Condition Assessment of NTMWD 20” Water Supply Line

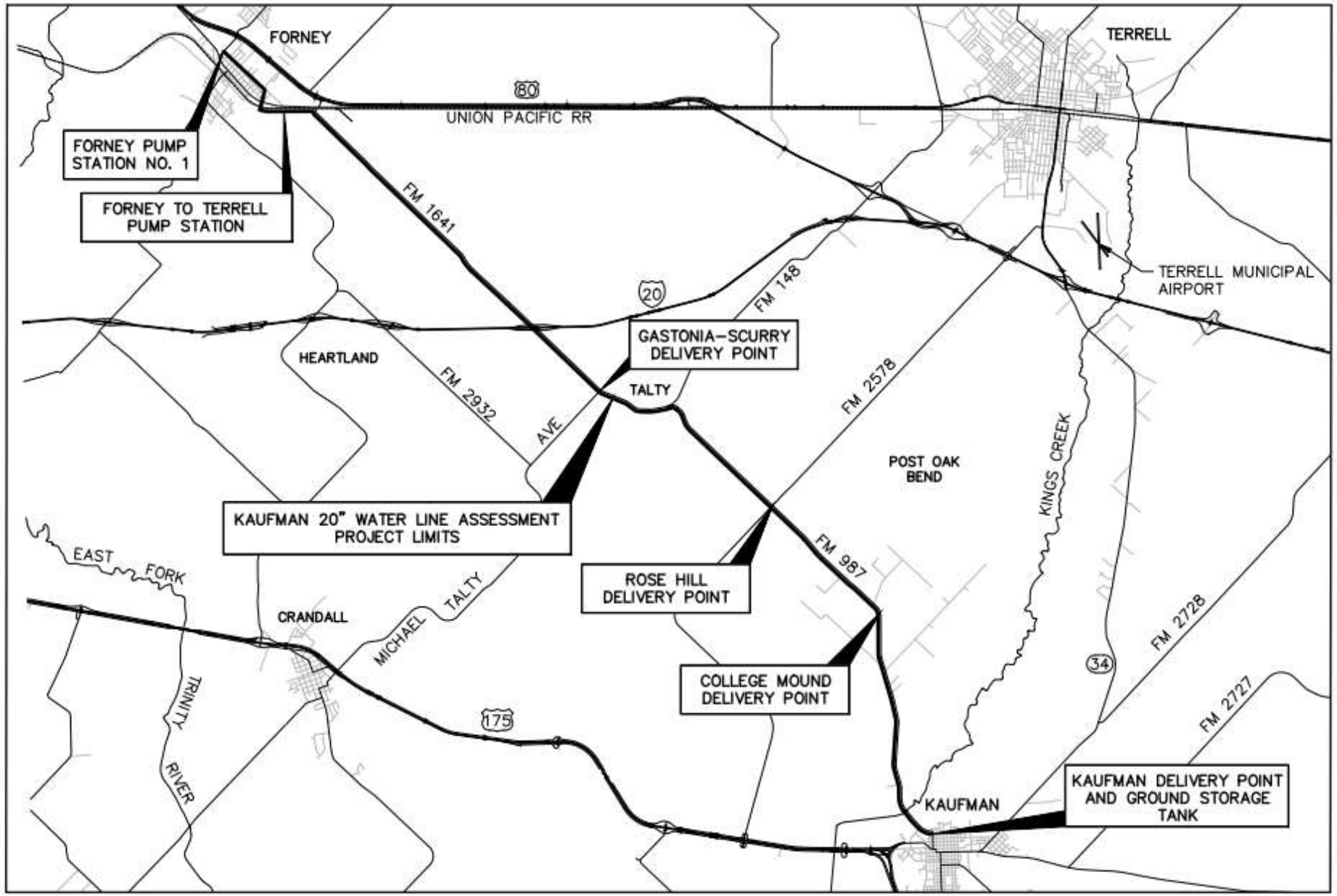
James Bryan, P.E.
Kimley-Horn and Associates, Inc.

