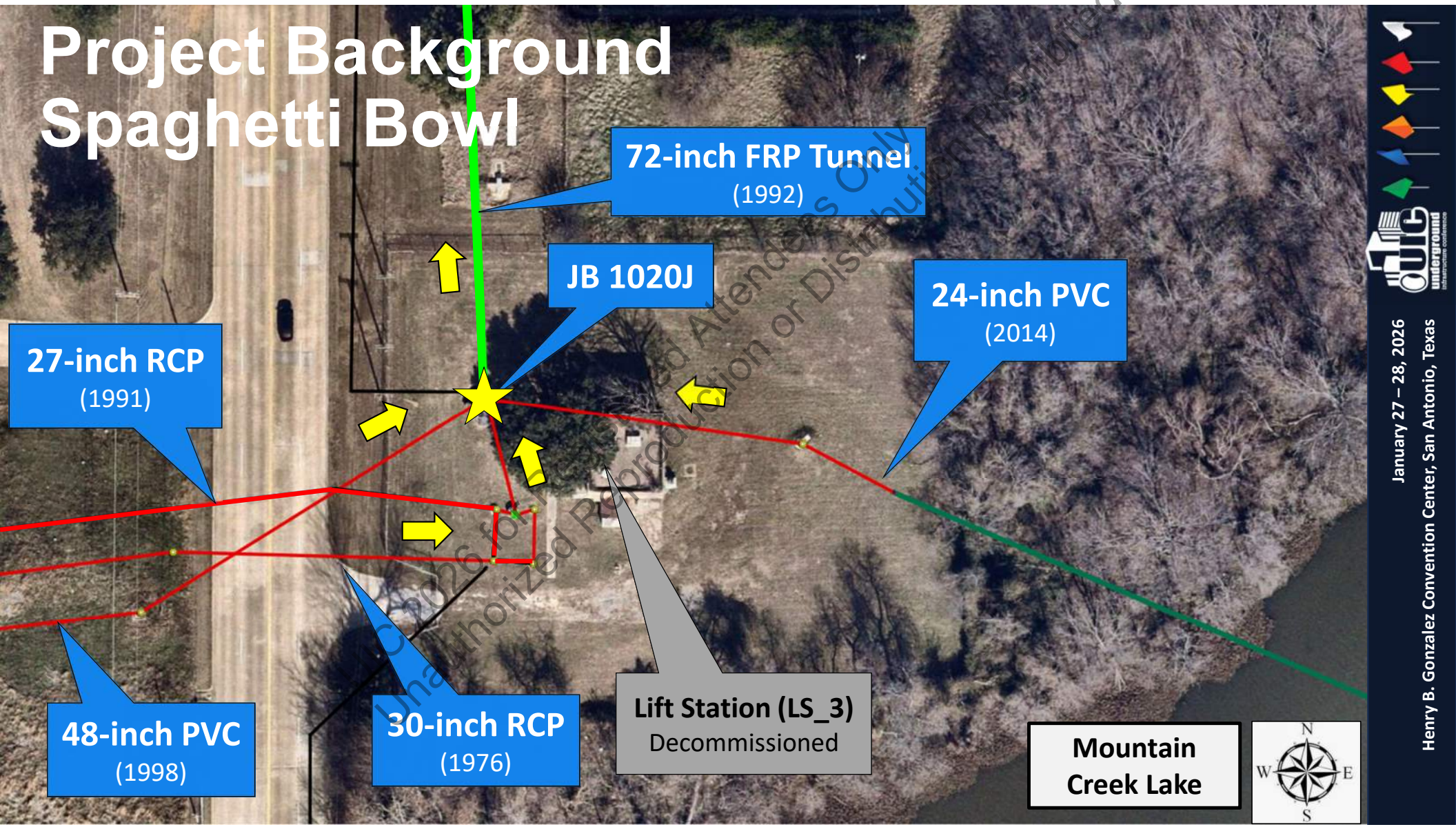
- Existing Structure Failure
- Depth Up to 60-FT
- Consolidate Existing Gravity Sewers:
  - Spaghetti Bowl: 24-, 27-, 30-, and 48-inch
- Key constraints:
  - Soils
  - Floodplain
  - Maintaining Existing Operations

