Lessons Learned During Trenchless Planning, Design, and Construction

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What are Lessons Learned?

"A lesson learned is a summary of insights gained from experiences, both negative and positive, that can be applied to future actions."

- Can be both positive and negative
- **Can be applied to future actions!**

Agenda

- Construction Site Access
- Annular Space Grouting
- Fulltime Resident Inspection / Specialty Inspection
- Geotechnical Investigation Scoping
- Adequate SUE
- Submittal Reviews
- Information on Drawings
- Communication and Collaboration

Construction Site Access

What to look for:

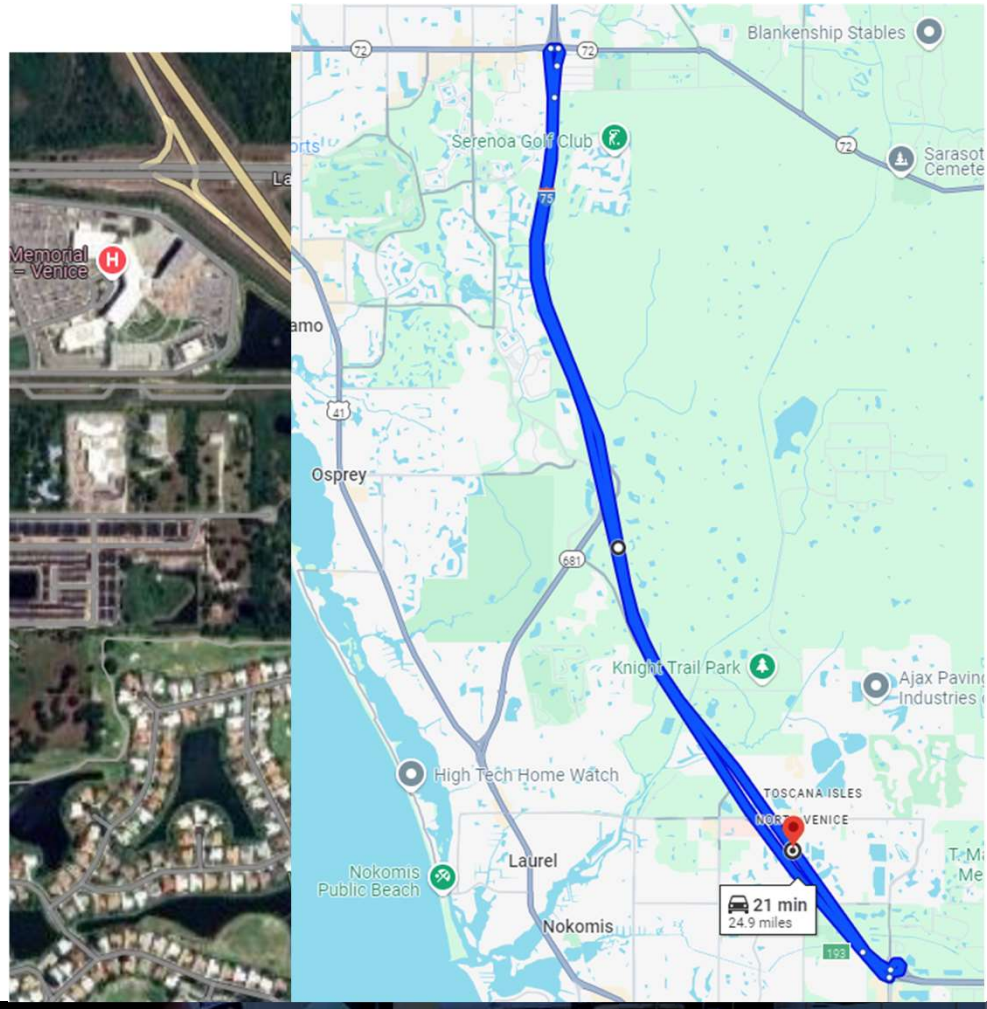
- Access locations
- Space for turning equipment
- Location of OHE
- Length of access roads
- Load limits on roads & bridges

How do we communicate access in our Contract Documents?