Tuesday, January 28, 2020 – 9:00 AM

Room 202A – Track II Waterworks

Background Information

- C-303 pressure class 150 pipe manufactured in 1975
- Approximately 81,000 linear feet (15 miles)
- Single water line providing supply to several customers
- Existing asset management data supported need to assess

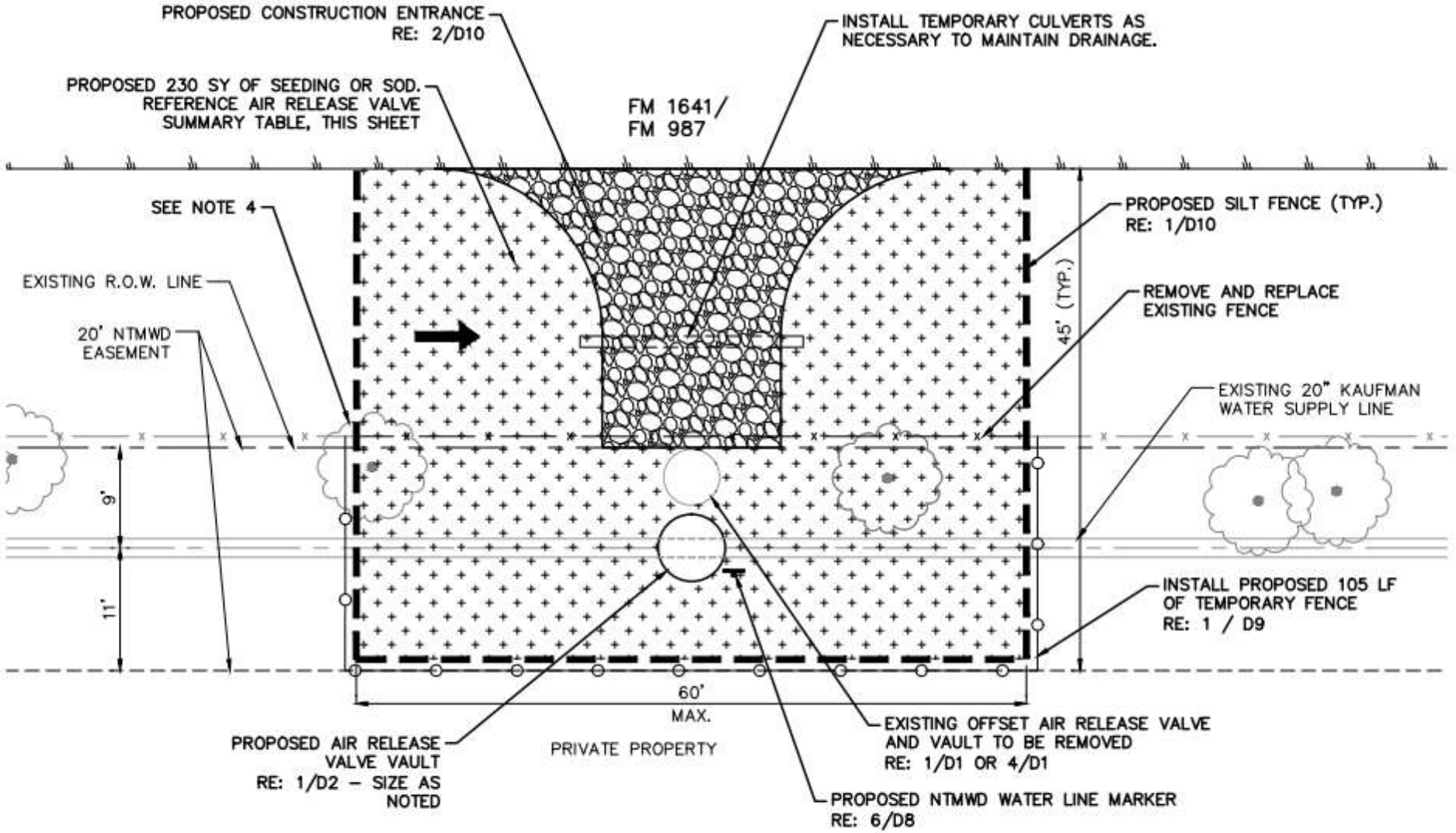

FORNEY
TERRELL
80
UNION PACIFIC RR
FORNEY PUMP STATION NO. 1
FORNEY TO TERRELL PUMP STATION
FM 1641
TERRELL MUNICIPAL AIRPORT
20
FM 148
GASTONIA–SCURRY DELIVERY POINT
HEARTLAND
FM 2932
AVE
TALTY
FM 2578
POST OAK BEND
KINGS CREEK
KAUFMAN 20" WATER LINE ASSESSMENT PROJECT LIMITS
EAST FORK
FM 987
ROSE HILL DELIVERY POINT
CRANDALL
MICHAEL TALTY
COLLEGE MOUND DELIVERY POINT
34
FM 2728
175
FM 2727
TRINITY RIVER
KAUFMAN
KAUFMAN DELIVERY POINT AND GROUND STORAGE TANK

