UCT The Underground Utilities Event
Underground Construction Technology | January 28-30, 2020 | Fort Worth, TX

# A Case Study on a Trenchless Crossing Under USACE Levee

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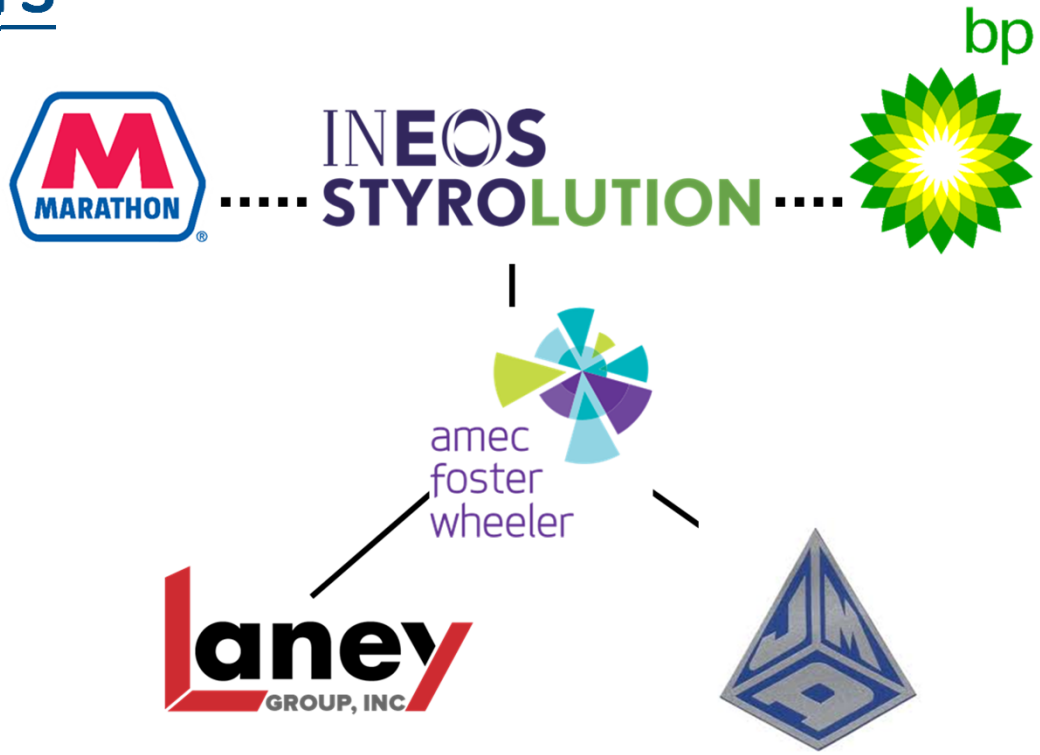
# Project Location – Galveston County, TX

# Project Background

- INEOS Styrolution (INEOS) facility operates shares water and wastewater facilities with adjacent to the Marathon Galveston Bay Refinery (GBR) and BP Chemicals.
- In 2019, INEOS was required to reduce the allowable water flow from a hydraulic maximum of 2,200 gpm to as low as 300 gpm.
- Necessary to be in compliance with National Emission Standards for Hazardous Pollutants (NESHAPs) 40 CFR QQQ regulations.
- In response, INEOS Styrolution installed a wastewater discharge pipeline to transfer wastewater from the INEOS Styrolution, Texas City facility to the Gulf Coast Waste Disposal Authority facility (GCA.)

