



Track I-A
Sewer Construction & Rehabilitation
(10:30 AM to 10:55 AM)
January 28, 2020

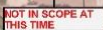
M-245 48-inch Sanitary Sewer Inverted Siphon Failure

Partial Collapse of 48-inch Single Barrel Siphon Crossing of the Trinity River Floodway

Presented By:

Chris Brooks, P.E.





City of Fort Worth Interceptor Condition Assessment Program

Proactive Identification of Collection System Risks

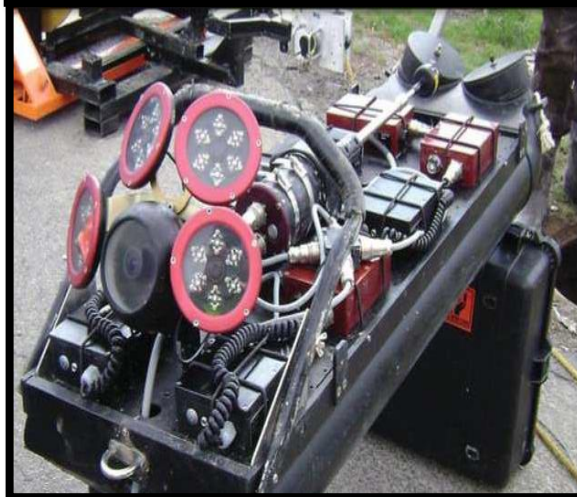
- ICAP began in 2010 and is Ongoing
- Targeted high priority drainage basins in the City – e.g. West Fork Trinity, Village Creek, Big Fossil Creek...
- Typically Uses MSI tools (laser, sonar and high definition video) to inspect pipelines.
- CUES Fly Eye inspection and evaluation system.
- Inspection of Inverted Siphons – *How's it Done?*

Sonar Profiling

Sonar profiling can be achieved by mounting the Sonar Profiler in one of the two following ways:

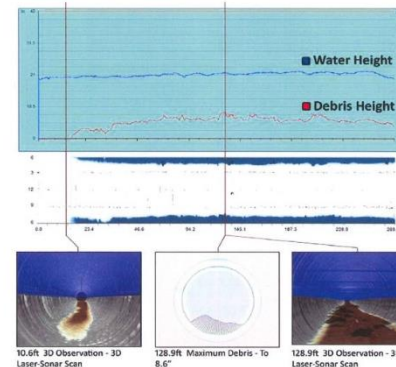
1. In pipes ranging from 450mm to 2200mm in size (18" to 87") with 1/3 of the pipe surcharged to being completely surcharged the HDSUB can be used.
2. In pipes ranging from 1000mm to 3000mm in size (39" to 118") with 1/4 to 3/4 of the pipe surcharged the HDFloat can be used.

The sonar images are recorded into a video format (combined with Laser where available) which is analysed and reported using Profiler software.



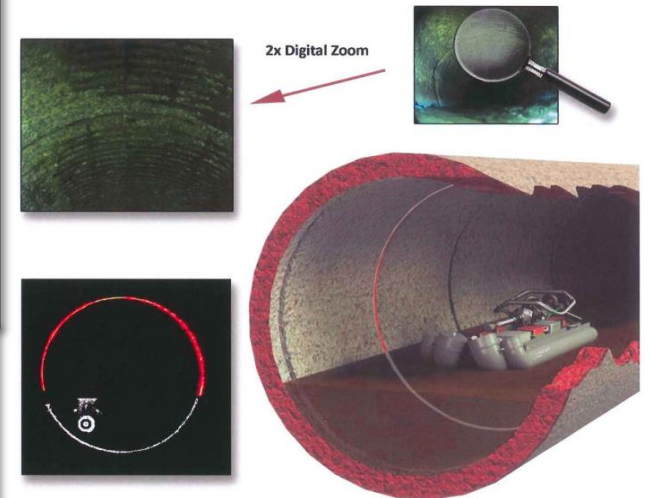
Debris Graph

Below is an example Debris Graph with the corresponding Flat Graph™ and observations. In this example the full HD Profiler System has been used (Sonar and Laser) although both the Debris Graph and Flat Graph™ can be created with only Sonar used. The Flat Graph™ is used to topographically map pipe radial variances from the reference shape and size from start to end of pipe. The Debris Graph displays the debris and water height over the length of the asset. The average debris depth, average water level and debris volume accompany the graph in reports.

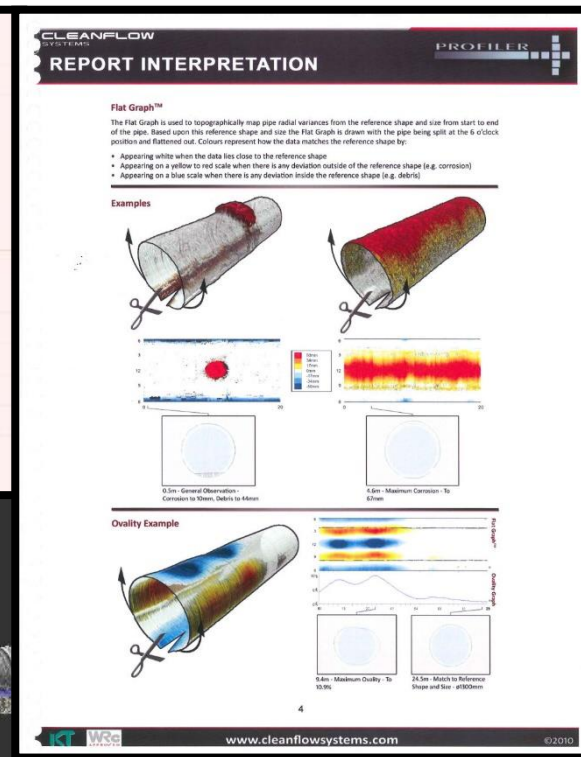
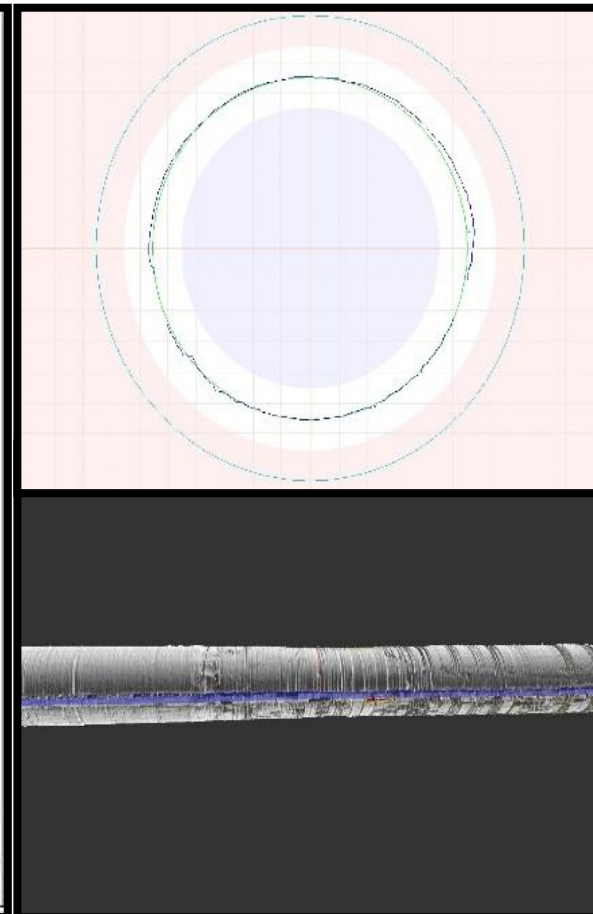
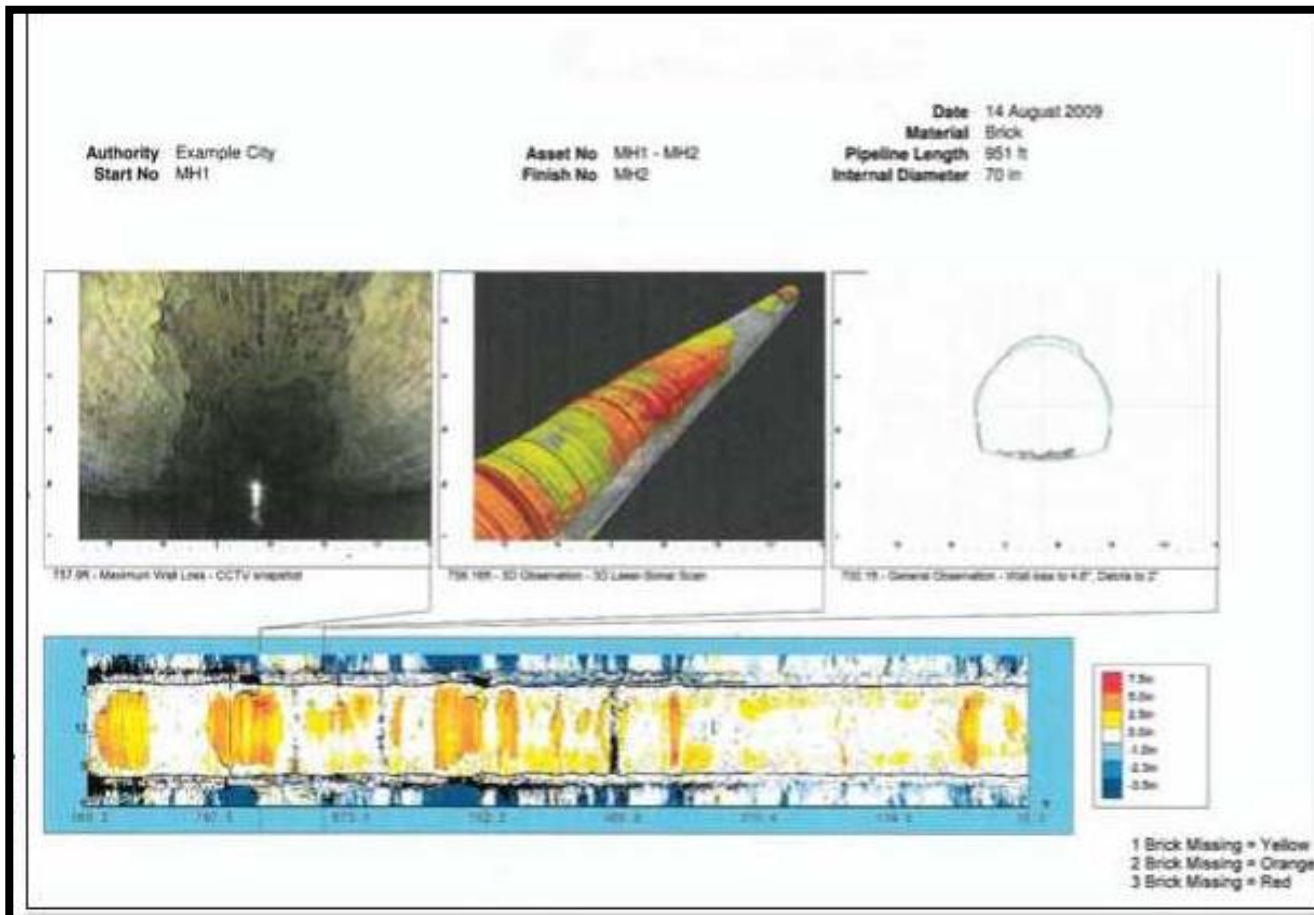