Scope Overview

- Preliminary site investigation
- Evaluate access locations and determine inspection limits
- Develop construction and inspection schedule
- Prepare bid documents for pre-inspection improvements
- Perform inspection
- Review inspection results and recommendations
- Prepare replacement strategy and capital improvement plan

Pre-Inspection Improvements

- Installation of access manways for equipment entry/extraction
- Modifications to 25 existing air release valves
- Construction sequencing plan
- Dewatering plan
- TxDOT permitting
- Standard site plan for most locations
- Individual site plans for unique locations
- Access plans

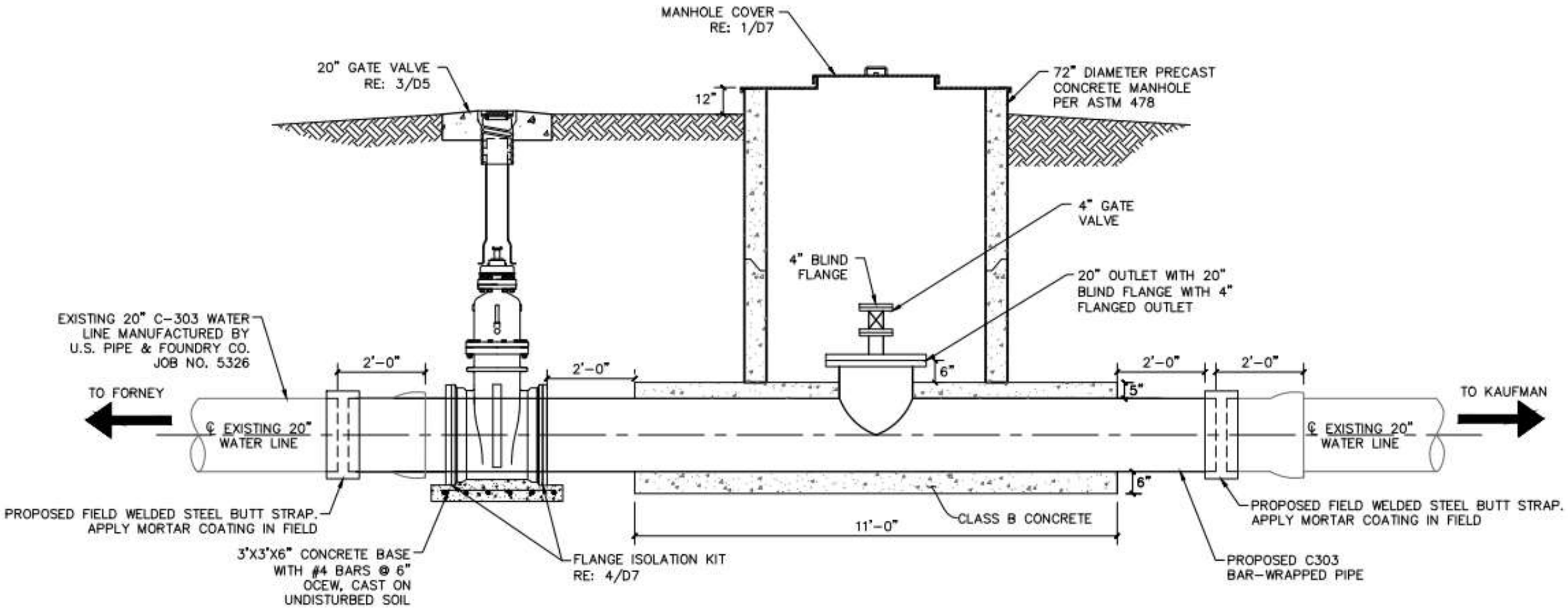


Typical Air Release Valve Site Plan 2

DETAIL

2
W2

SCALE: 1" = 10'



2
D5

Access Manway and Isolation Valve #3
SECTION

SCALE: 1/2" = 1'-0"