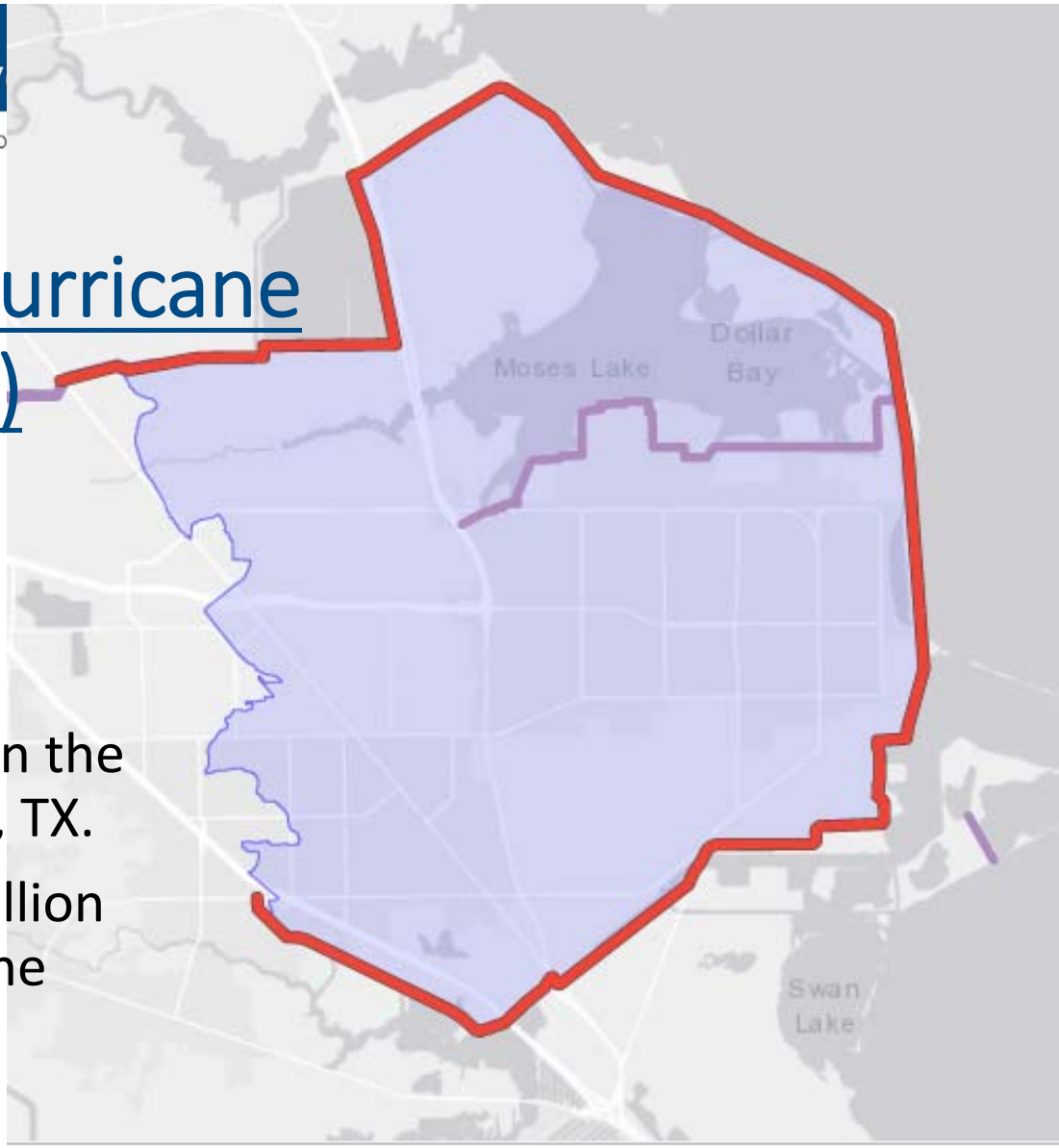
# Project Stakeholders

- INEOS Styrolutions
- Marathon Petroleum
- BP Chemical
- Amec Foster Wheeler
- Laney Directional Drilling
- J. M. Davidson, Inc.



# Texas City & Vicinity Hurricane Flood Protection (HFP)

- Constructed in 1930.
- 20.6 miles of levees.
- 1.35 miles of flood wall.
- Reduces risk for 45,000 people in the cities of Texas City & La Marque, TX.
- $4 billion in property and $20 billion petrochemical industry within the leveed system.