HD Profiler System Module Overview

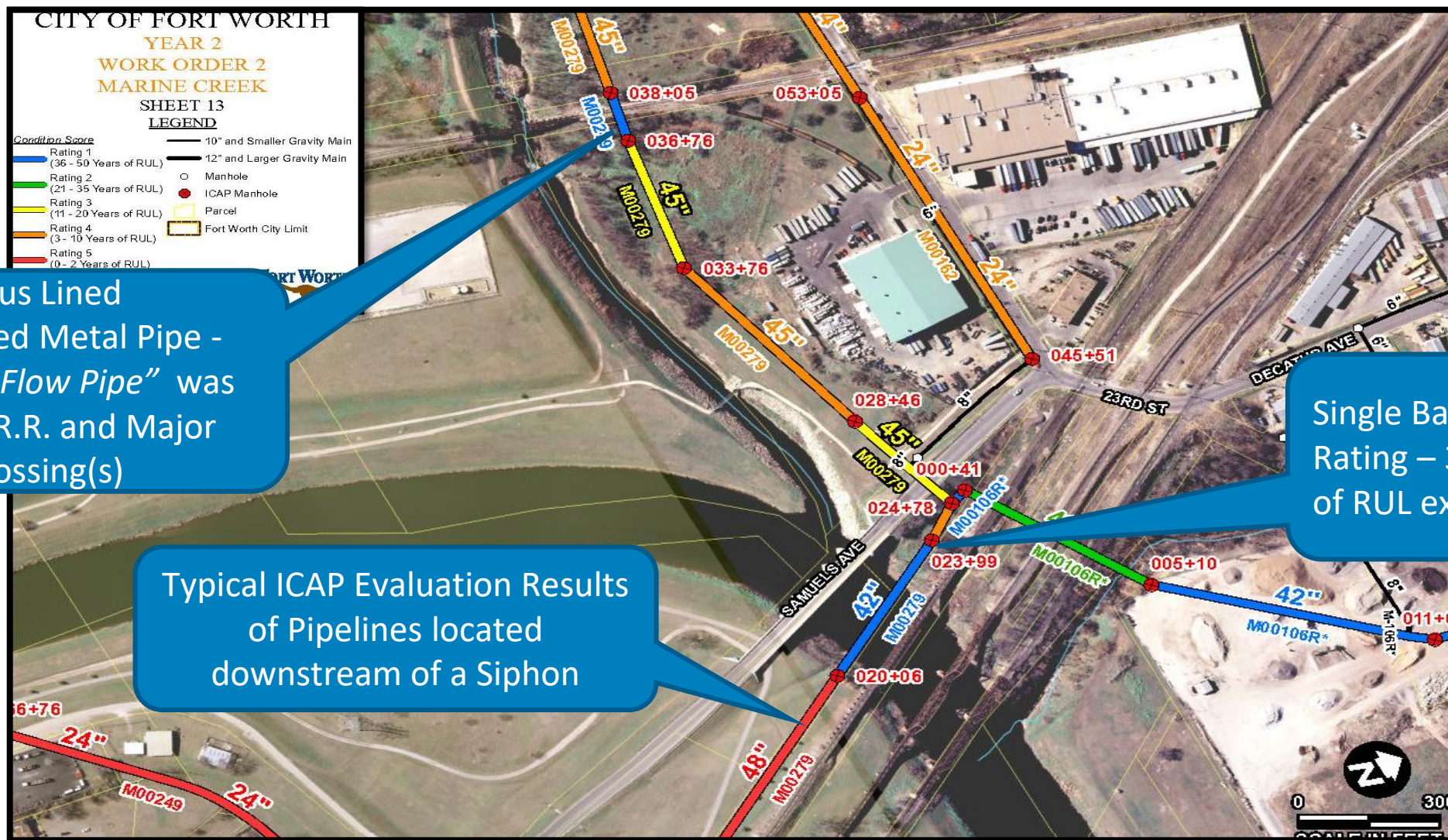
Through the use of the data received from both the laser and sonar a complete picture of the condition of the pipe can be ascertained. The output data from the two units is then merged into one complete inspection video that can be analysed and reported within the Profiler software. Each video frame has a corresponding FlyEye data frame, from which accurate measurements can be determined. There are approximately six laser frames for every sonar frame captured per second.



ICAP MSI Report Exhibits



ICAP FINDINGS - MSI Report Ratings Exhibits

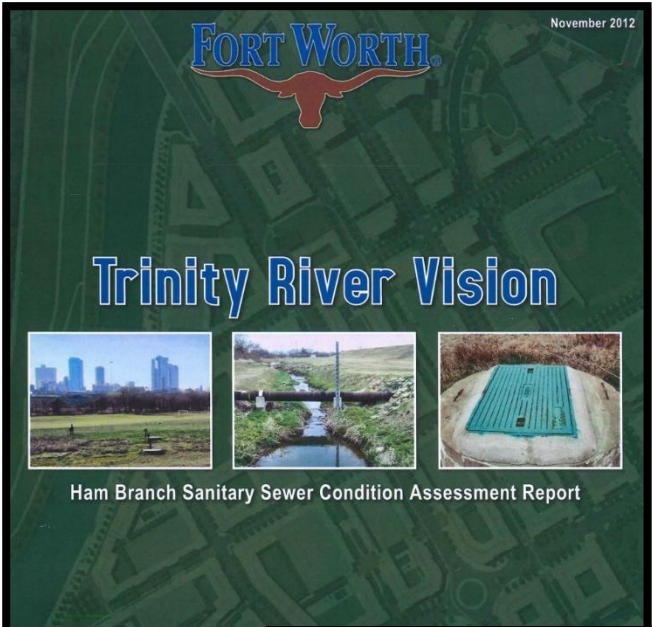




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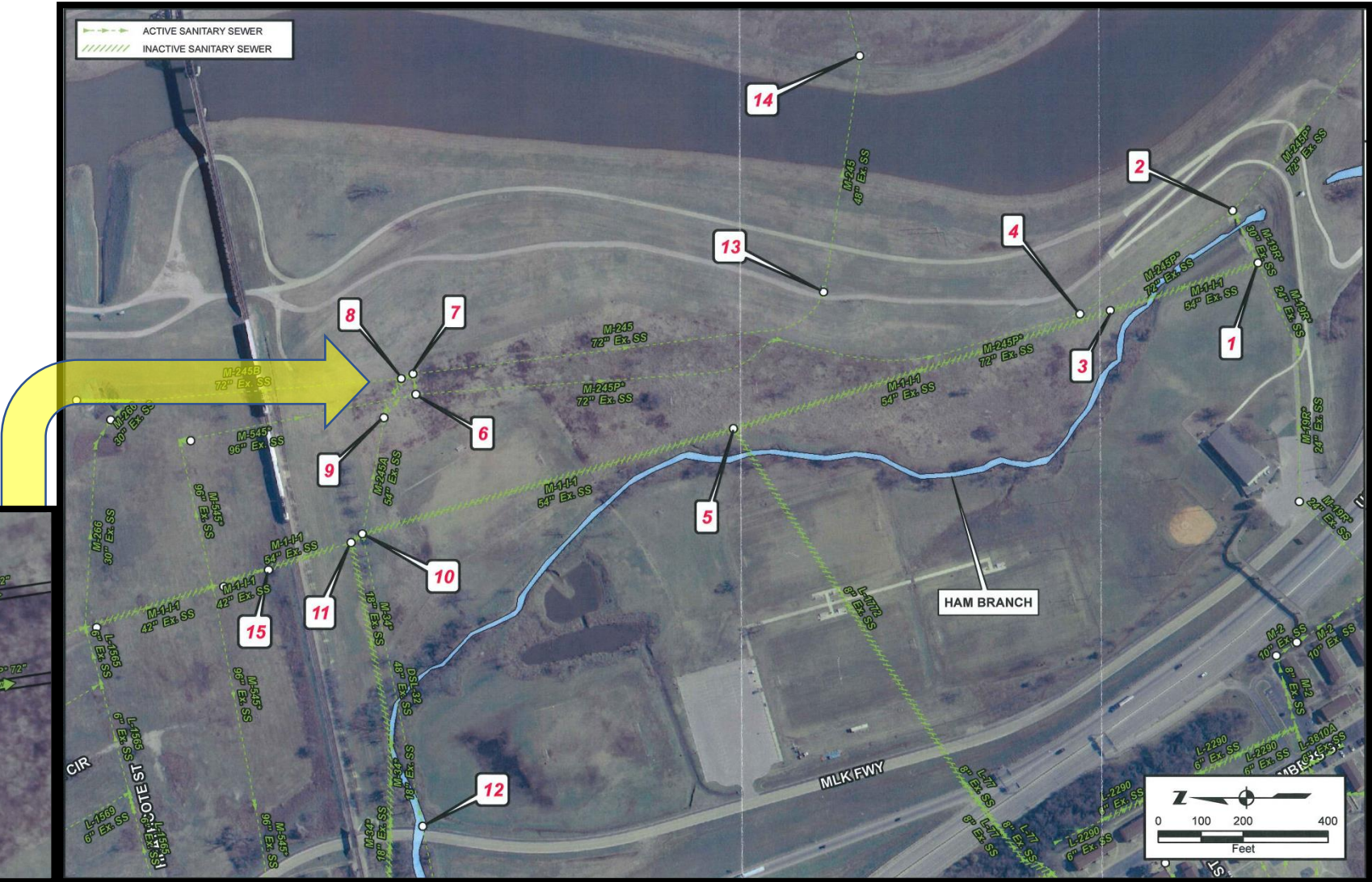
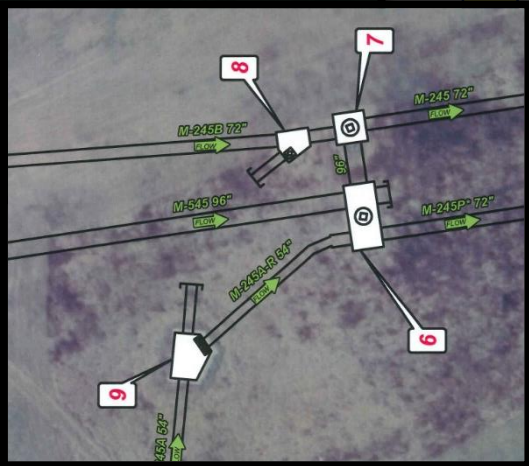
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West Fork Trinity Interceptors – M245/M245B Assessments