Inspection Phase

- Equipment
  - SmartBall®
  - PipeDiver®
- Segments
  - SmartBall® - 3 segments
  - PipeDiver® - 2 segments, 3 runs per segment (1 for bars, 2 for wall loss)
- Schedule
  - SmartBall® - 3 days (April 3 – 6)
  - PipeDiver® - 3 weeks (April 10 – May 3)

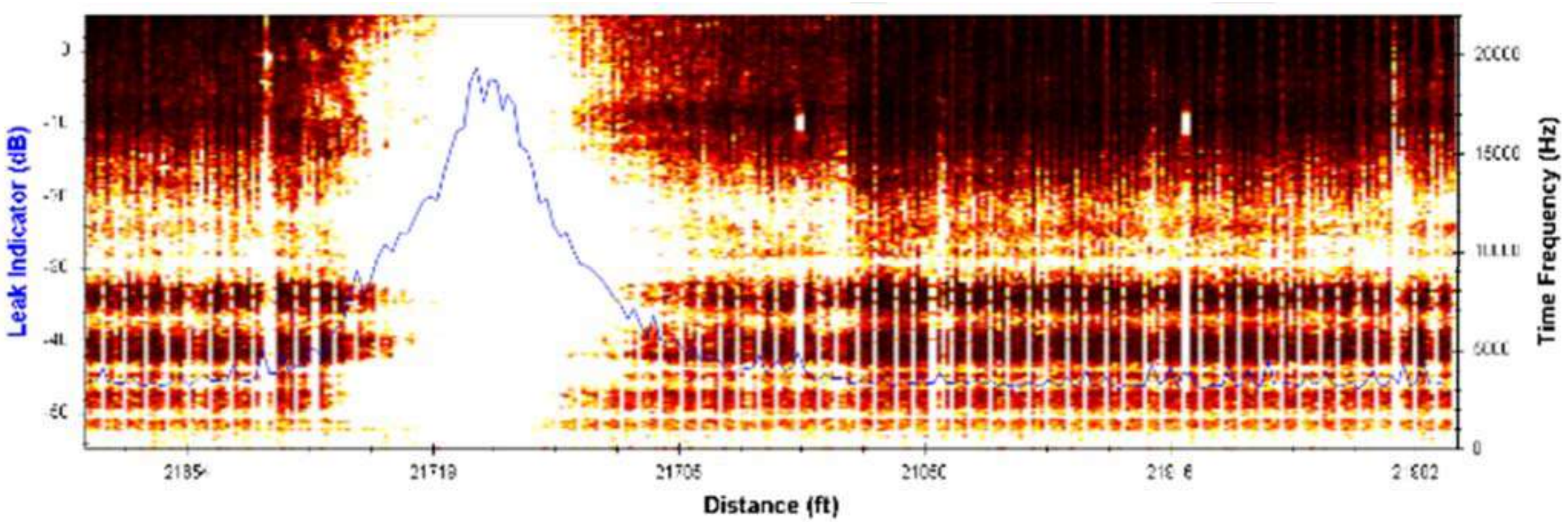
Results

- SmartBall® Inspection
  - Two leaks detected
    - Small, unknown type
    - Large, pipe joint type
  - No static air pockets detected

Table 2.3: Leak #1	
Leak Location Description	Event lines up along the side of Farm to Market Road 987, upstream of ARV A-18
Leak Distance from Nearest Downstream Tracking Location	1,026 feet upstream of ARV A-18
Leak Size	Small
Leak Type	Unknown

Table 2.4: Leak #2	
Leak Location Description	Event lines up on the side of Farm to Market Road 987 West Pyle Street along Kings Creek
Leak Distance from Nearest Downstream Tracking Location	101 feet upstream of ARV A-25
Leak Size	Large
Leak Type	Possible Joint Leak- Map and data show a small bend where the leak is located