Project Background
Deep Infrastructure

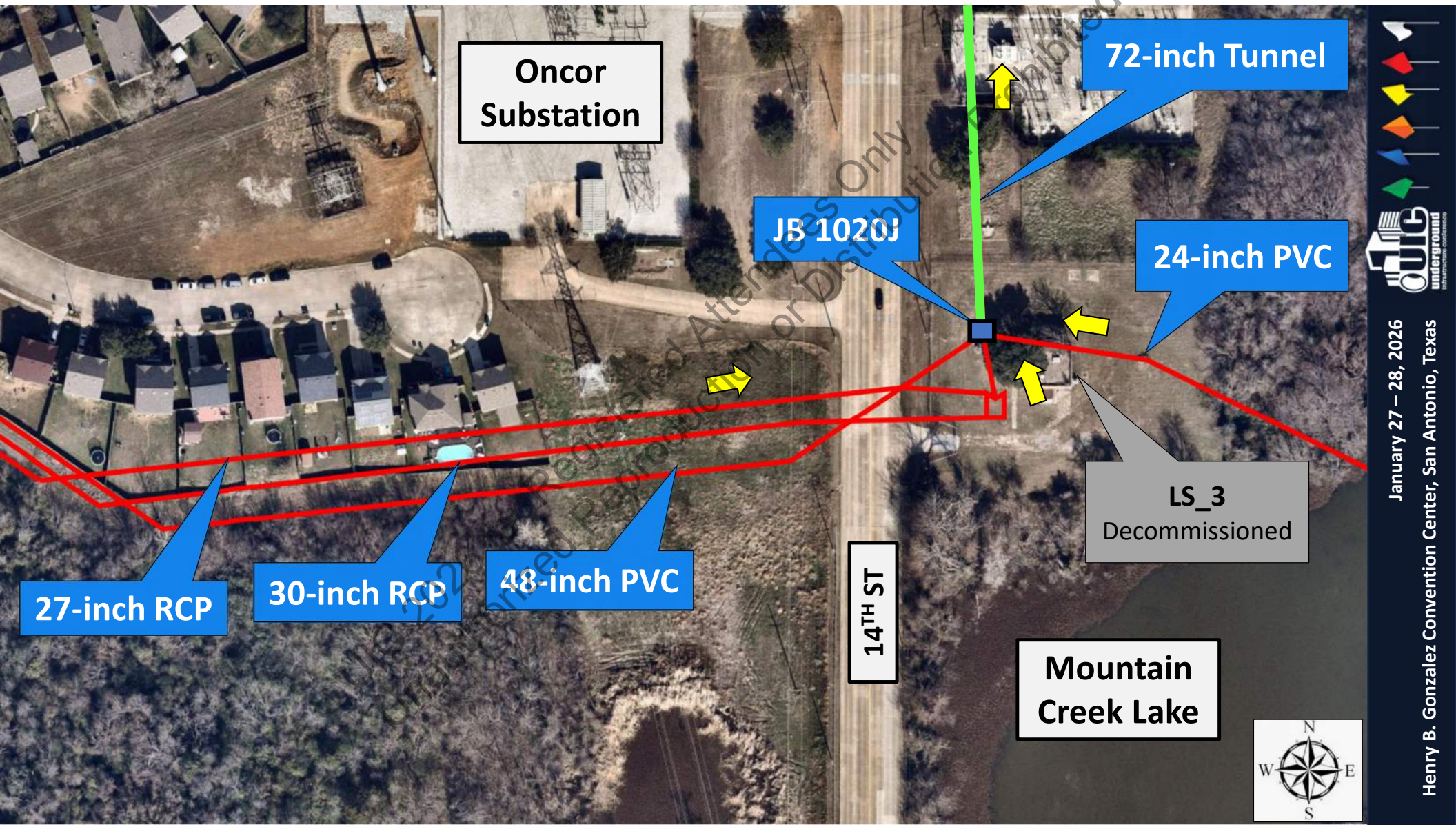


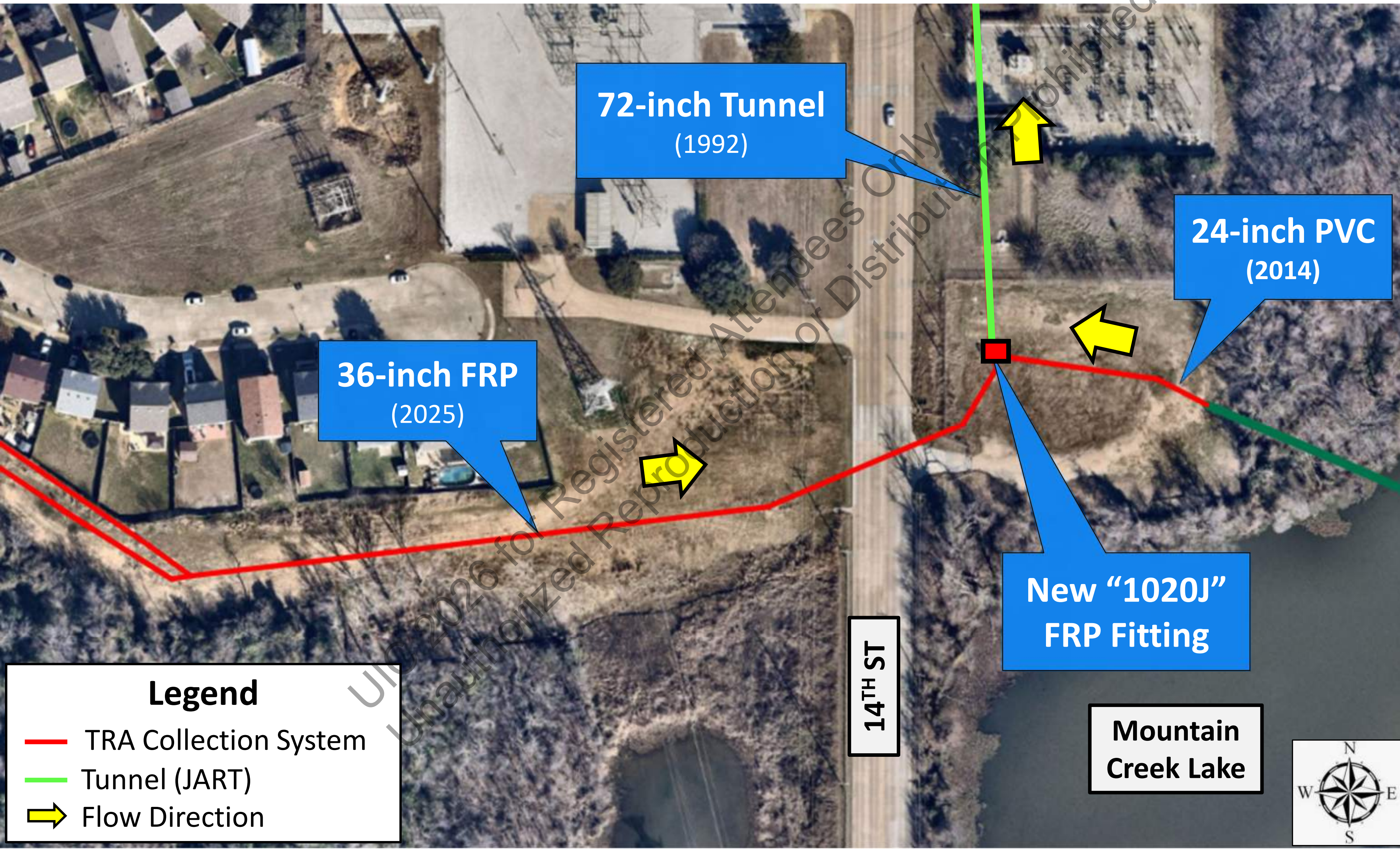
JB 1020J
60-foot depth

JB 1020J
January 2022 Failure



Project Background
Existing Structure Failure





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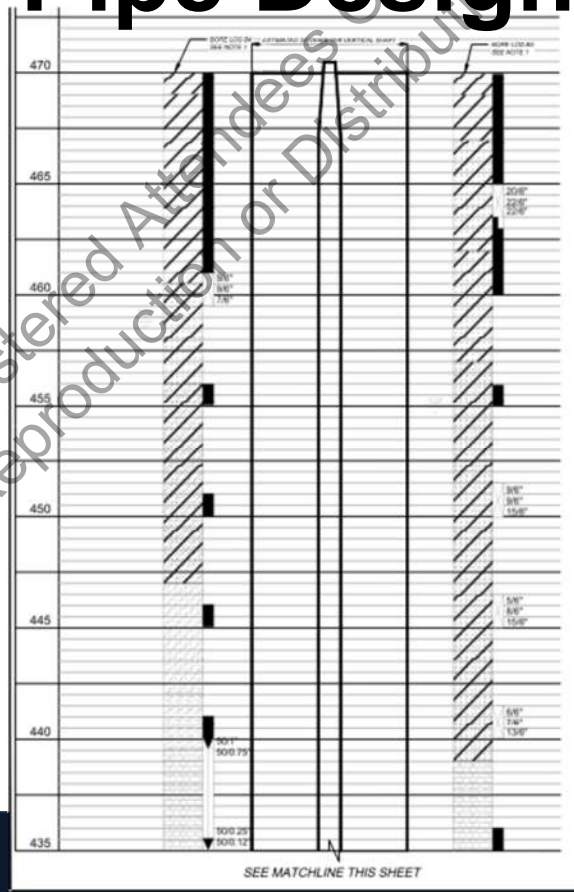
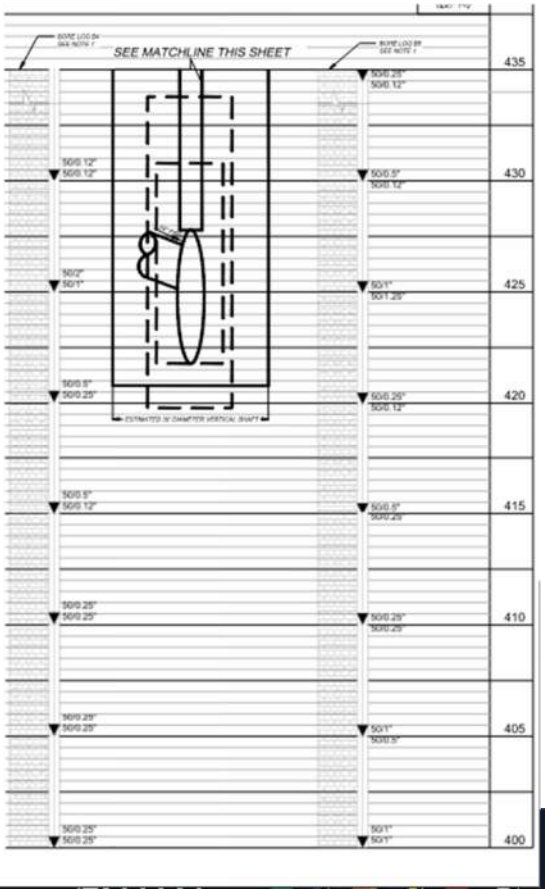
Why is Deep Underground Infrastructure Challenging?

- Up to 60-ft depth
- Increased construction risk with depth
- Access and safety concerns
- Ground water
- Cost and schedule sensitivity

Challenge 1
Large-Diameter Pipe Design

- Deep installation requirements
- Existing connections dictate grade
- Design in the floodplain
- Worker safety considerations