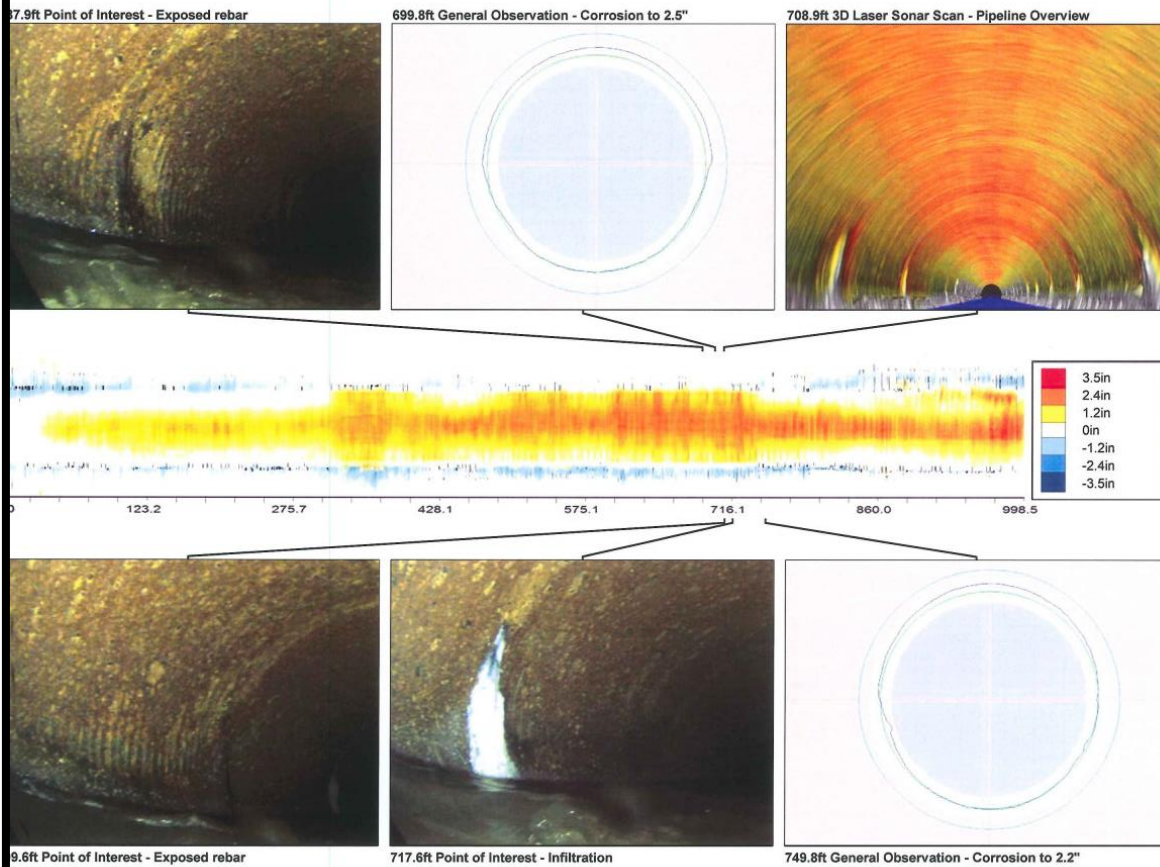
Trinity River Vision

Ham Branch Sanitary Sewer Condition Assessment Report

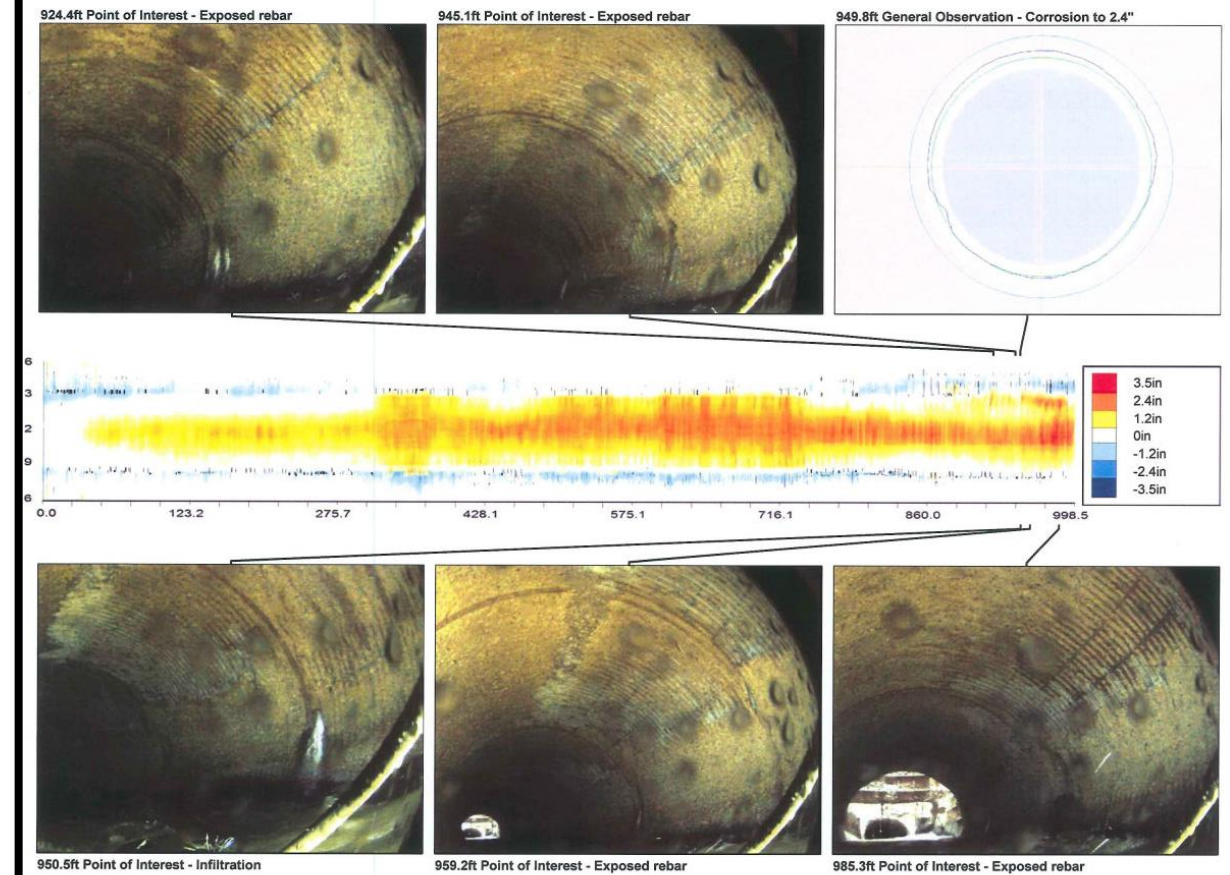


M-245 MSI Assessment Results

Observation Report



Observation Report



Ham Branch Interceptors Air Quality Investigations

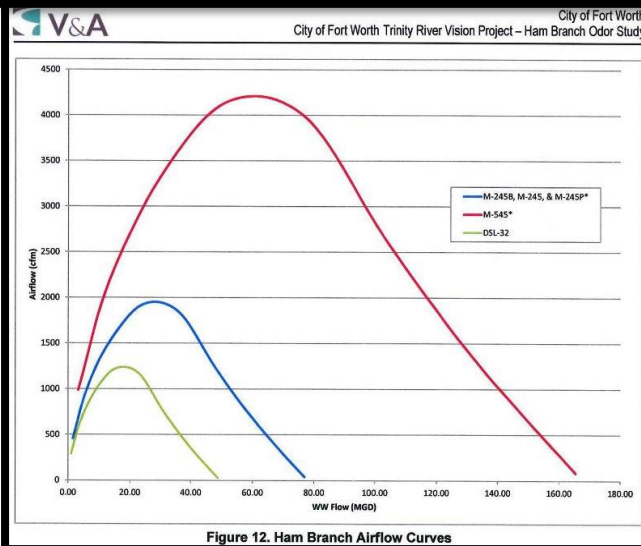
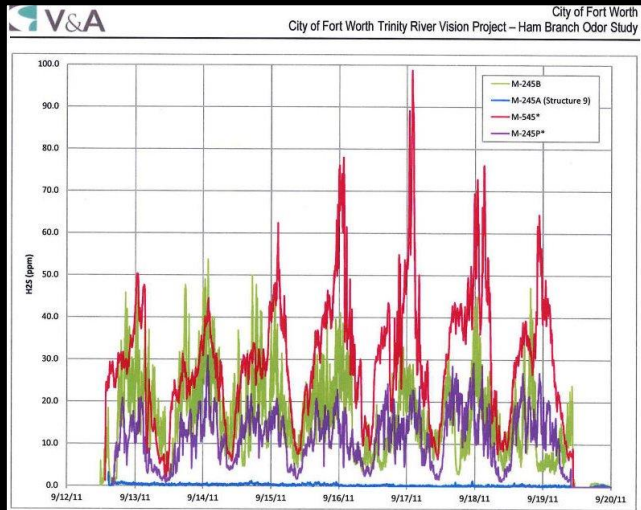