# Design & Permitting

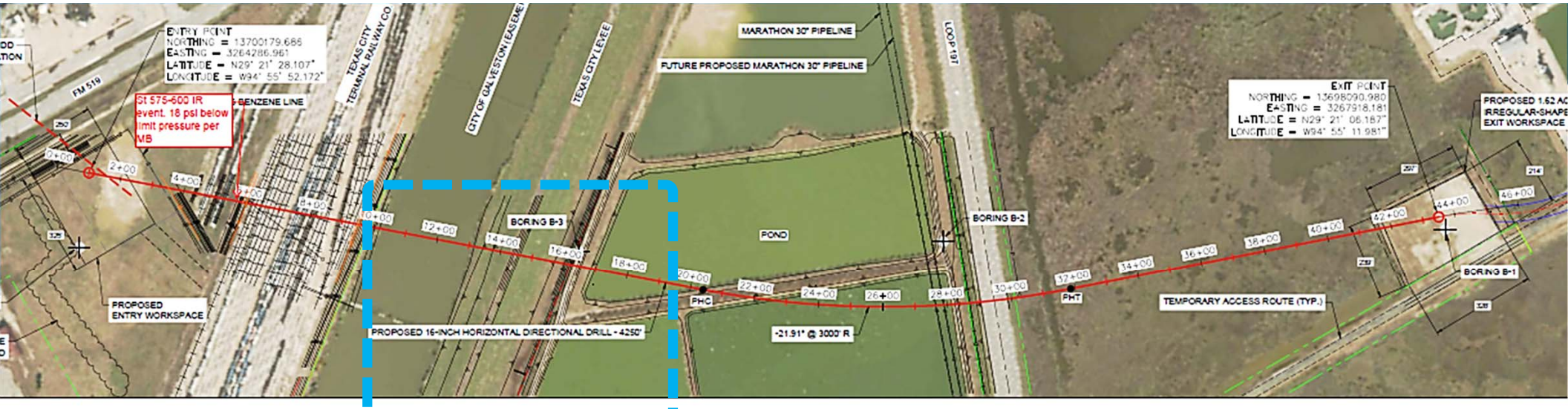
- INEOS Styrolution submitted an initial 408 permit application to the USACE Galveston District in July 2017.
- USACE levee requiring FS=2 and heightened sensitivity of USACE due to other construction challenges near by led to higher level of scrutiny than usual of design and permit.
- Adjusting design and permitting documents during the process as perpendicular pipeline installed via HDD was constructed.
- Discuss this crossing being the final HDD crossing using HDD in Galveston Country.