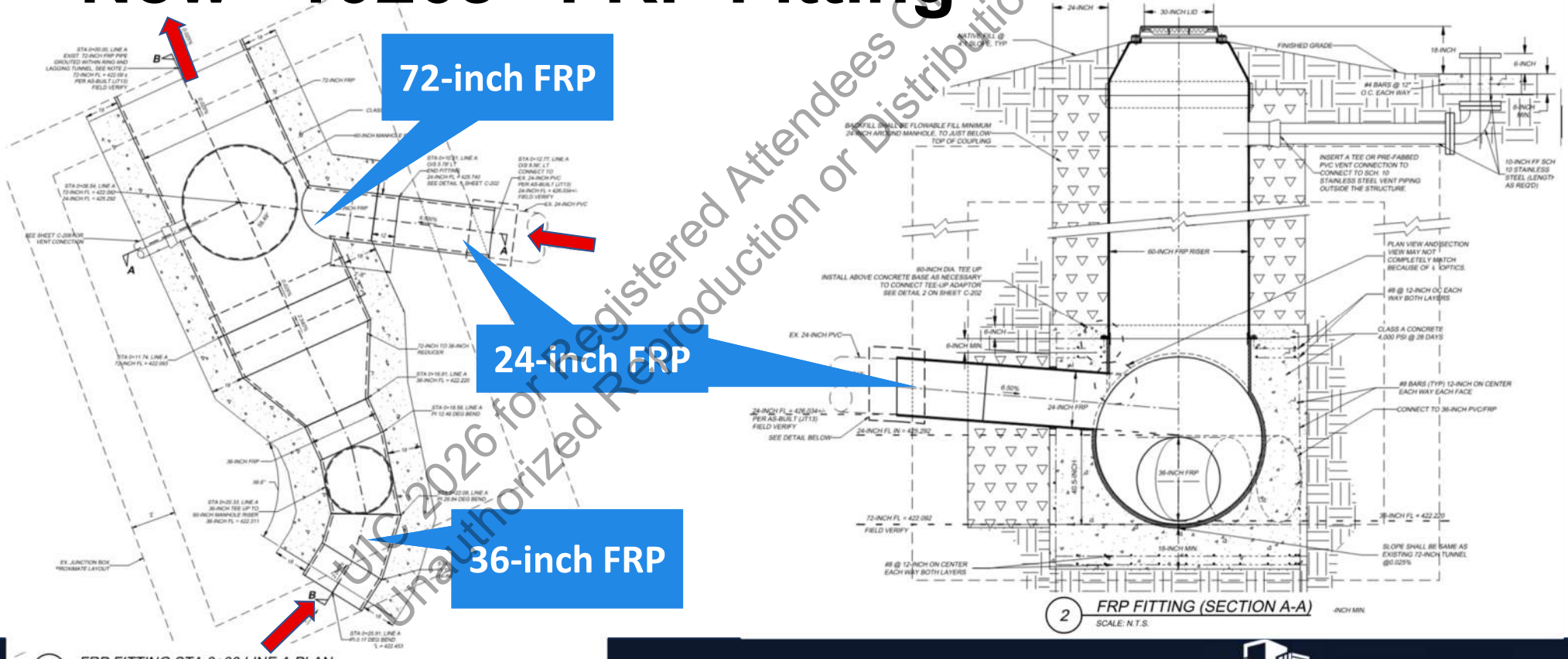




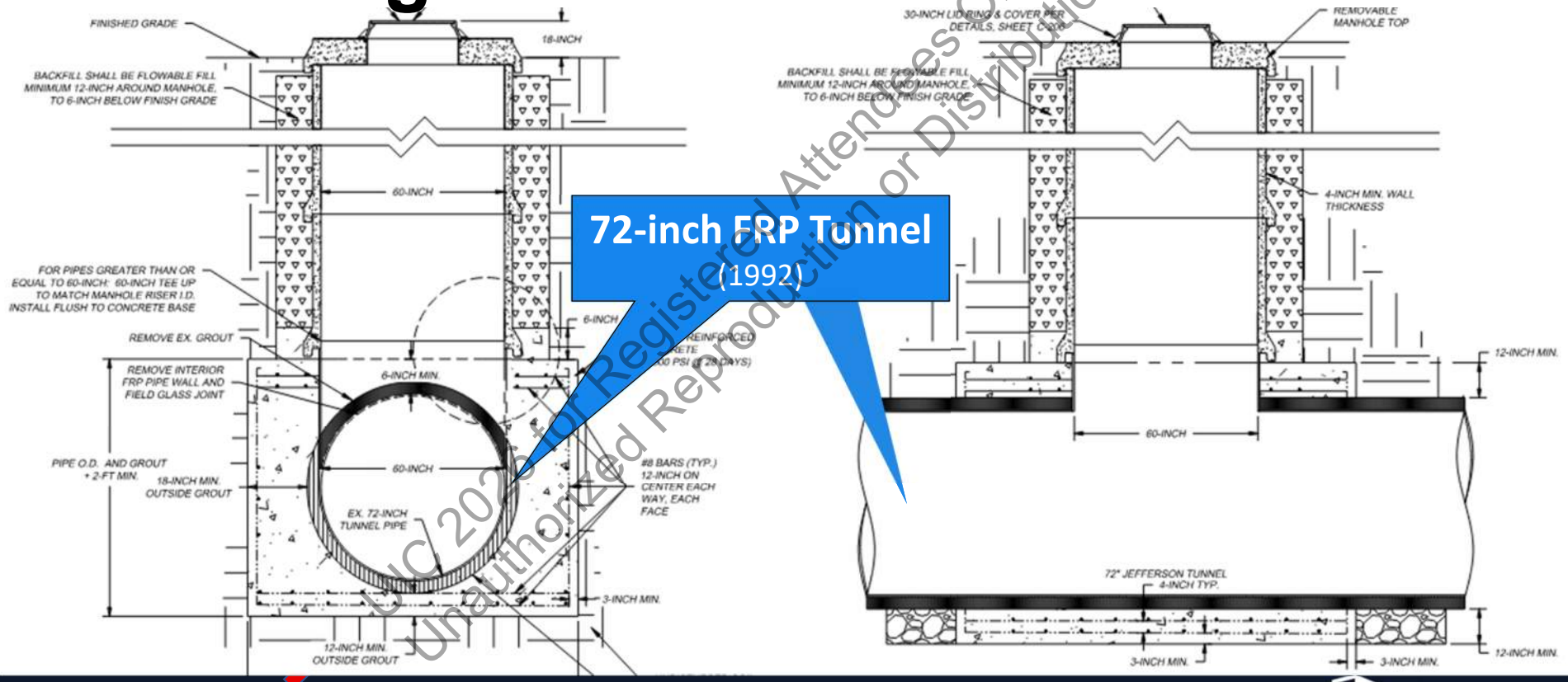
Challenge 2
Large Structure Design

- Existing infrastructure
- Strategically placed manholes
- Custom fitting configuration
- Structural considerations

Large Structure Design
New “1020J” FRP Fitting



Large Structure Design Discharge MH



72-inch FRP Tunnel
(1992)