Leak #2 – Large Leak at Pipe Joint



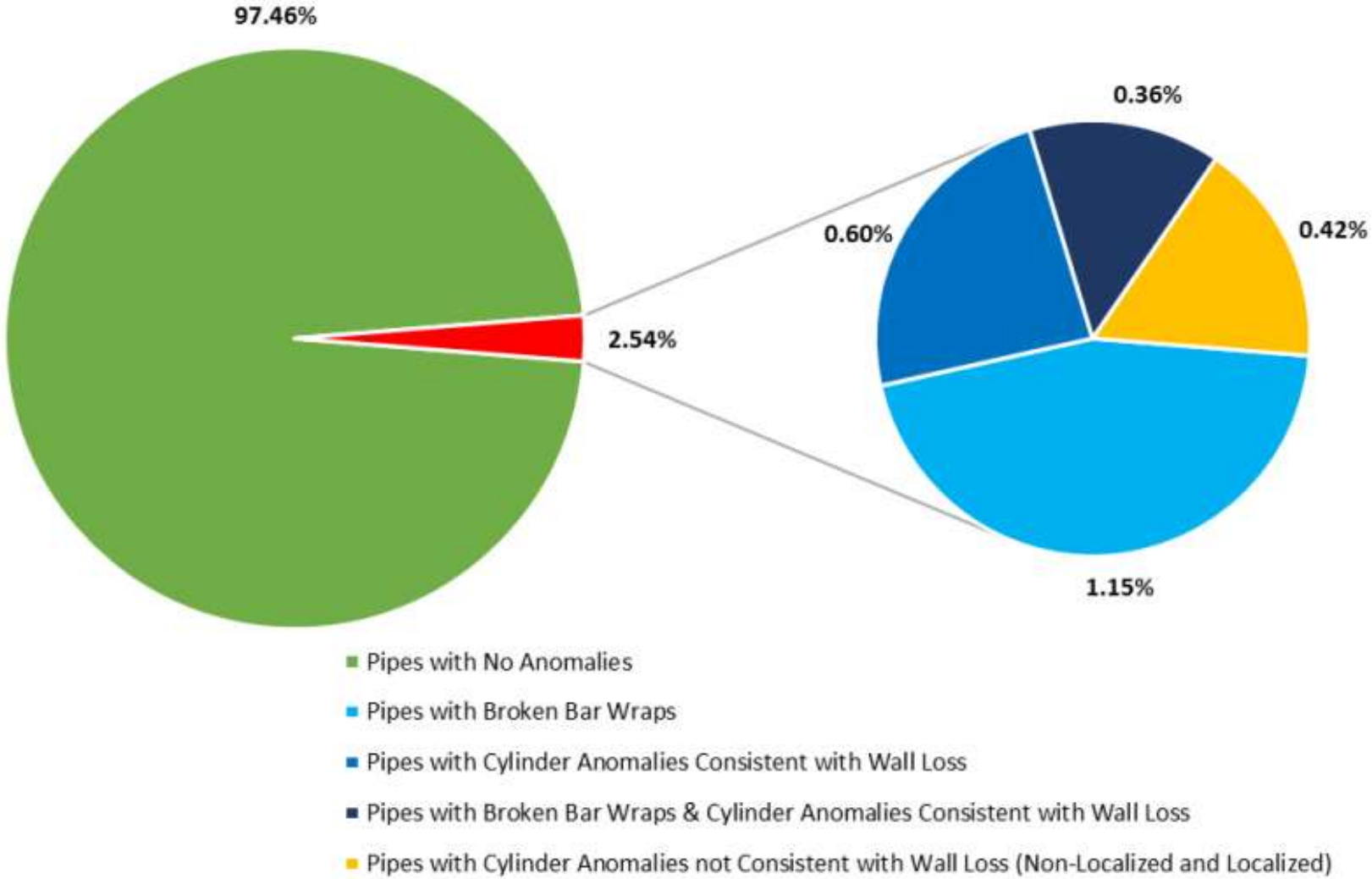
Results

- PipeDiver® Inspection

Table 2.6: Summary of Analysis Results

Segment	Diameter (inches)	Number of Inspected Pipes	Pipes with Broken Bar Wraps	Pipes with Cylinder Anomalies Consistent with Wall Loss	Pipes with Cylinder Anomalies not Consistent with Wall Loss (Localized)	Pipes with Cylinder Anomalies not Consistent with Wall Loss (Non-localized)
1	20	982	8	6	2	4
2		674	17	10	1	0
Total		**1,656**	**25**	**16**	**3**	**4**

Results


97.46%
2.54%
0.36%
0.60%
0.42%
1.15%
Pipes with No Anomalies
Pipes with Broken Bar Wraps
Pipes with Cylinder Anomalies Consistent with Wall Loss
Pipes with Broken Bar Wraps & Cylinder Anomalies Consistent with Wall Loss
Pipes with Cylinder Anomalies not Consistent with Wall Loss (Non-Localized and Localized)

Data Analysis

- Three-dimensional, non-linear finite element analysis (FEA)
- Pipe performance curves based on FEA
  - Visible cracking of inner liner and steel yield limits
  - Design operating plus surge pressure
  - Various depths of cover based on as-built drawings