Table 2.
Ventilation Model Results

	Diameter (inches)	Slope	2015 PDWF (MGD)	Airflow (cfm)	
				Actual	Worst Case
M-245B	72	0.080%	14.36	1593	2003
M-545*	96	0.080%	51.25	4167	4314
DSL-32	48	0.280%	3.50	612	1271
M-245	72	0.080%	25.80	1982	2003
M-245P*	72	0.080%	25.77	1983	2003

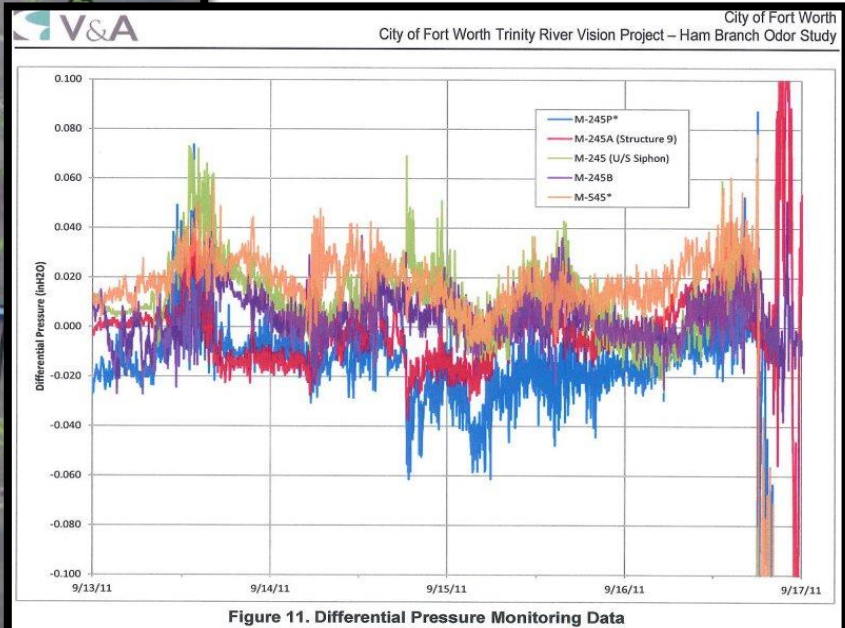
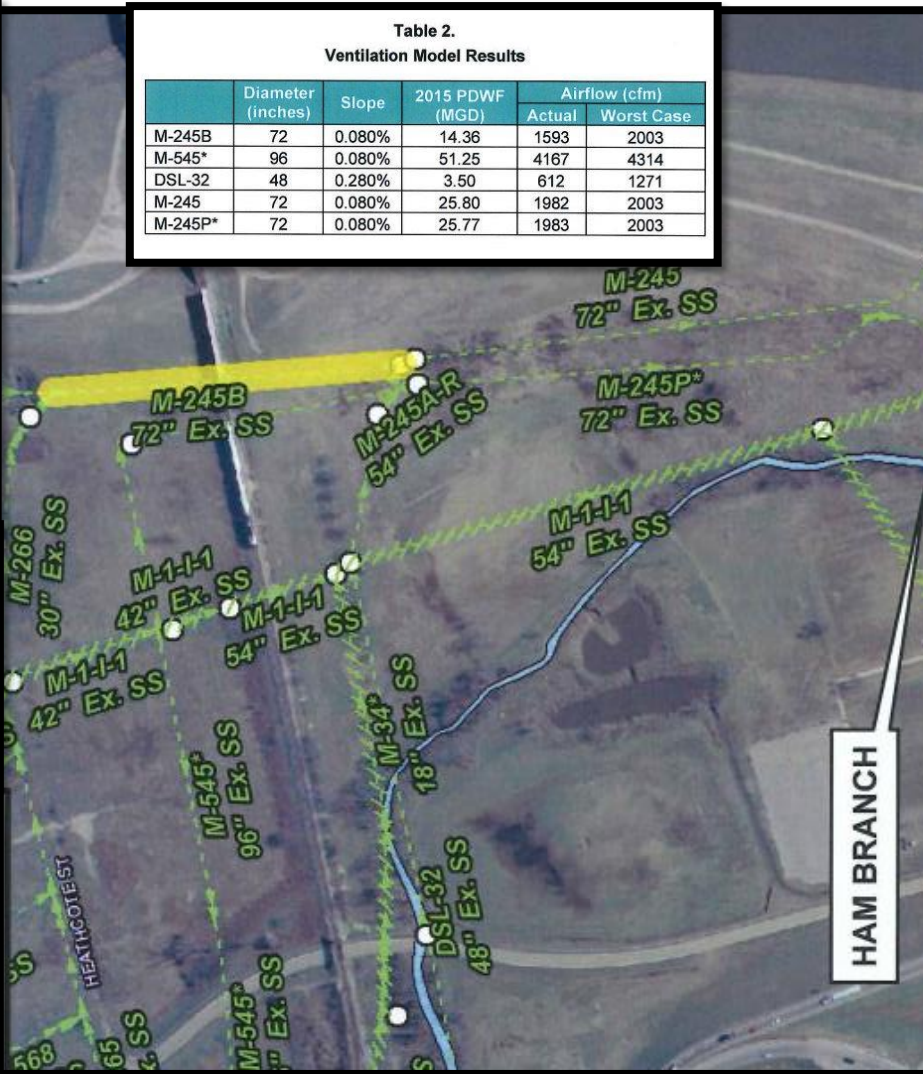
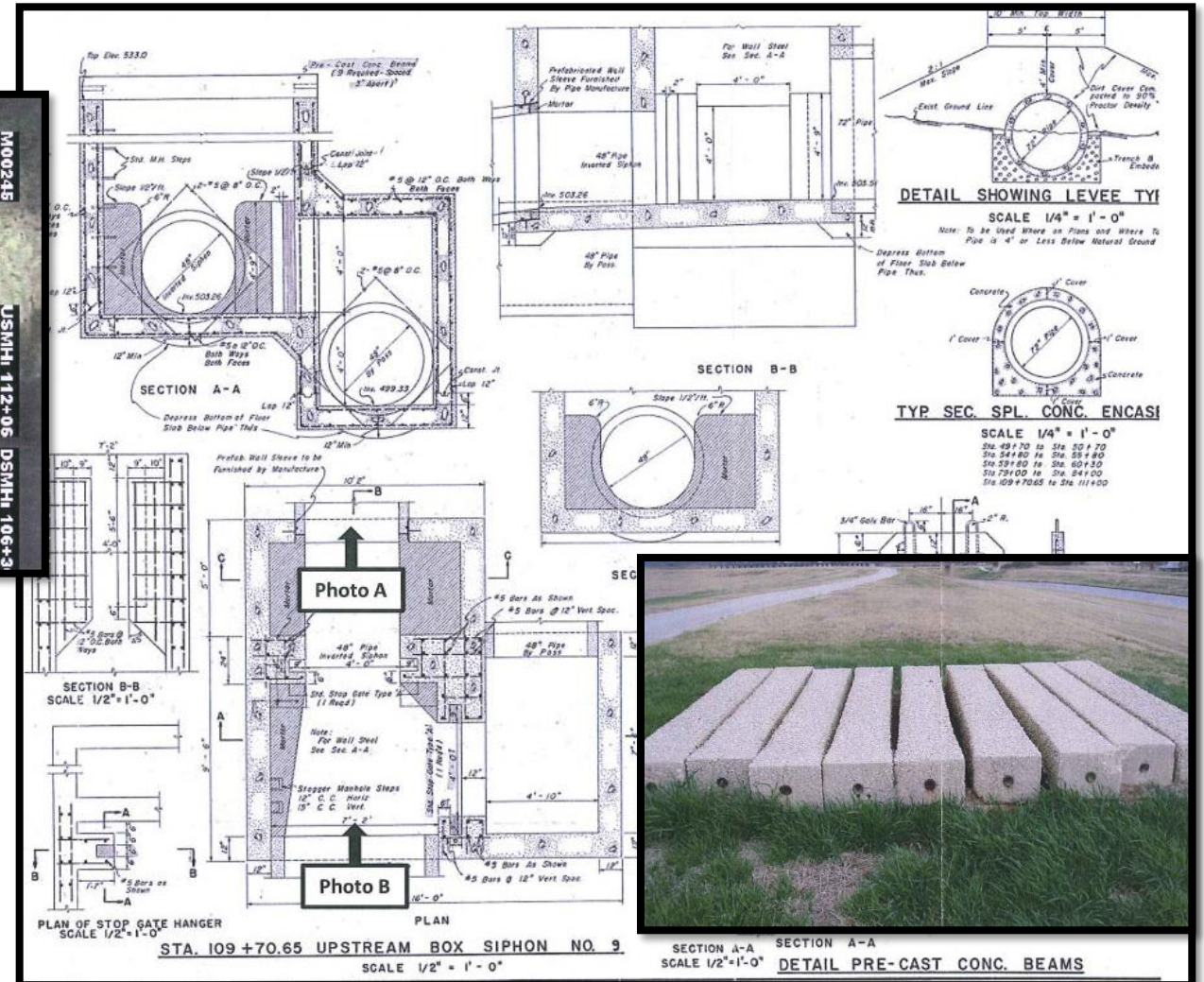
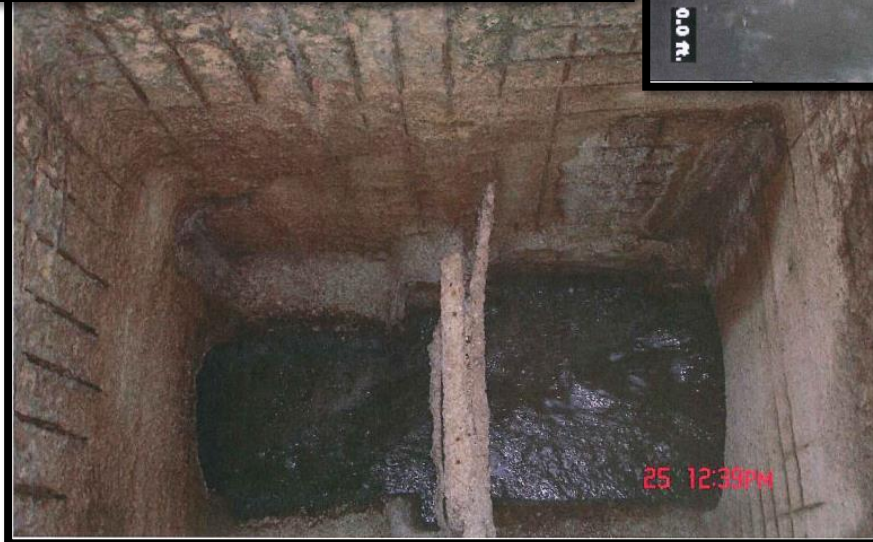