Construction Site Access

Project Example – Venice, FL

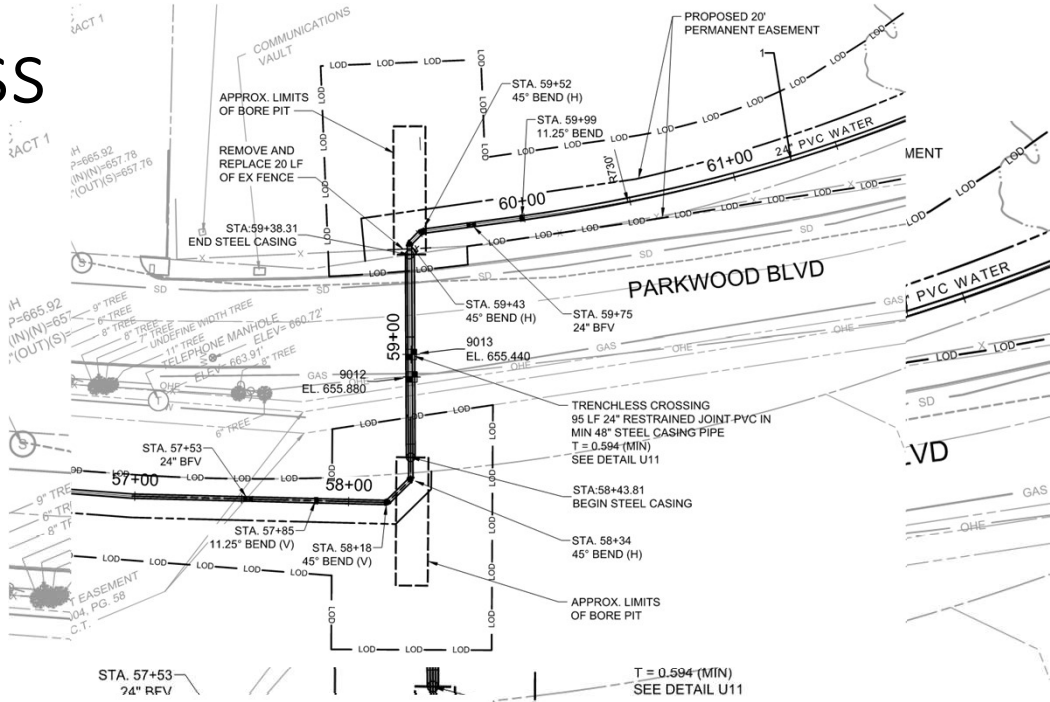
- New FM under I-75
- Microtunneling under travel lanes
- Open cut in median
- Access to median from NB lanes only