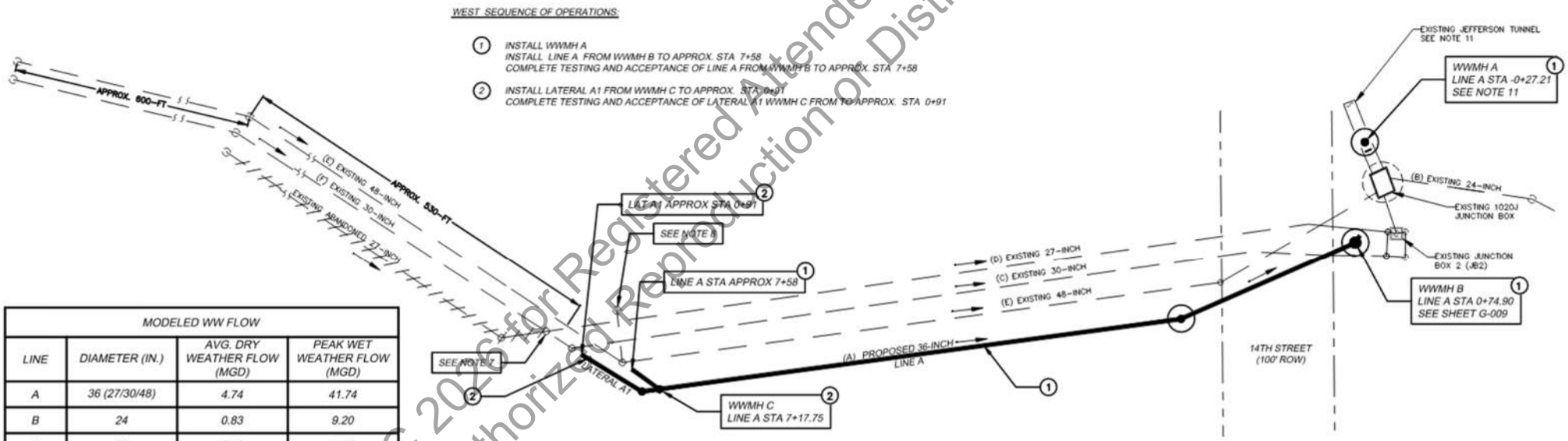
Challenge 3
Site Constraint

- Excavation limitations for construction and future maintenance
- Existing compromised shaft
- Oncor overhead electric

Challenge 4
Maintaining Continuous Sewer Flow

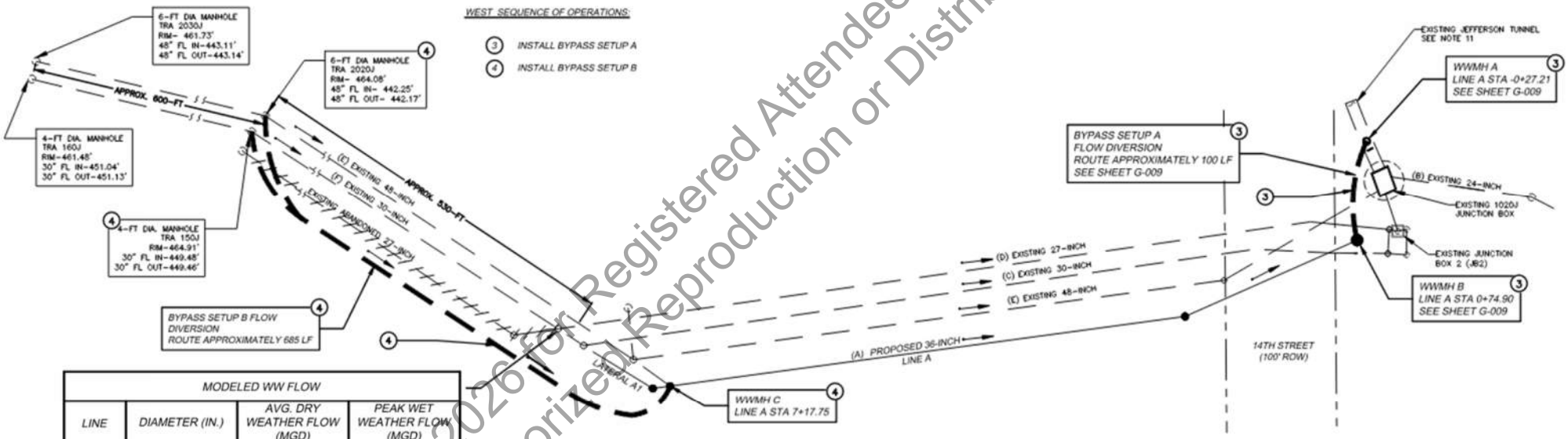
- Existing service constraints
- SSO risks
- Suggested bypass

Challenge 4
Maintaining Continuous Sewer Flow



MODELED WW FLOW			
LINE	DIAMETER (IN.)	AVG. DRY WEATHER FLOW (MGD)	PEAK WET WEATHER FLOW (MGD)
A	36 (27/30/48)	4.74	41.74
B	24	0.83	9.20
C	30	0.48	4.37
D	27	0.63	4.39
E	48	3.62	32.97
F	30	1.11	8.76