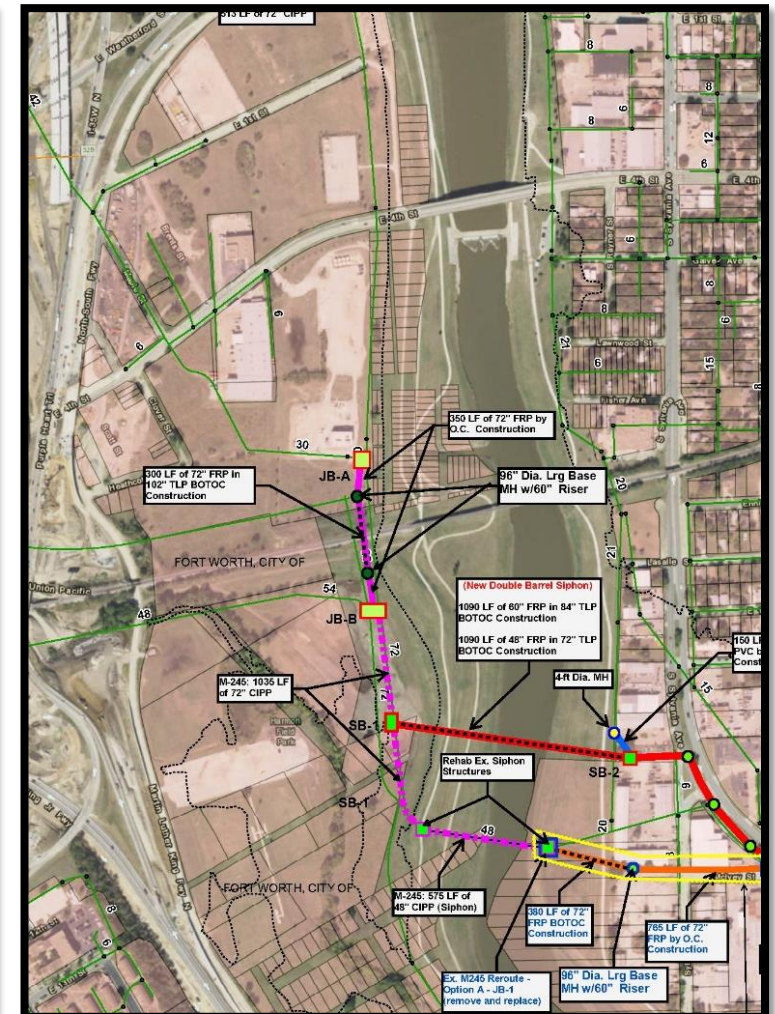
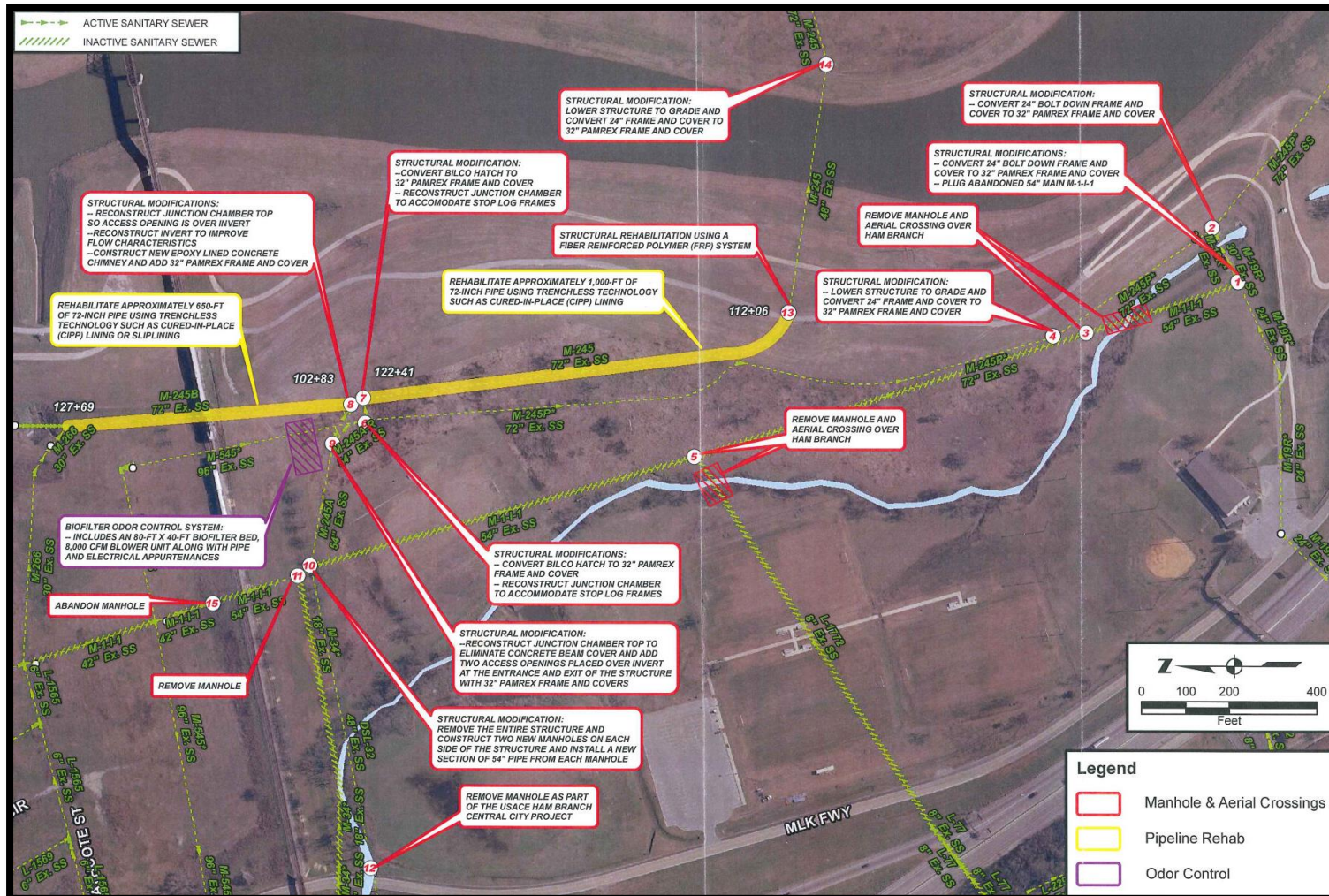
Table 1.
Sampling Data Summary

	H ₂ S (ppm)			Dissolved Sulfide (mg/l)	Observations
	Average	Max	Min		
M-245B	17	54	2	---	
M-545*	30	99	1	2.0	
Structure 10	---	---	---	N/D	Solids Too High for Reading
M-245A (Structure 9)	0	1	0	N/D	Solids Too High for Reading
M-245 (U/S Siphon)	---	---	---	---	
M-19R*	---	---	---	N/D	
M-245P*	12	31	1	N/D	

M-245 US Siphon Box Condition Assessment



Ham Branch Interceptors ICAP Recommendations



“Fort Worth – You have a Problem”

December 6, 2018

The Fort Worth Water Department (FWWD) was notified of two (2) sink holes in the WF Trinity River Floodway Levee by Tarrant Regional Water District (TRWD). Upon visiting the site, we observed this.....





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M-245 WF Trinity River “Levee” US Siphon Box





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and More Unpleasant Images like these....





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Sink Holes on the Move....