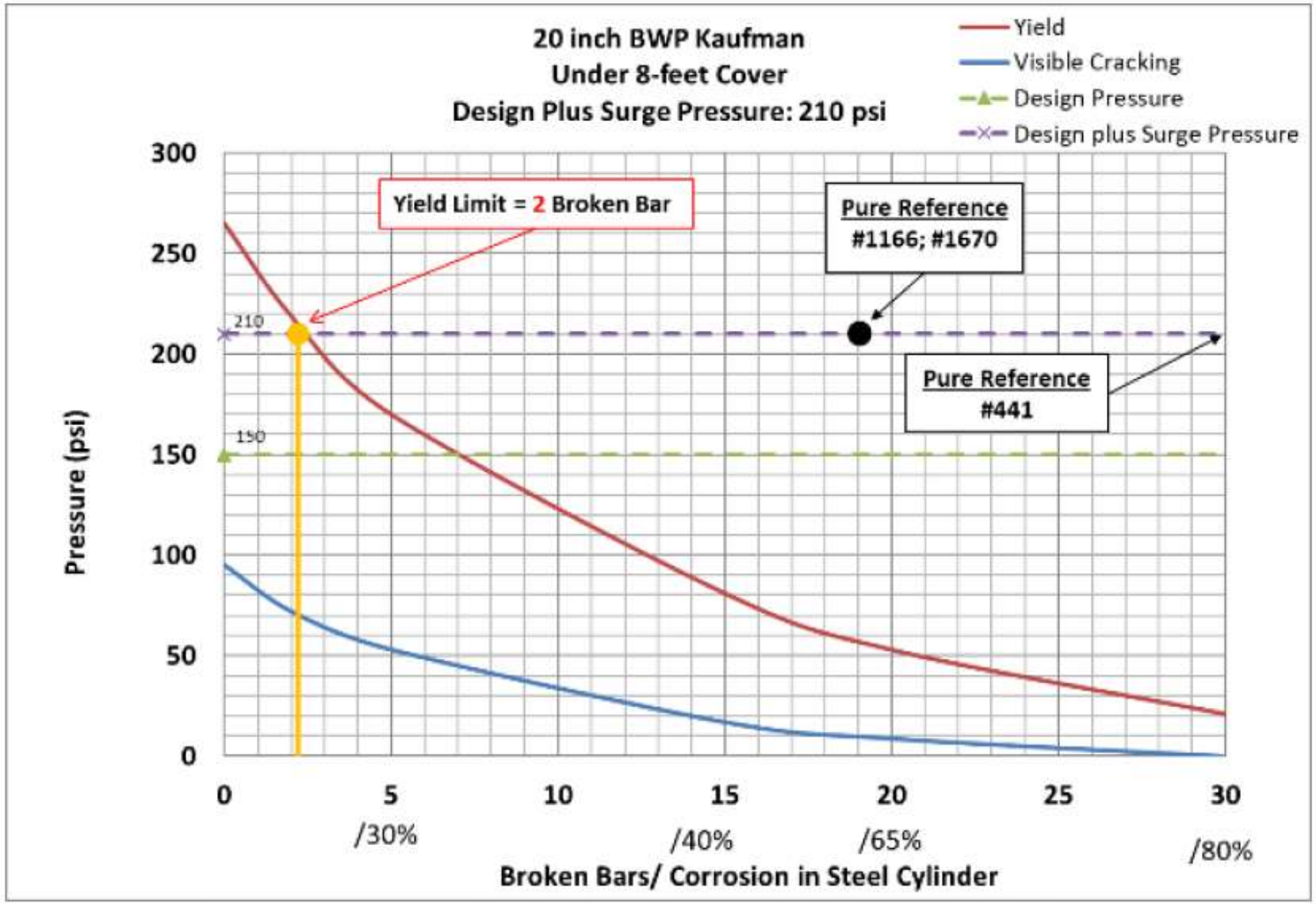


Figure 3.1: Performance Curve for the 20-Inch Class 150 BWP Under 8-Feet of Cover