Construction Site Access

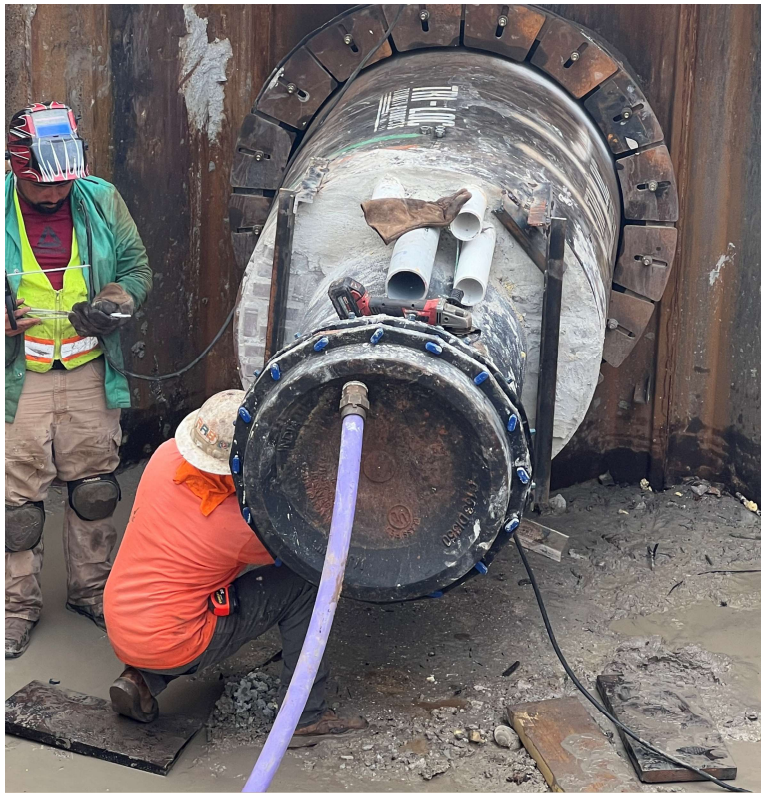
Project Example – Frisco, TX

- New 24” water main
- Several trenchless crossings



2. CONTRACTOR TO ACCESS BORE PIT AT ~ STA 58+50 DOWN THE LOD FROM EUBANKS STREET. DIRECT ACCESS OFF PARKWOOD BLVD IS NOT PERMITTED.
3. CONTRACTOR TO ACCESS BORE PIT AT ~STA 59+50 OFF PARKWOOD BLVD. CONTRACTOR TO REMOVE AND REPLACE FENCING AS NECESSARY FOR ACCESS.

Annular Space Grouting



- Annular Space Grouting: Filling the space around a pipe installed within another pipe or tunnel
- Why do we do it?
  - Ensure long-term stability

Annular Space Grouting

How we want it done:

- Low-density flowable fill or cellular grout
- Specify grout density
- Specify maximum reach
- Specify number of lifts
- Vents / Grout verification ports
- Prevent flotation

Annular Space Grouting

Collapsed Pipe – North Carolina

- Pumped heavy-weight flowable fill
- Pumped in single lift
- Pumped fast
- Only a single 1-inch vent

Annular Space Grouting

Water-filled Annular Space

- Watertight casing – initially dry space
- Backfilled reception shaft
- Turned off dewatering
- Groundwater seeped through the bulkhead and filled annular space
- During grout placement started getting water through bulkhead

Annular Space Grouting – Trends

- Single lift & single reach
- Lower density grout (35 pcf)

Ok if…

- Annular space confirmed to be dry (and kept dry)
- Buoyancy calculations accounted for a single lift
- Proper vents installed
- Pump rate and pressure monitored
- Experienced contractor

Fulltime Specialty Inspection

- Inspection vs Specialty Inspection
- Documentation and tracking for potential claims
- Prevent project delays
- Improved cooperation and coordination

Fulltime Specialty Inspection

Project Example – North Carolina

- 5 miles of large-diameter sewer with two 120-inch tunneled crossings
- Pipe jacking + hand mining at face using sand shelves and breasting boards
- No fulltime or specialty inspection
- Sudden in-rush of material inside tunnel → significant road settlement

Fulltime Specialty Inspection

Project Example – North Carolina

- Contractor onsite that evening claimed different site conditions than anticipated
- Investigation shows they weren't following submitted procedures
- No onsite documentation