Challenge 4
Maintaining Continuous Sewer Flow



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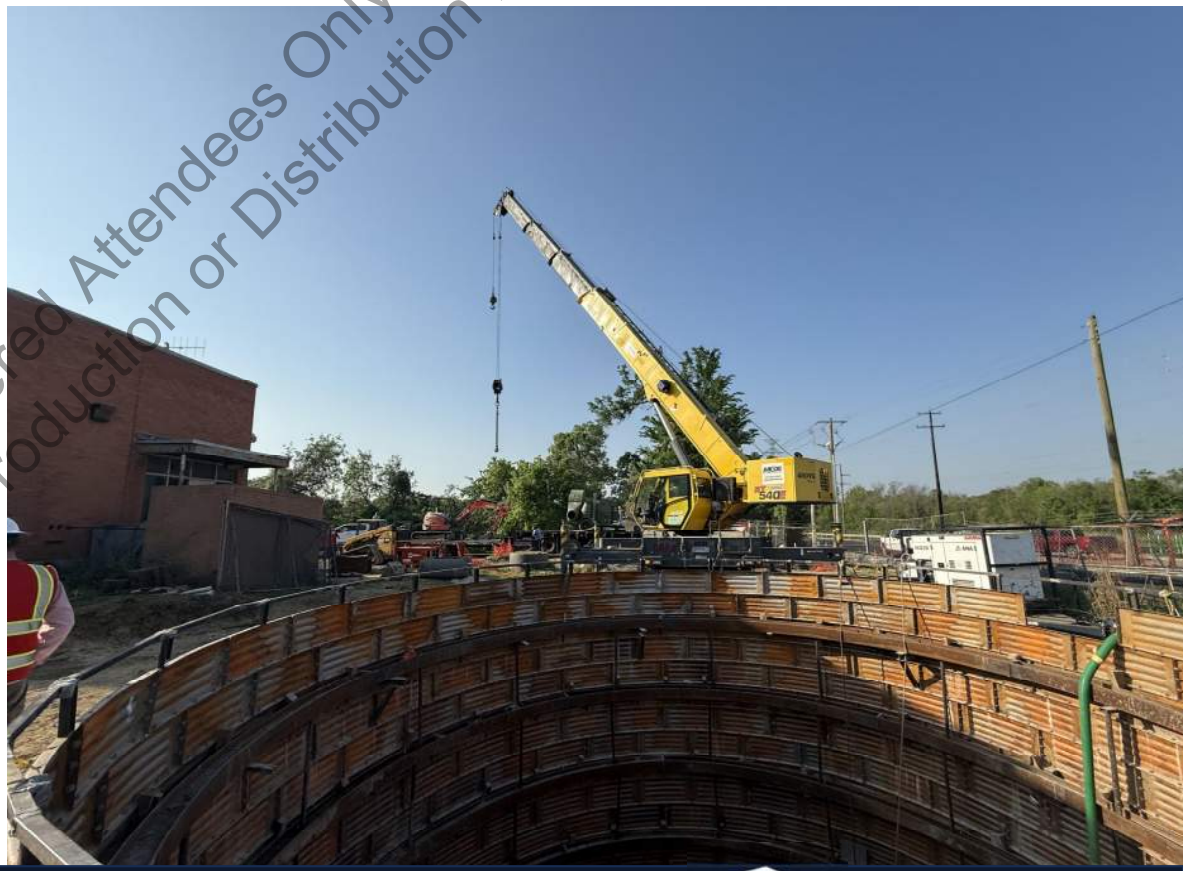
Construction Overview

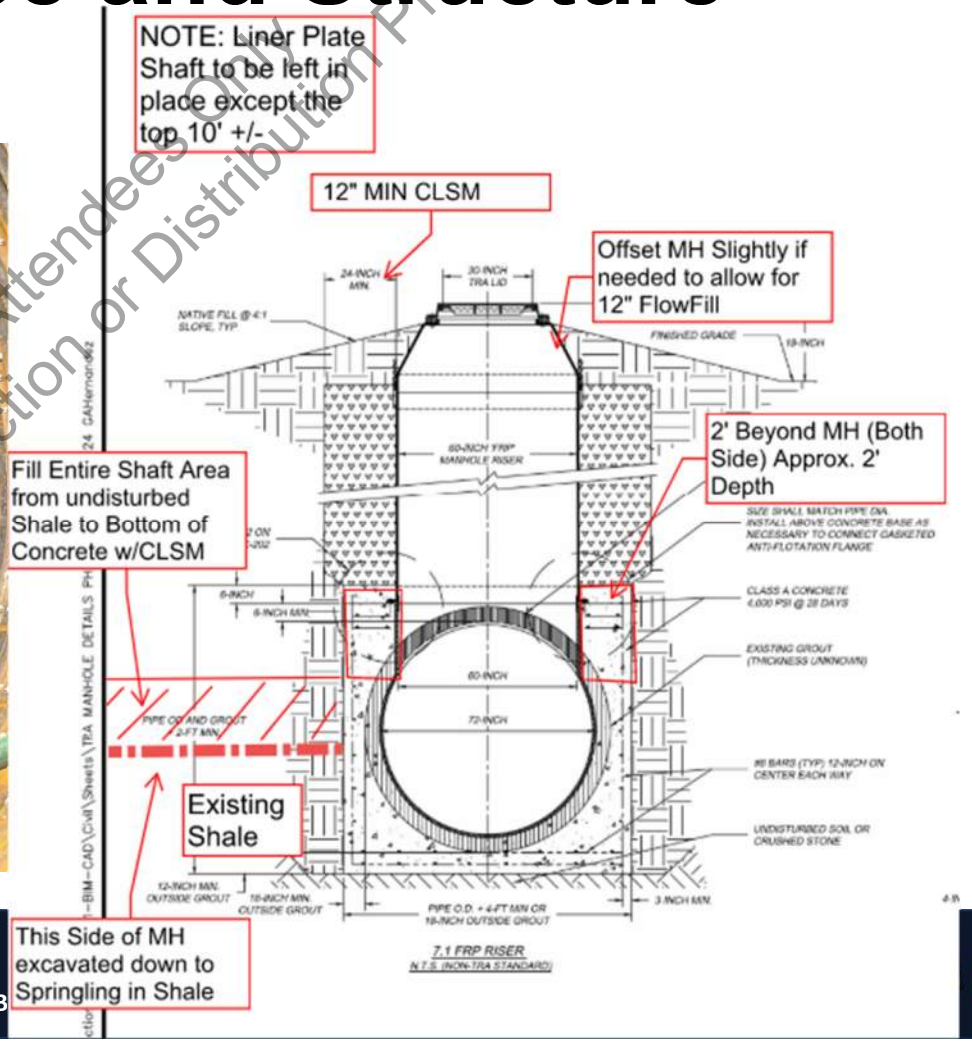
- Trench stability and safety risks
- Field modifications
- Survey control and tolerances
- Sequencing of deep pipe and manhole installation
- Contractor and inspection coordination