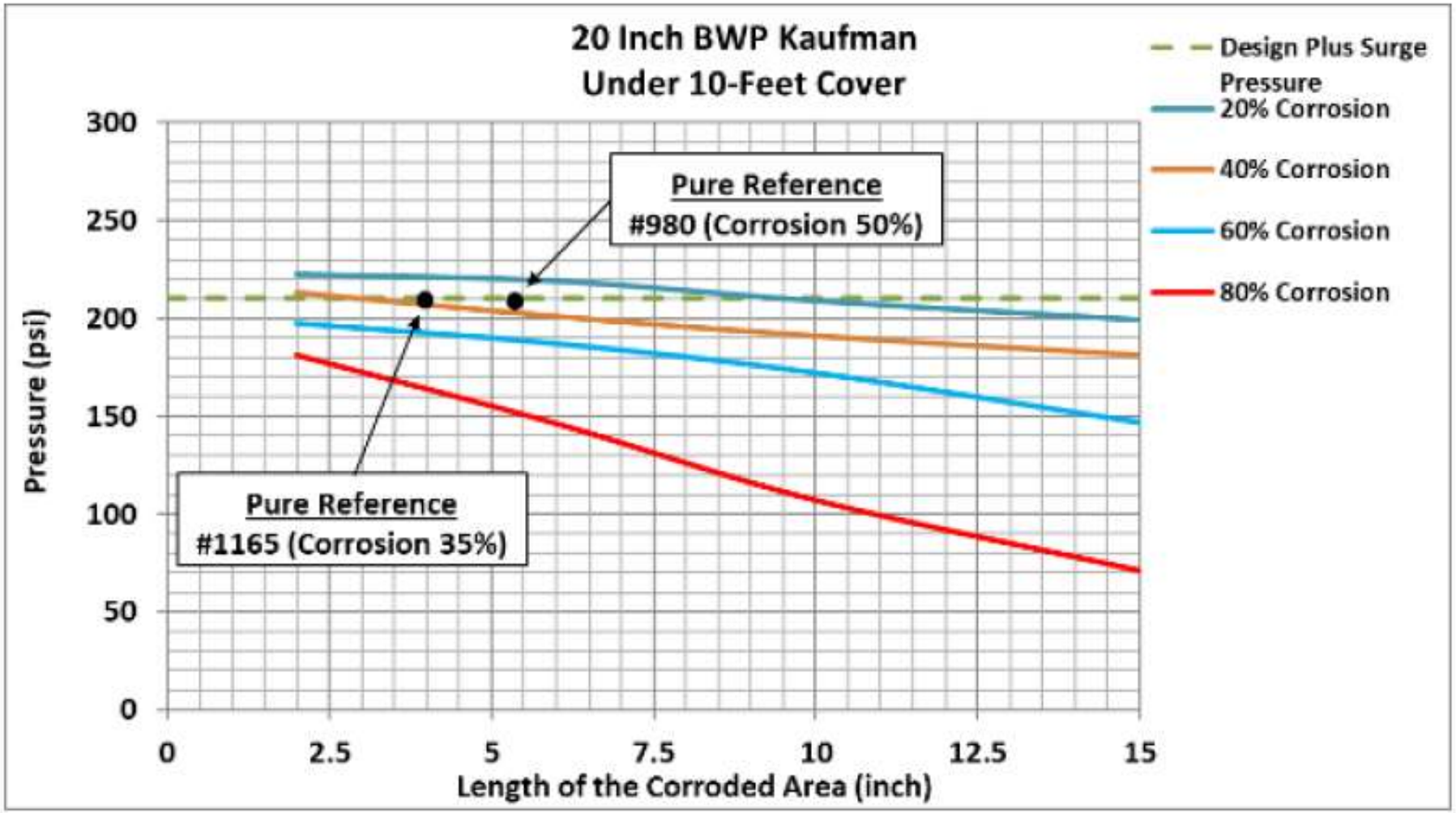


Figure 3.3: Corrosion Performance Curve for the 20-Inch Class 150 BWP Under 10-Feet of Cover

Recommendations

- Repair two leaks
- Repair 1 pipe segment containing up to 64 bar breaks
- Repair 6 pipe segments with combined bar breaks and corrosion
- Observe condition of excavated pipe segments to determine approach for remaining damaged segments

Cost Breakdown

- Pre-inspection improvements: $1.4 million
- Pipeline inspection: $831,000
- Repair of damaged sections: $1.6 million (projected)

Considerations/Things to Know

- PipeDiver® can’t pass through butterfly valves at this pipe size
- 30% detection threshold
- Model has to be calibrated based on previous testing