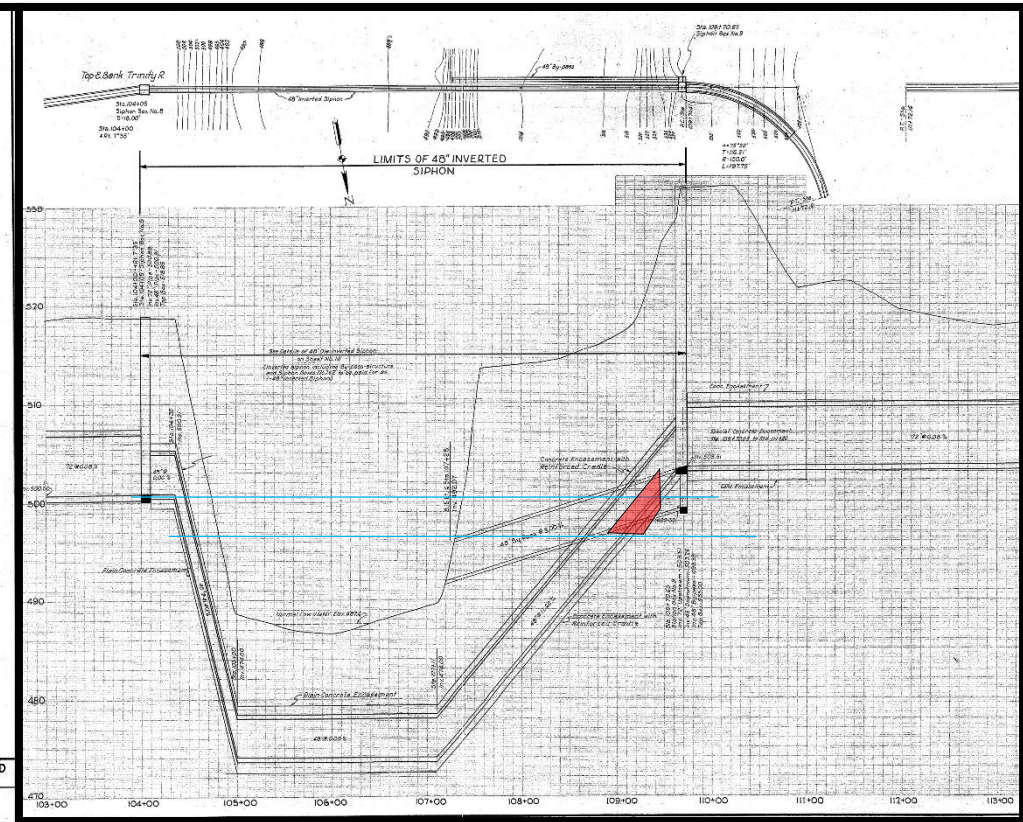
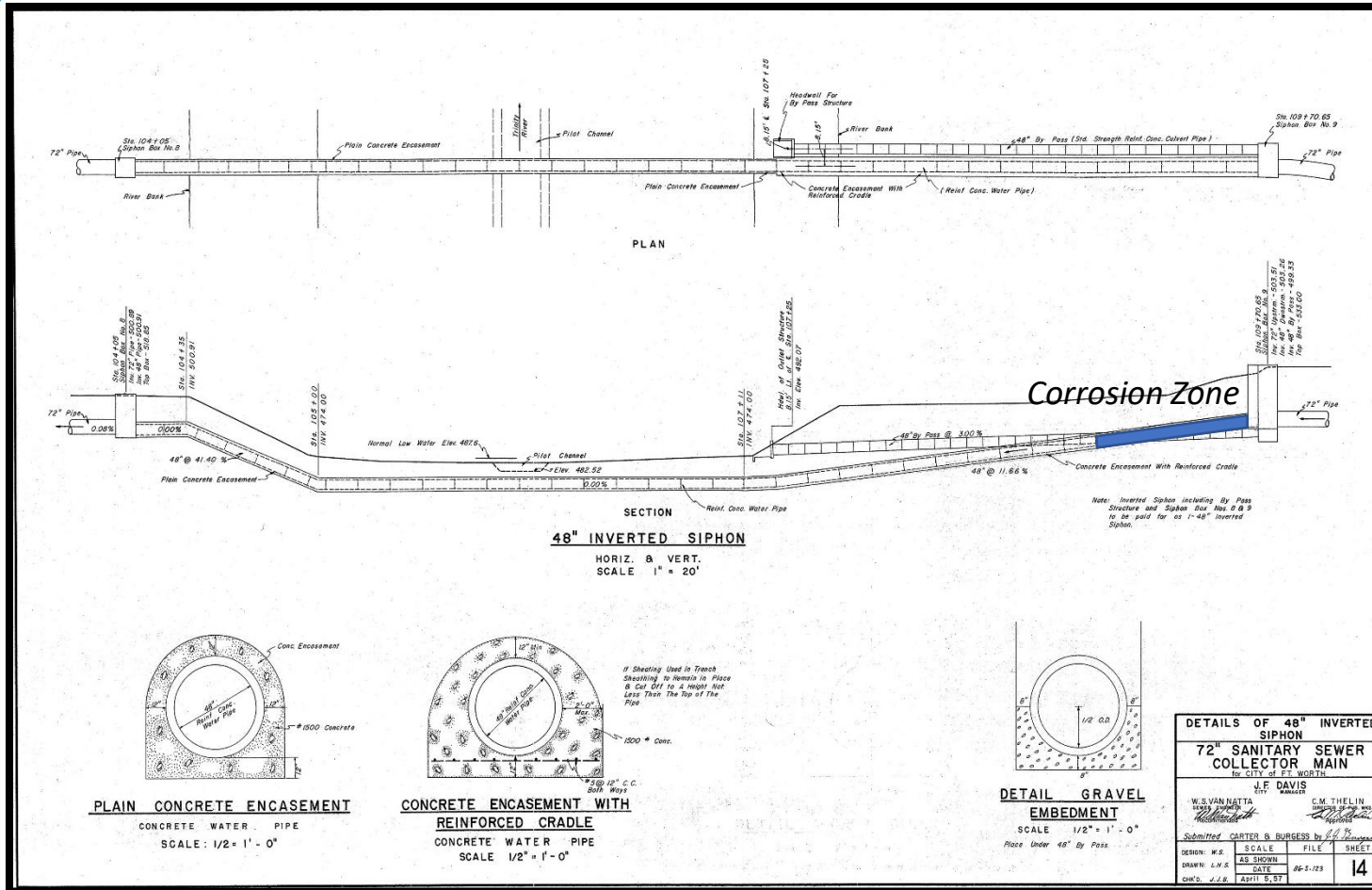




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M-245 Trinity River Inverted Siphon 1957 As-Built



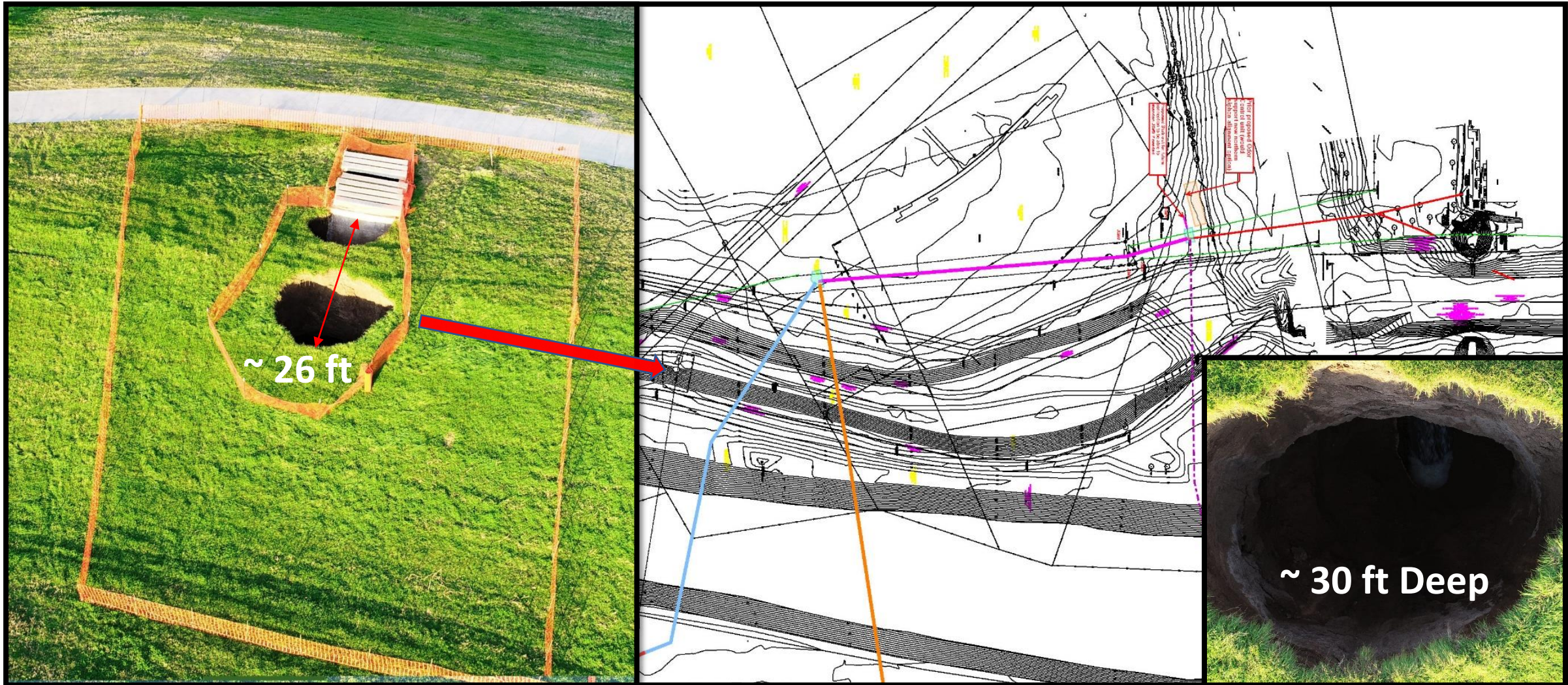
DETAILS OF 48" INVERTED SIPHON			
72" SANITARY SEWER COLLECTOR MAIN			
J.F. DAVIS			
W.B. VAN NATA			
C.M. THELIN			
Submitted CARTER & BURRESS by J.F. DAVIS			
DESIGN: W.B.	SCALE: AS SHOWN	FILE: 86-1-123	SHEET: 14
DRAWN: L.V.S.	DATE: APRIL 5, 57		
CHECKED: J.F. DAVIS			



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WF Floodway Survey Captured by Drone and Traditional Survey



Initial Remediation Action Plan Proposal to USACE/TRWD

Proposed 32-Ft Dia.
Tunnel Liner Plate (TLP)
Vertical Shaft to depths
of approximately 30-ft



- Install 16-ft Dia. TLP shaft for a Proposed 6-ft Dia. MH (23-ft deep) DS of the Pipe Failure for Bypass Discharge
- Design and Set up a 44-mgd bypass system to meet Peak Wet Weather Flows during Construction
- Dewater Ex. 48-inch Siphon to make the Force Main Discharge Connection (this required another manhole installed on the east side of the Trinity River prior to the DS Siphon Box)
- Comply with all USACE Design Criteria for Levee Repairs (6-in max soil lifts compacted to 90% (+) Std. Proctor Densities
- December 21, 2018 – TRWD/USACE Approved Vertical TLP Repair Plan



Unacceptable Material Delays – What about Plan B?