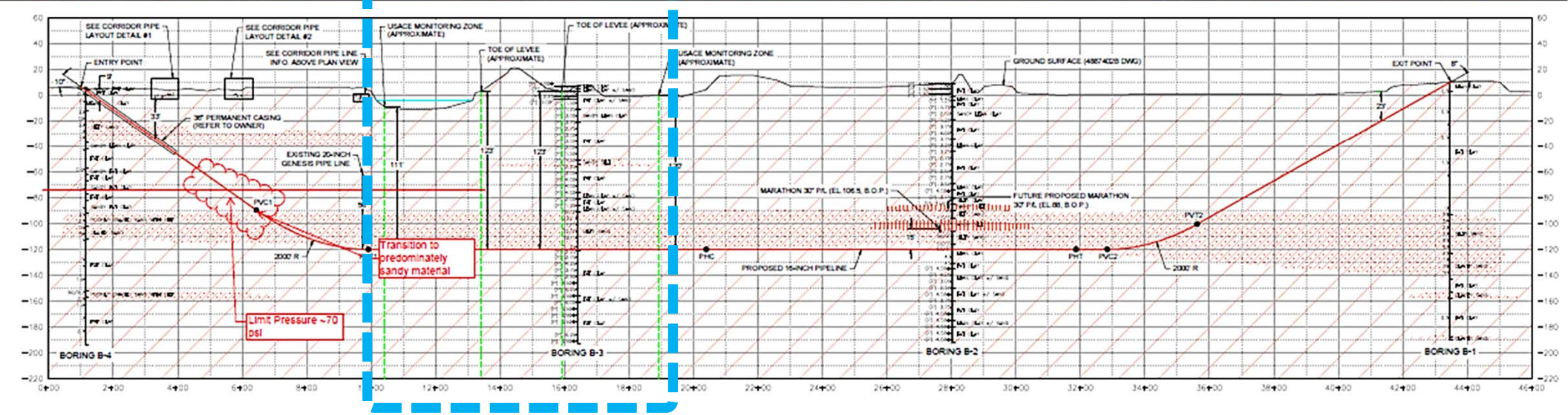
# Engineering & Design

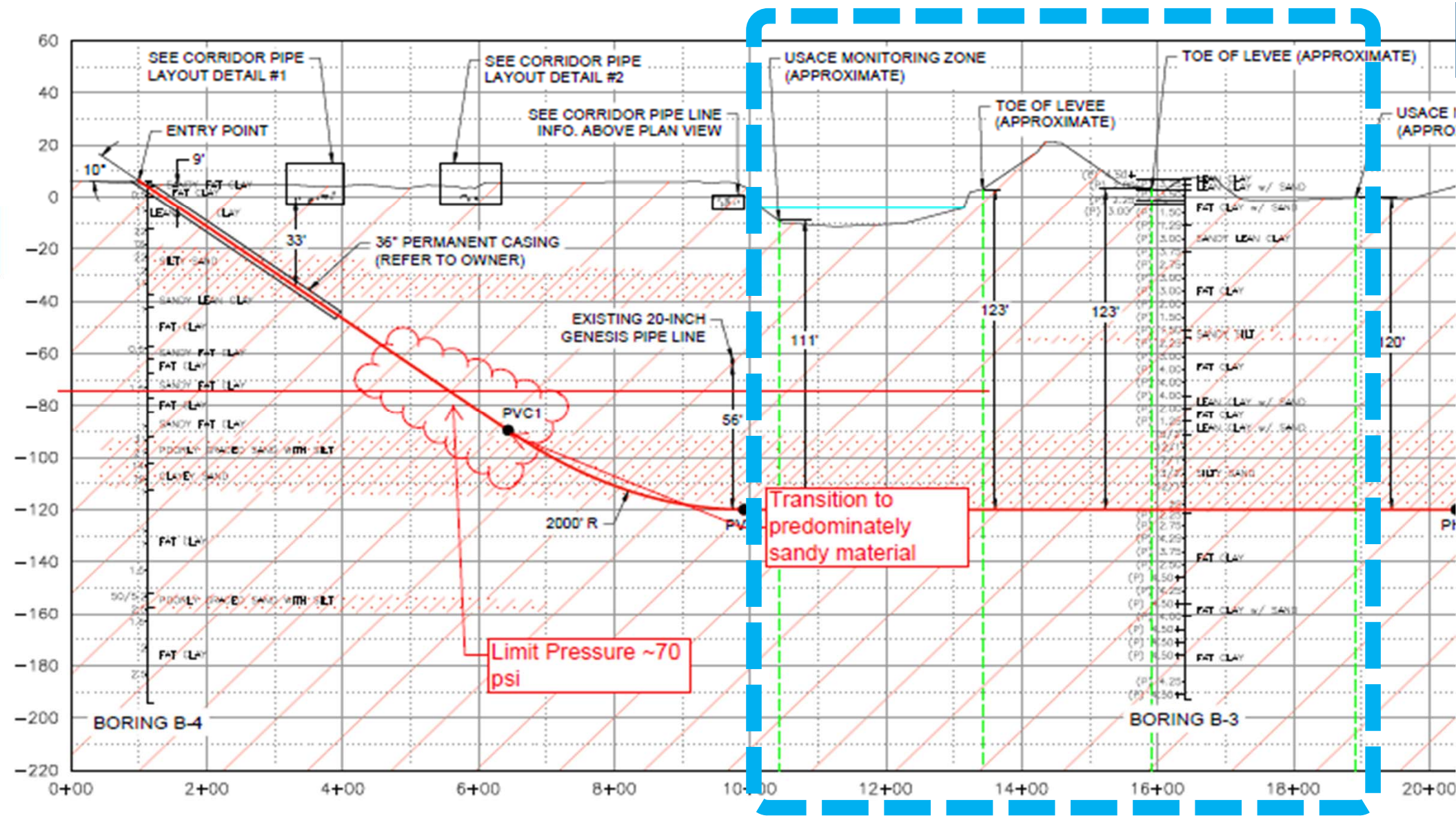
- Casing Pipe: 16” OD x 0.250” w.t.
- Casing Pipe Grade: A53 X-42 Steel
- Carrier Pipe: 8.625” OD DR-9 IPS 8
- Carrier Pipe Grade: HDPE 4710
- Design Factor: 0.72
- Design Radius: 2,000’ Vertical
  3,000’ Horizontal
- Minimum Radius: 1,400’ Vertical
- Horizontal Length of Crossing: 4,250’