Fulltime Specialty Inspection

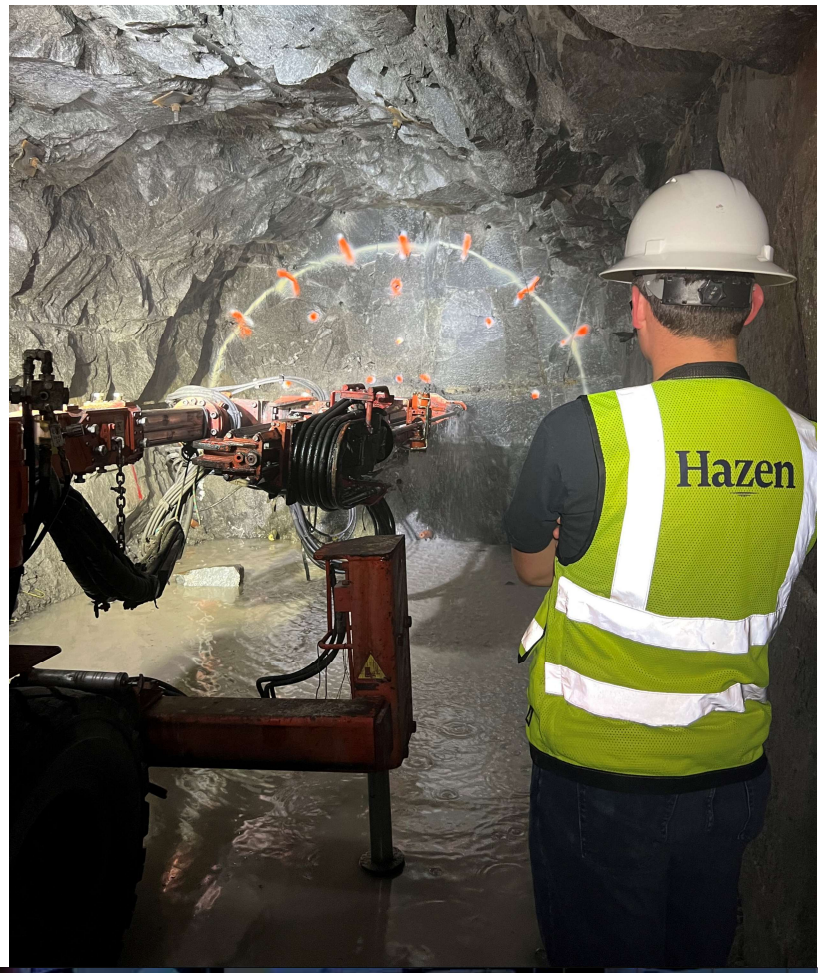
Project Example - Tennessee

- Fulltime inspection
- Detailed daily reports
  - ✓Tracked time spent on activities
  - ✓Observations by inspector
  - ✓Notes about contractor's efforts
  - ✓Photos