- January 11, 2019 Meeting: TRWD/USACE were notified that the 32-ft Dia. TLP shaft would take approximately 8 weeks to arrive
- Plan B defined as...

Implementation of an Old School Point Repair Plan

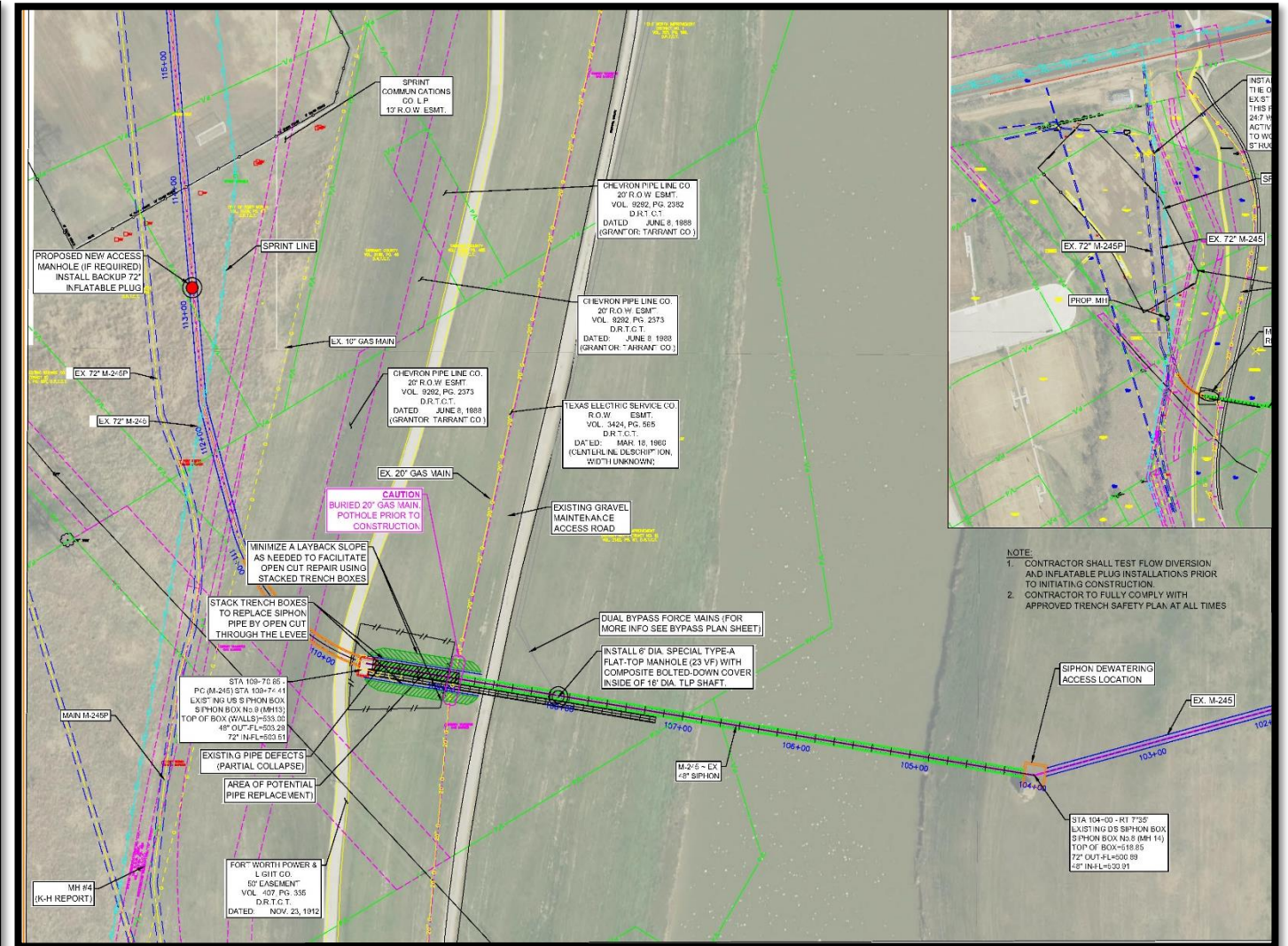
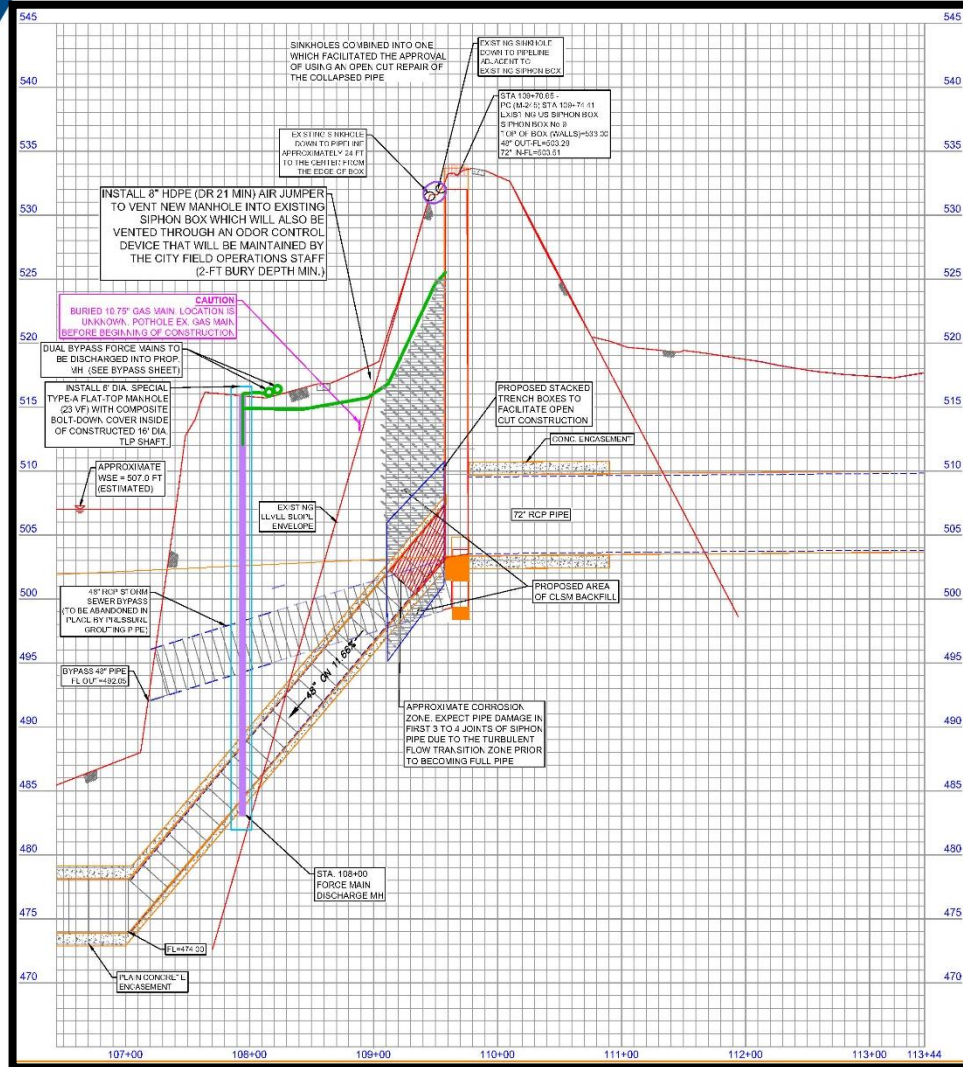
- Contractor benches side cross slopes and stack trench boxes in the levee to excavate down to the pipe and make that point repair.
- Plan B was verbal authorized by the USACE and Open Cut and Bypass Preparations began immediately
- Step 1: Evaluate surcharging impacts of applying 15 MGD Flow Diversion into M-245P using a new 72-inch inflatable pipe plug.
- This didn't go quite as well as planned....