HORIZONTAL DIRECTIONAL DRILL DATA
TEXAS HURRICANE PROTECTION LEVEE HDD

| DESCRIPTION | STATION (ft) | ELEVATION (ft) |
|---|---|---|
| ENTRY @ 10° | 1+00.00 | 6.24 |
| PVC1 = 2000’ RADIUS | 6+43.60 | −89.62 |
| PVT1 = | 9+90.90 | −120.00 |
| PHC = −21.91° 3000’ RADIUS | 20+39.46 | −120.00 |
| PHT = | 31+86.55 | −120.00 |
| PVC2 = 2000’ RADIUS | 32+83.34 | −120.00 |
| PVT2 = | 35+61.69 | −100.54 |
| EXIT @ 8° | 43+50.00 | 10.25 |
| HORIZONTAL DISTANCE (ft) = 4250.00 | | |
| DIRECTIONAL DRILL PIPE LENGTH (ft) = 4268.81 | | |


ENTRY POINT
NORTHING = 13700179.686
EASTING = 3264286.961
LATITUDE = N29° 21' 28.107"
LONGITUDE = W94° 55' 52.172"
St 575-600 IR event. 18 psi below limit pressure per MB
BENZENE LINE
FM 519
TEXAS CITY TERMINAL RAILWAY CO
CITY OF GALVESTON EASEMENT
TEXAS CITY LEVEE
MARATHON 30" PIPELINE
FUTURE PROPOSED MARATHON 30" PIPELINE
LOOP 197
EXIT POINT
NORTHING = 13698090.980
EASTING = 3267918.181
LATITUDE = N29° 21' 06.187"
LONGITUDE = W94° 55' 11.981"
PROPOSED 1.62 AC IRREGULAR-SHAPE EXIT WORKSPACE
BORING B-3
POND
BORING B-2
BORING B-1
PHC
PHT
PROPOSED ENTRY WORKSPACE
PROPOSED 16-INCH HORIZONTAL DIRECTIONAL DRILL - 4250'
-21.91° @ 3000' R
TEMPORARY ACCESS ROUTE (TYP.)