Fulltime Specialty Inspection

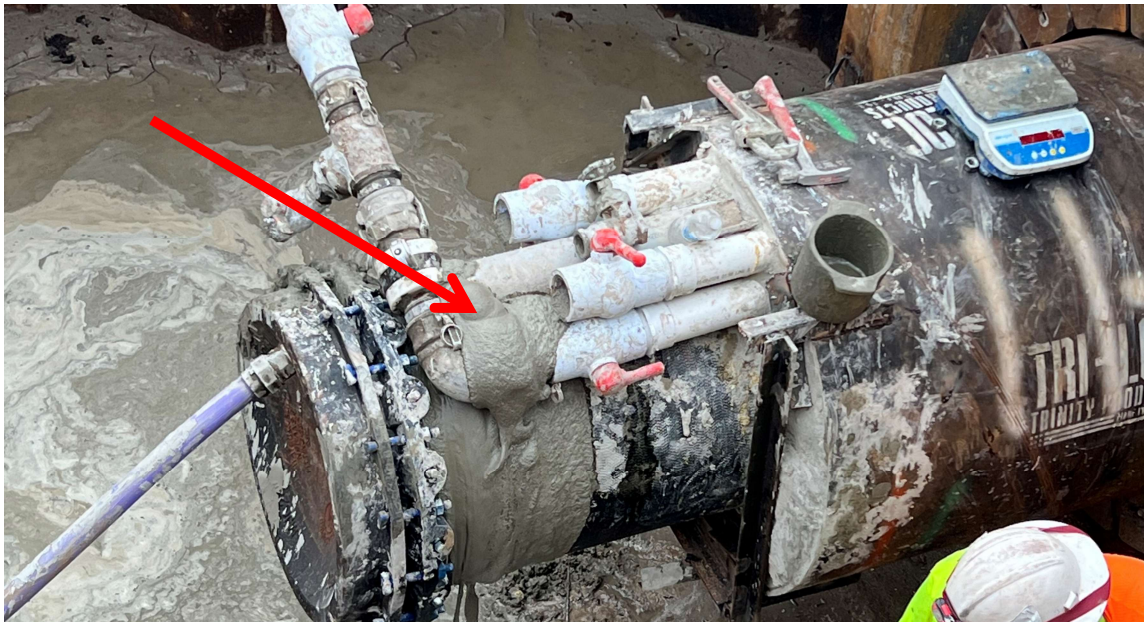
Project Example – Virginia

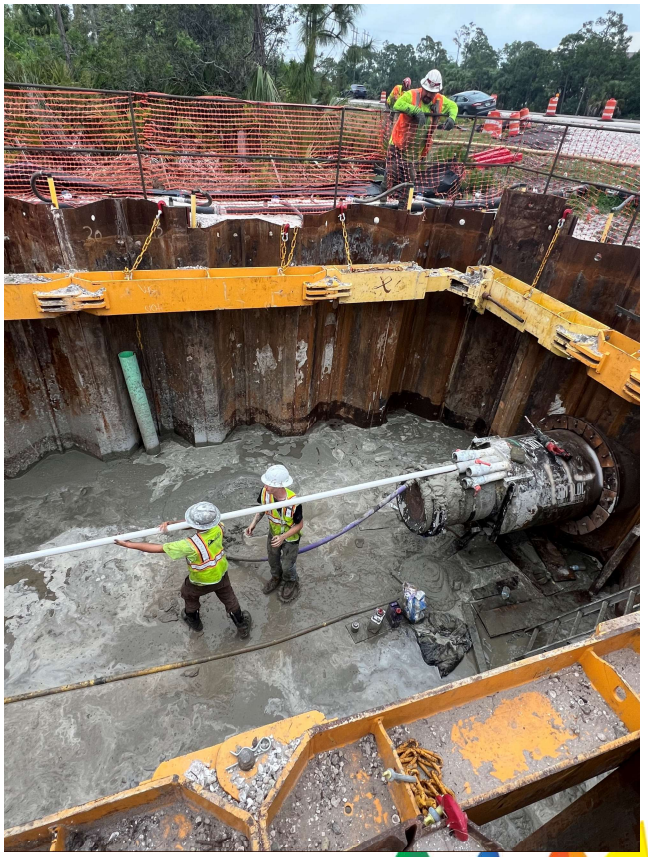
- 12-foot horseshoe drill and blast tunnel
- Fulltime resident observation
- Facilitated better communication and collaboration
- Reduced downtime
- Prevented rework



Fulltime Specialty Inspection

Project Example – Florida





Example Construction Documentation

Notes on Excavated Material:

- During this stage, excavated material is carried to the receiving shaft through the 16-inch augers/casing. With the addition of lubrication at the face of the PCH, the consistency of the material brought to the reception shaft resembles a high-slump concrete. It does not hold its form, but does not flow past a certain "slump" distance when it is pushed out of the casing by the auger. Material does not flow through the casing, and only moves when the auger is turning.
- Pictures show that there is some standing water in the reception shaft. This water is coming in at one corner of the shaft and is not flowing in from the casing.