Site Constraints

Site Constraints



Large Diameter Pipe and Structure Construction



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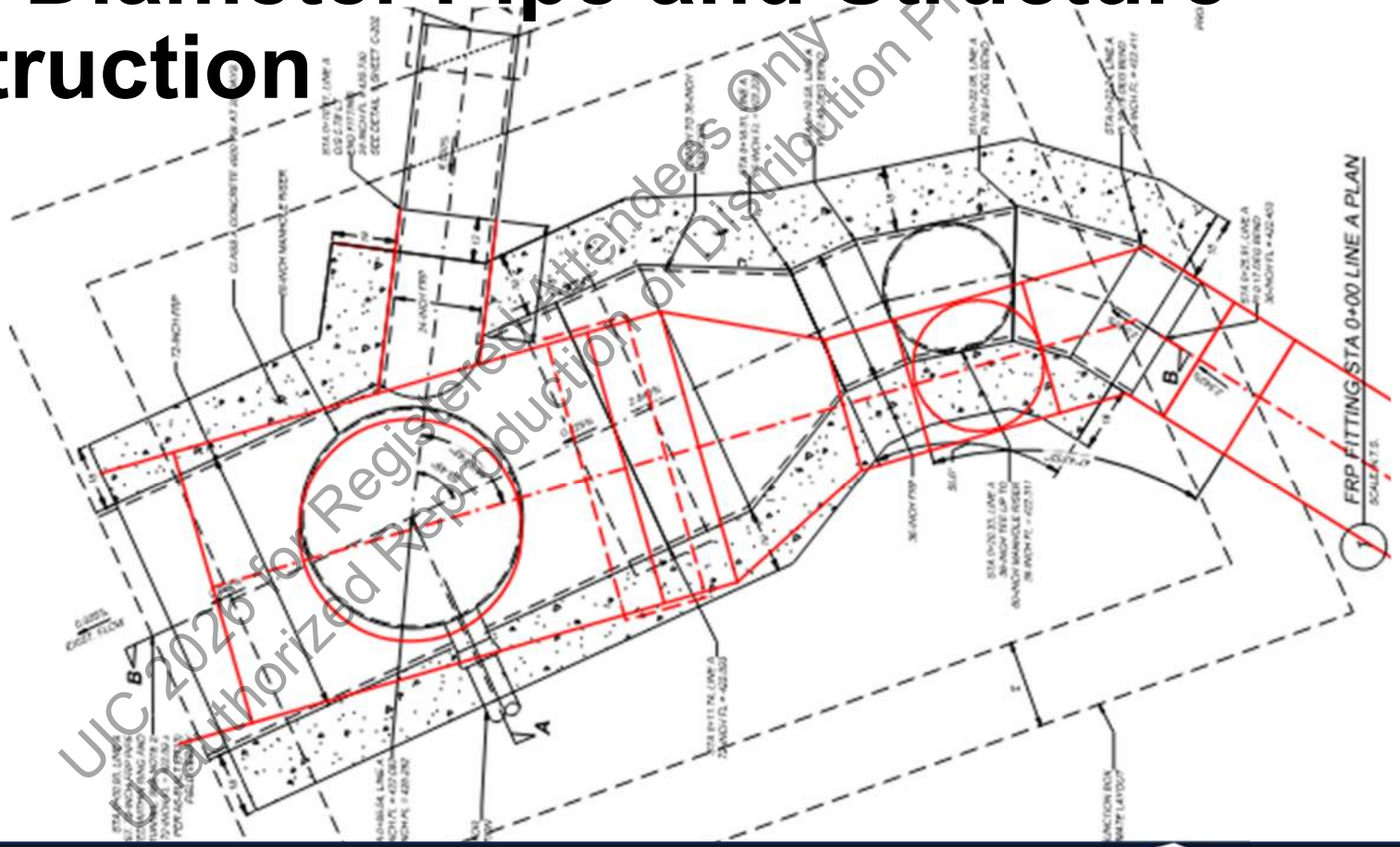
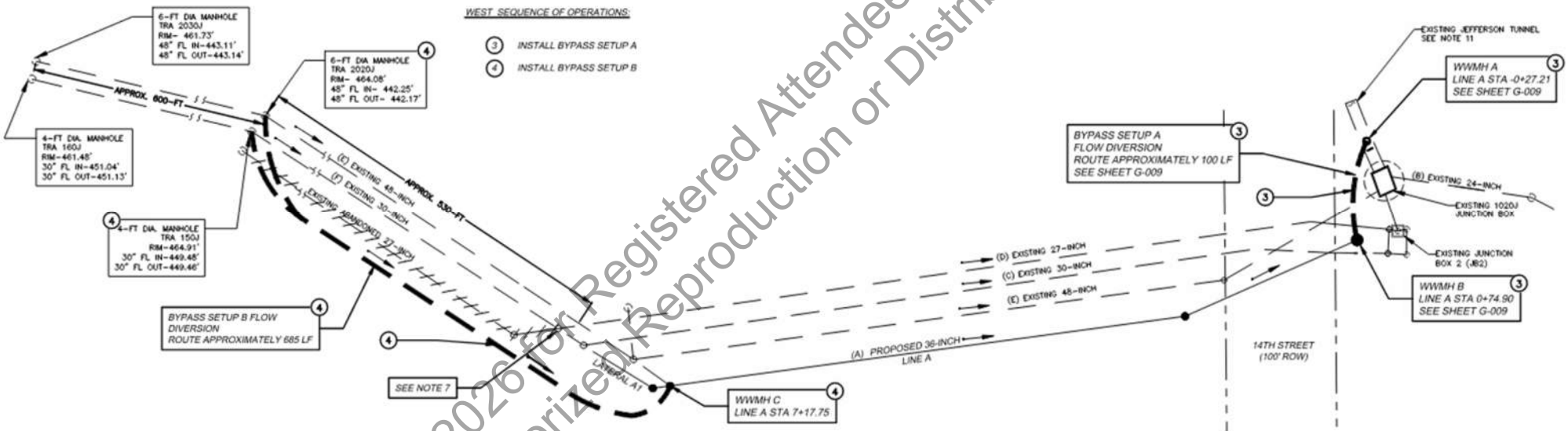
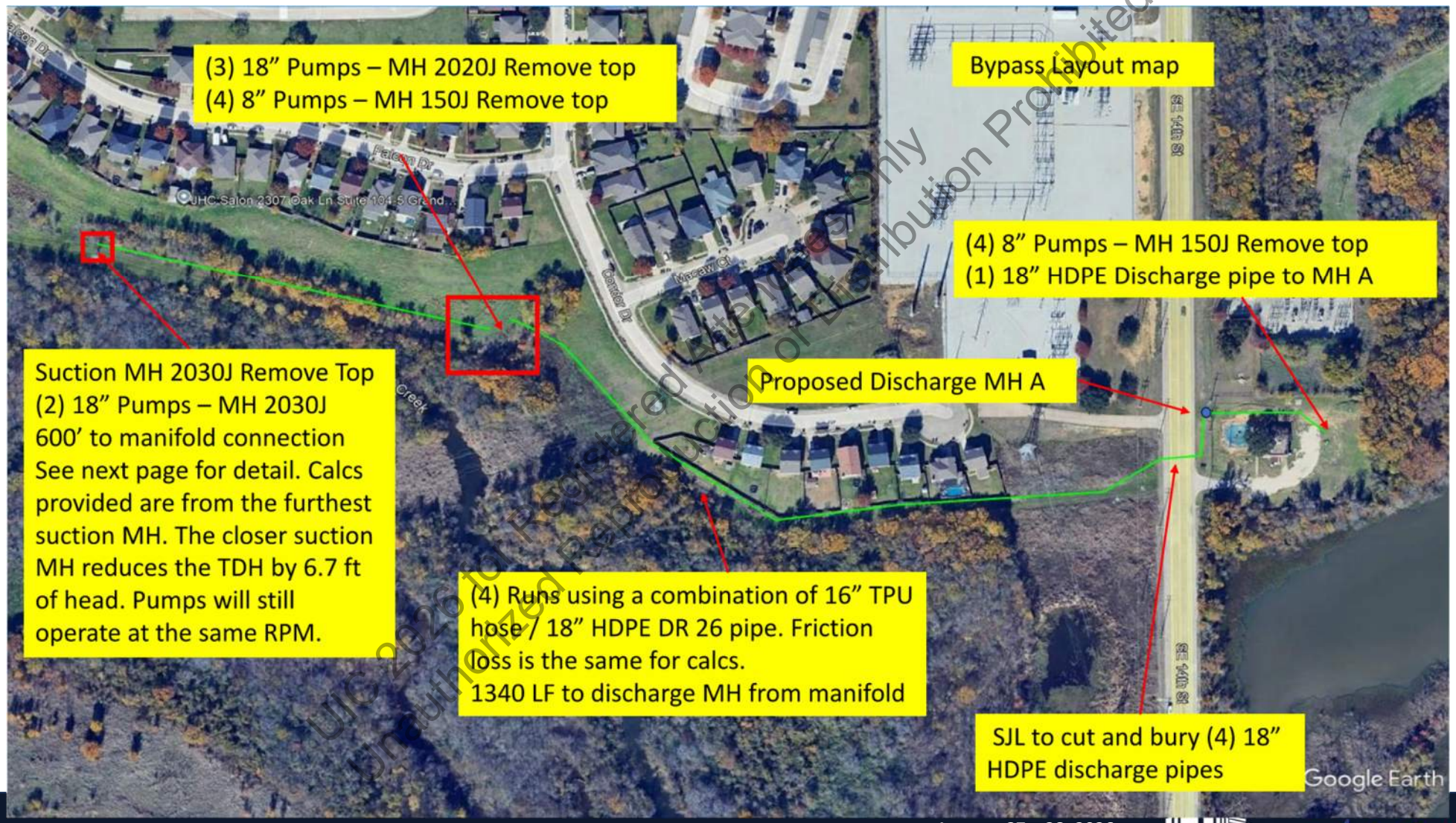


Bypass Pumping and Staged Construction





Bypass Pumping and Staged Construction

Bypass Pumping and Staged Construction

- Single bypass system
- Phasing and sequencing
- Redundancy and contingency planning
- Key coordination lessons

Key Takeaways

- Early constructability reviews
- Contractor engagement
- Safety planning for deep work
- Monitoring and inspection protocols
- Design modifications during construction
- Collaboration between owner, engineer, contractor, and manufacturer

Key Takeaways for Designers

- Design considerations for deep large-diameter gravity pipe
- Importance of constructability and operations planning
- Applicability to future projects

Questions?

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