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Plan B Design and Siphon Repair Profile



Emergency Bypass System

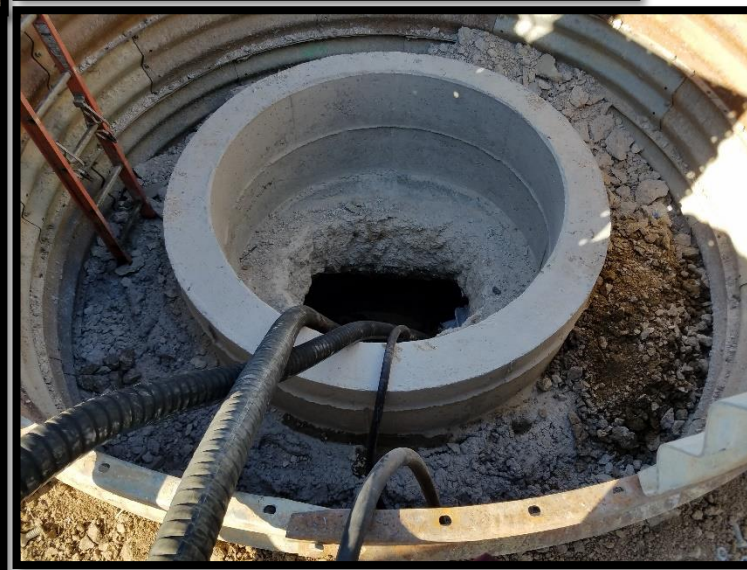




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Emergency Siphon Point Repair Construction





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Siphon Box Repairs

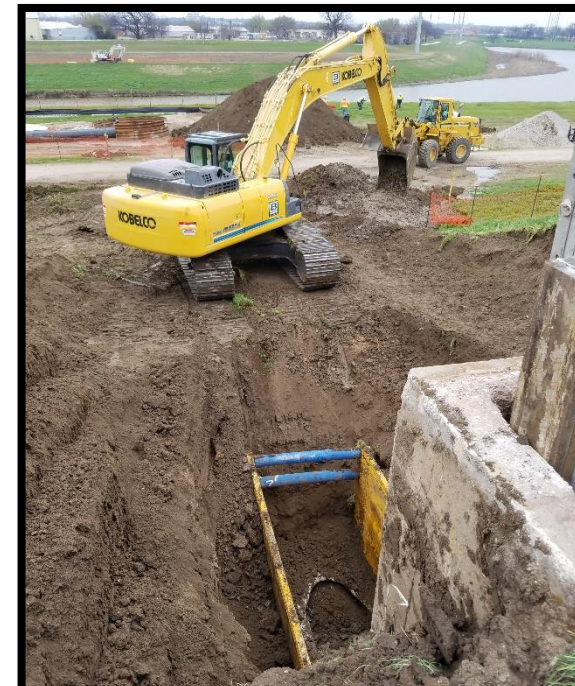




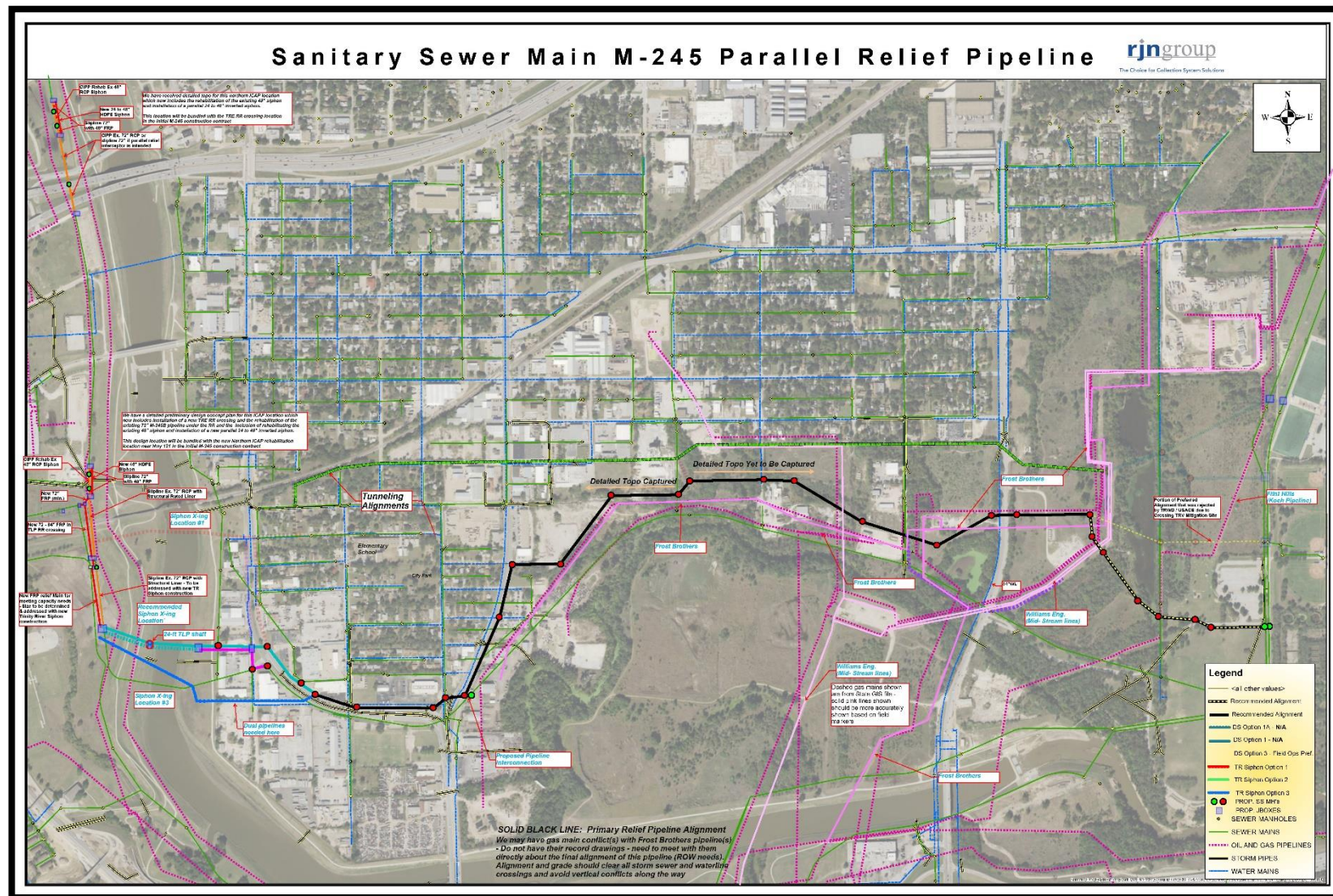
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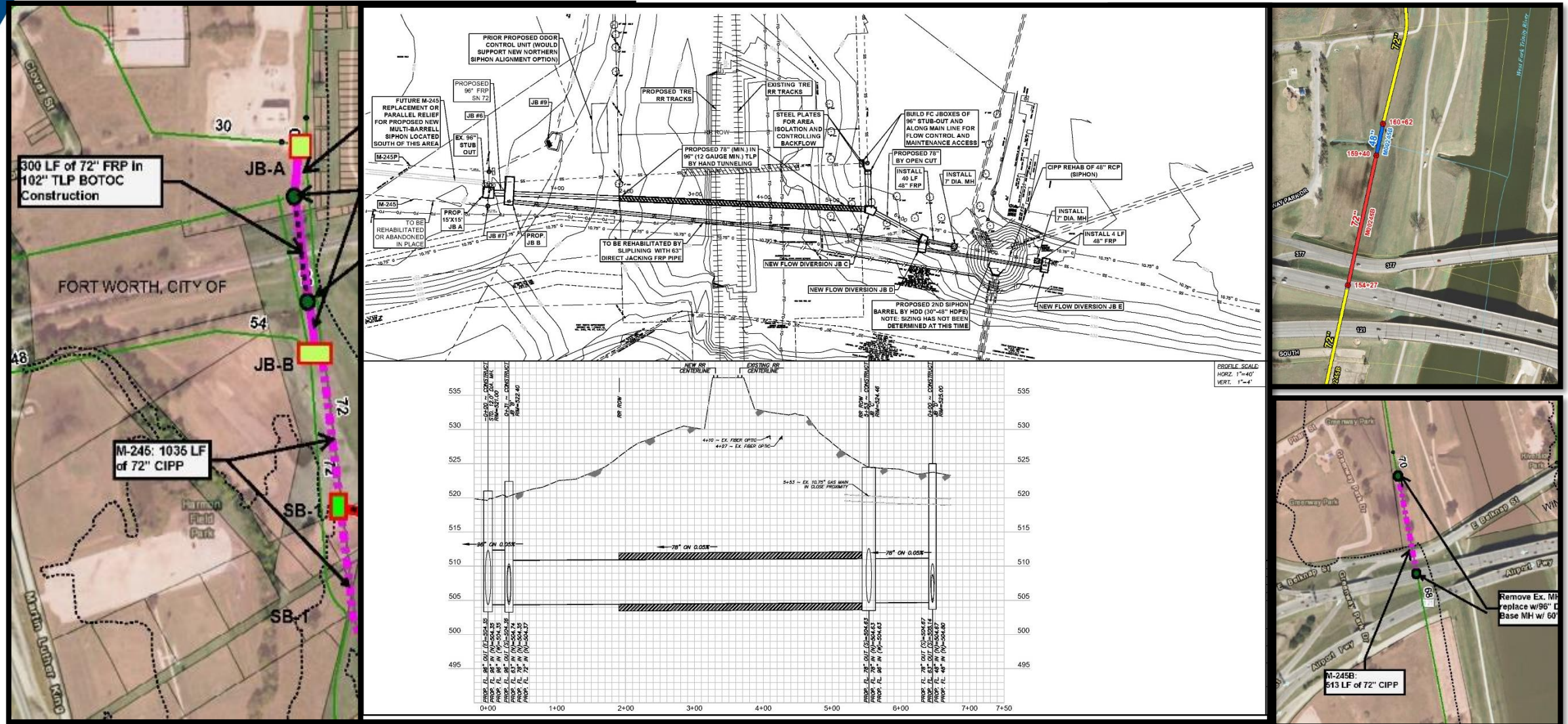
Emergency Siphon Point Repair Construction



M-245 Parallel Relief Pipeline Project – Next Steps



M-245 Parallel Relief Pipeline Project – Next Steps



QUESTIONS?

Thank You For Attending