SEE CORRIDOR PIPE LAYOUT DETAIL #1
SEE CORRIDOR PIPE LAYOUT DETAIL #2
SEE CORRIDOR PIPE LINE INFO. ABOVE PLAN VIEW
USACE MONITORING ZONE (APPROXIMATE)
TOE OF LEVEE (APPROXIMATE)
ENTRY POINT
30" PERMANENT CASING (REFER TO OWNER)
EXISTING 20-INCH GENESIS PIPE LINE
PVC1
2000' R
Transition to predominately sandy material
Limit Pressure ~70 psi
GROUND SURFACE (4867402S DWG)
EXIT POINT
MARATHON 30" P/L (EL 105.5, B.O.P.)
FUTURE PROPOSED MARATHON 30" P/L (EL 88, B.O.P.)
PVT2
PVC2
PHC
PHT
PROPOSED 16-INCH PIPELINE
BORING B-4
BORING B-3
BORING B-2
BORING B-1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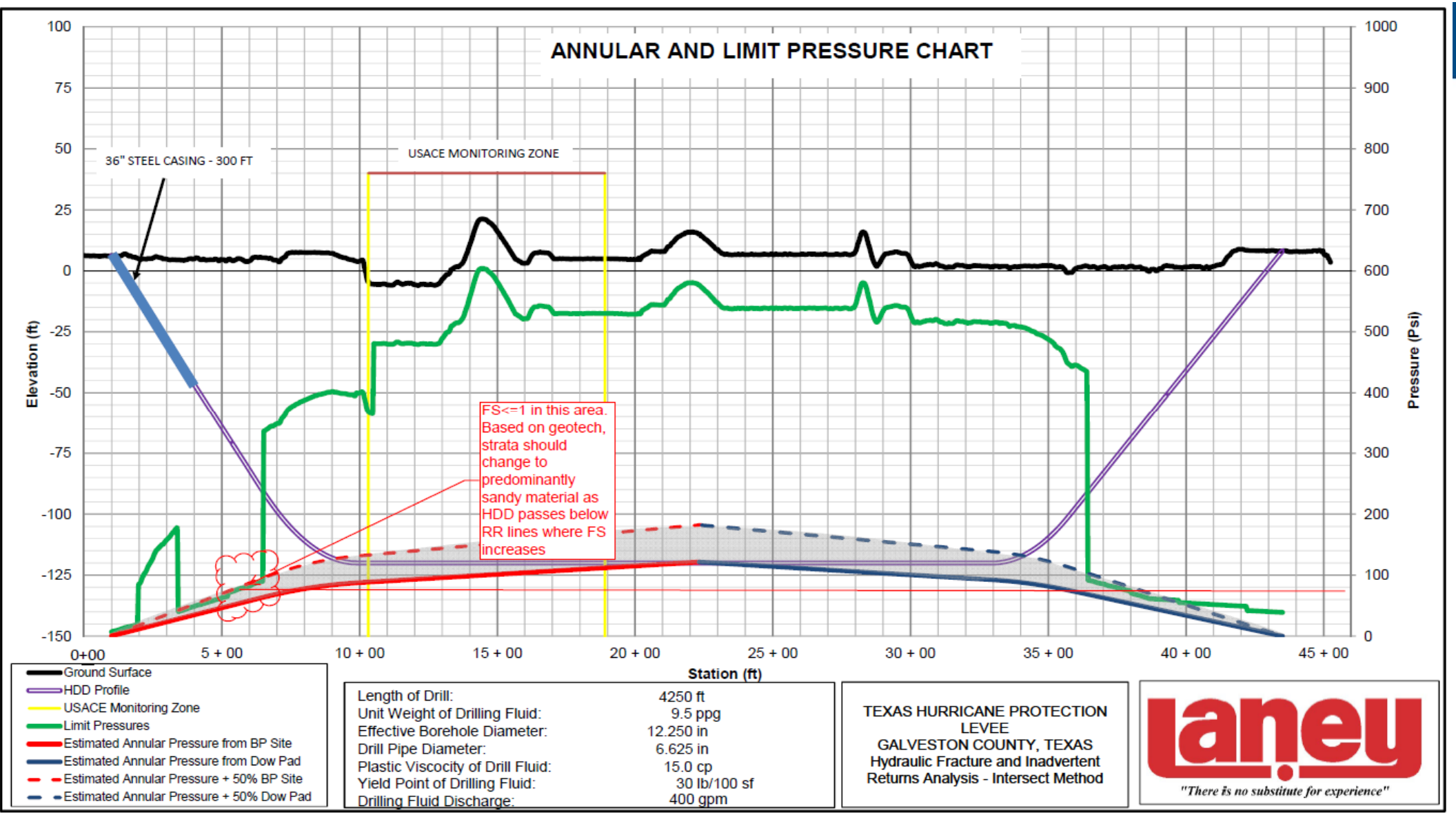
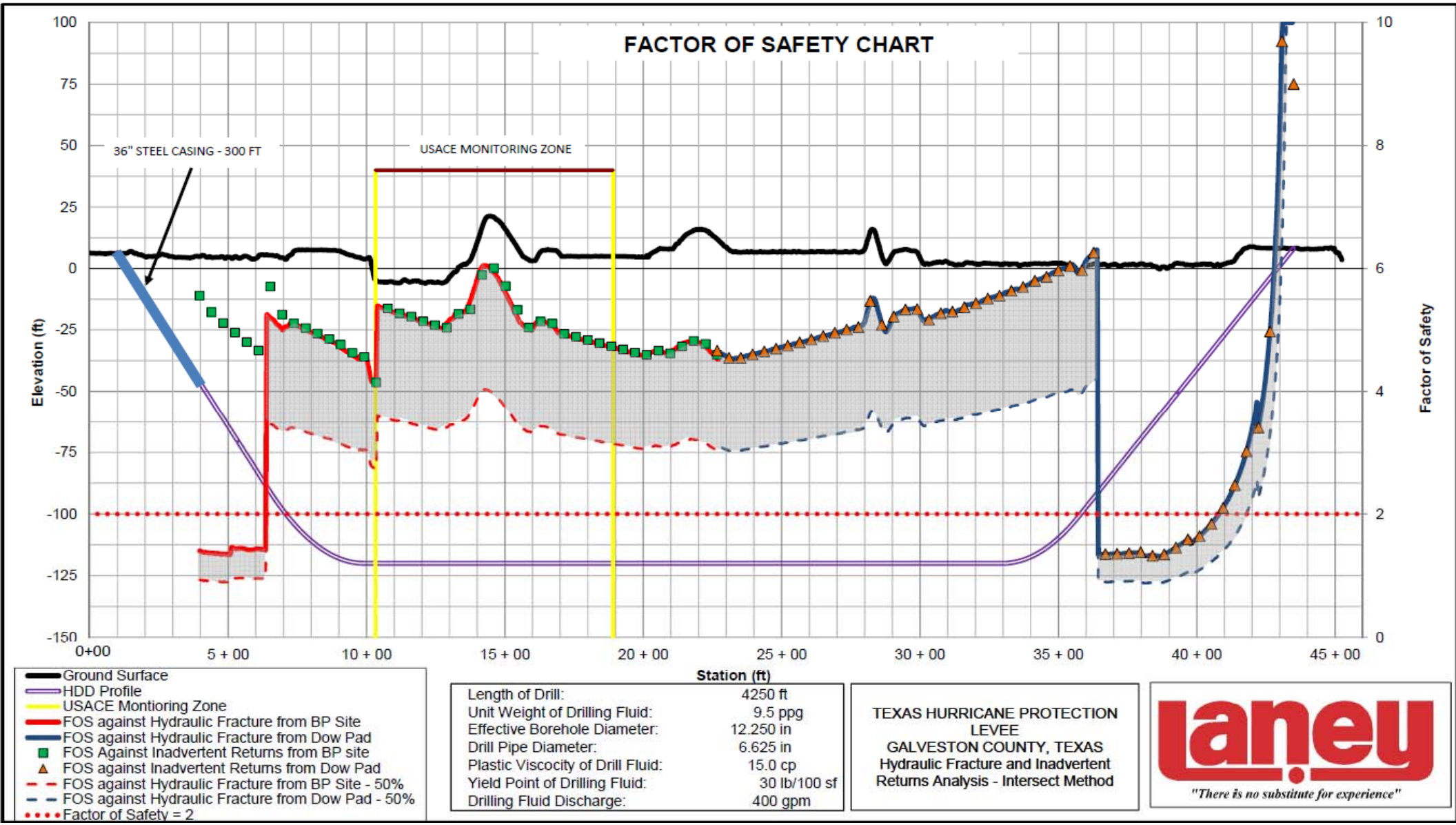
USACE MONITORING ZONE (APPROXIMATE)
TOE OF LEVEE (APPROXIMATE)
TOE OF LEVEE (APPROXIMATE)
ENTRY POINT
10°
9°
33'
36" PERMANENT CASING (REFER TO OWNER)
EXISTING 20-INCH GENESIS PIPE LINE
56'
111'
123'
123'
120'
PVC1
2000' R
Transition to predominately sandy material
Limit Pressure ~70 psi
BORING B-4
BORING B-3
60
40
20
0
−20
−40
−60
−80
−100
−120
−140
−160
−180
−200
−220
0+00
2+00
4+00
6+00
8+00
10+00
12+00
14+00
16+00
18+00
20+00




| | |
|---|---|
| Length of Drill: | 4250 ft |
| Unit Weight of Drilling Fluid: | 9.5 ppg |
| Effective Borehole Diameter: | 12.250 in |
| Drill Pipe Diameter: | 6.625 in |
| Plastic Viscocity of Drill Fluid: | 15.0 cp |
| Yield Point of Drilling Fluid: | 30 lb/100 sf |
| Drilling Fluid Discharge: | 400 gpm |

TEXAS HURRICANE PROTECTION LEVEE
GALVESTON COUNTY, TEXAS
Hydraulic Fracture and Inadvertent Returns Analysis - Intersect Method

Laney
"There is no substitute for experience"

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# Construction – Equipment Selection

- Executed using the intersect method and utilized gyroscopic steering tools because wireline over the water was not permitted.
- Both the primary rig and the auxiliary rig had a Push/Pull Capacity of 500,000 lbs.

# Construction - Tooling & Casing

- Drill Pipe - 6.625-inch-diameter
- 31’ Non-magnetic (Monel) steering collar
- 12.25” MT tri-cone drill bit
- 20” Barrel Reamer
- 24” Barrel Reamer
- 30” Fly Cutter

# Casing

Casing @ Entry:

- 295-feet of 36-inch steel casing in three separate sections
- 1st @ 100-feet, 2nd @ 100-feet, 3rd @ 95-feet
- 305-feet of 16-inch centralizer casing in three separate sections
- 1st @ 105-feet, 2nd @ 100-feet, 3rd @ 100-feet
- Staged to be installed within 36-inch casing

Casing @ Exit:

- 500-feet of temporary 16-inch casing by washing over drill string

| ACTIVITY | LANEY RIG 1 (ENTRY) | LANEY RIG 2 (EXIT) |
|---|---|---|
| **RIG UP** | RIG UP | RIG UP |
| **CASING** | INSTALL 36" CASING (24 HOUR OPERATIONS) | |
| | CLEAN OUT 36" CASING | |
| | INSTALL 20" CASING CENTRALIZED IN 36" CASING | |
| **PILOT HOLE** | TRIP DRILL STRING THROUGH 16" CASING (+ 305' = 305') | DRILL PILOT HOLE (+ 500' = 500') |
| | DRILL PILOT HOLE (+ 195' = 500') | INSTALL 16" WASHOVER CASING (+ 500' = 500') |
| | EXTRACT 16" CASING TO REMOVE CENTRALIZERS | DRILL PILOT HOLE (+ 500' = 1000') |
| | INSTALL 500' OF 16" CASING OVER DRILL STRING | SCHEDULED TRIP BACK TO CASING (- 500' = 500') |
| | DRILL PILOT HOLE UP TO MONITORING ZONE (+ 300' = 800') | TRIP BACK TO BOTTOM (+ 500' = 1000') |
| | SCHEDULED TRIP BACK TO CASING (- 300' = 500') | DRILL PILOT HOLE (+ 1000' = 2000') |
| | TRIP BACK TO BOTTOM (+ 300' = 800') | SCHEDULED TRIP BACK TO CASING (- 1500' = 500') |
| | DRILL PILOT HOLE THROUGH MONITORING ZONE (+ 1000' = 1800') | TRIP BACK TO BOTTOM (+ 1500' = 2000') |
| | DRILL PILOT HOLE TO INTERSECT POINT (+ 400' = 2200') | DRILL PILOT HOLE TO ~NTERSECT POINT (+ 41' = 2041') |
| **INTERSECT** | PILOT HOLE INTERSECT - BOTH RIGS (24 HOUR OPERATIONS) | |
| | TRIP BHA ACROSS TO ESTABLISH CONTINUOUS DRILL STRING | |
| | REMOVE 16" CASING ON BOTH SIDES OF THE CROSSING | |
| **REAM PASS** | 30" REAM PASS, SWAB PASS & PULLBACK (24 HOUR OPERATIONS) | |
| | PULL REAM FROM PIPE SIDE TO MONITORING ZONE (+ 2450' = 2450') | |
| | TRIP REAMER OUT TO PIPE SIDE | |
| | FORWARD REAM TO INTERSECT EXISTING 30" HOLE (+ 1791' = 4,241') | |
| | SWAB PASS | |
| **PULLBACK** | PULL PIPE | |
| **RIG DOWN** | RIG DOWN | |


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# Project Challenges

- Pressure requirements: Very difficult to manage but it was accomplished this also effects the drill schedule.
- Tight workspace on Plant side, limited space to try to get equipment or pipe in that side.
- Limited depth of cover under ditch and FM519, potential for HF/IR. Depth of tie-in at BP property (10-15’)
- Groundwater contamination requiring large diameter casing installation.
- The pipeline crossed land owned by BP Chemical, Texas City Terminal
- Railroad (TCTR), Galveston County, Marathon, DOW and the GCA…

# Construction Results

- Construction began January 2019 and completed in March 2019.
- Project successfully executed safely with no lost time due to injury.

| ACTIVITY | SIZE | PLANNED SHIFTS | ACTUAL SHIFTS |
|---|---|---|---|
| RIG UP | | 3.00 | 4.00 |
| PILOT HOLE | 12.25 in | 18.00 | 4.00 |
| REAMING PASS #1 | 30.00 in | 30.00 | |
| INTERSECT | | 8.00 | |
| CASING RUN #1 | 16.00 in | 4.00 | 7.00 |
| CASING RUN #2 | 20.00 in | 1.00 | 1.00 |
| CASING RUN #3 | 36.00 in | 7.00 | 11.00 |
| SWAB PASS | | 2.00 | |
| PULLBACK | | 2.00 | |
| RIG DOWN | | 2.00 | |
| SECONDARY SHIFTS | | | 32.00 |
| **TOTAL SHIFTS:** | | **77.00** | **59.00** |

# References


- Laney Directional Drilling. “Drilling Program Plan per USACE ER 1110-1-1908. Revision 2.” February 23, 2018.
- Baher, N. and Leimer, M. “INEOS Styrolution. Response to RMC comments to request for a pipeline crossing beneath USACE Levee and Drilling Program Plan. Texas City, Galveston County, Texas. 408 Permit Application SWG-408-17-9.” March 5, 2018.

# QUESTIONS ?

Laney GROUP, INC