Other work onsite not performed by [redacted]:

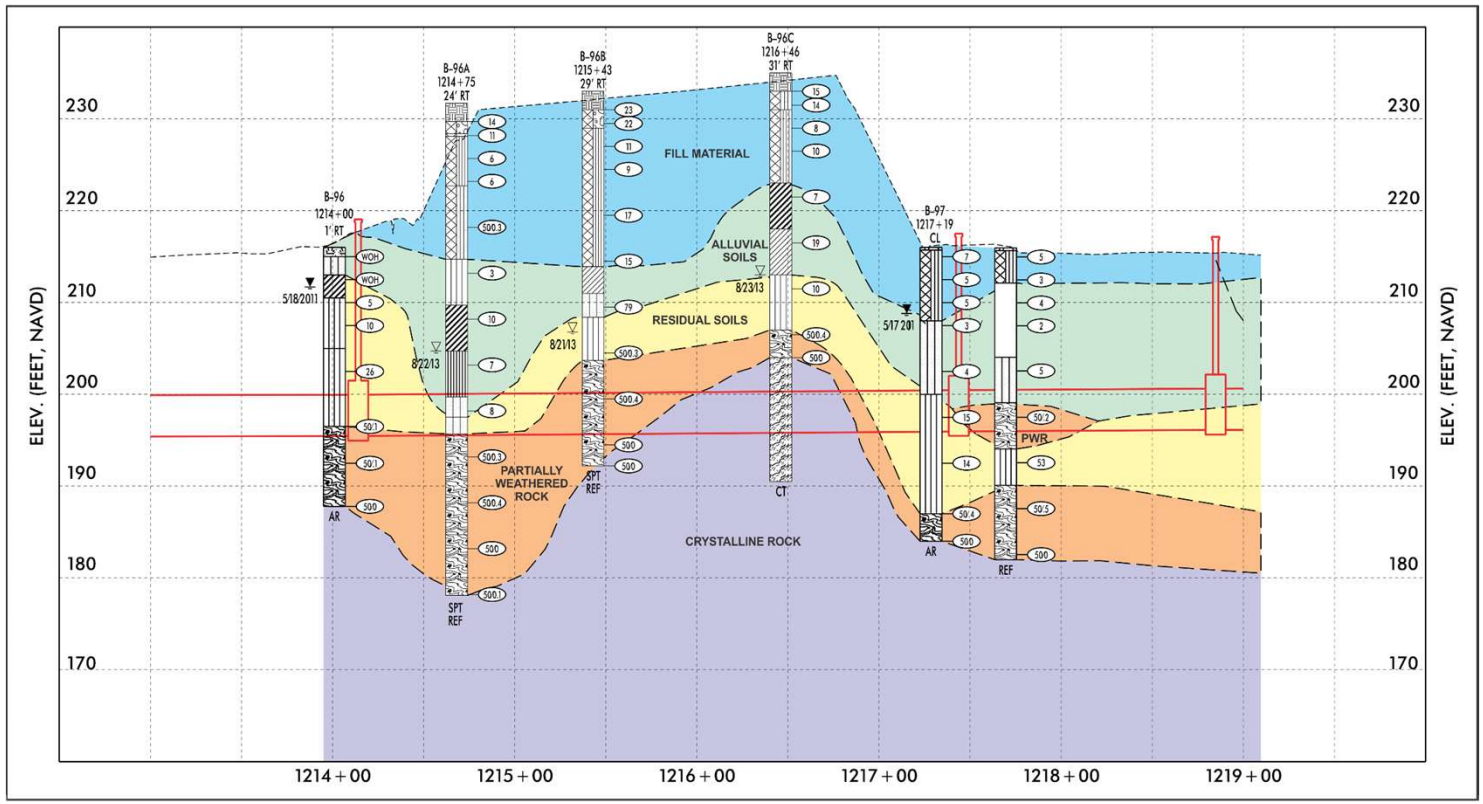
- [redacted] onsite at the RR launch shaft working on the deep dewatering wells.
- Surveyor onsite in the morning to survey the settlement markers. Some of the markers had to be reset from original position as they were disturbed when trying to locate existing comm lines between the launch shaft and edge of pavement.

Issues encountered today:

- [redacted] had problems with the hydraulic power pack that powers the pilot tube breakout tool to loosen pilot tube joints in the reception shaft – resulted in a couple of delays to excavation while maintenance was performed.

Construction Documentation

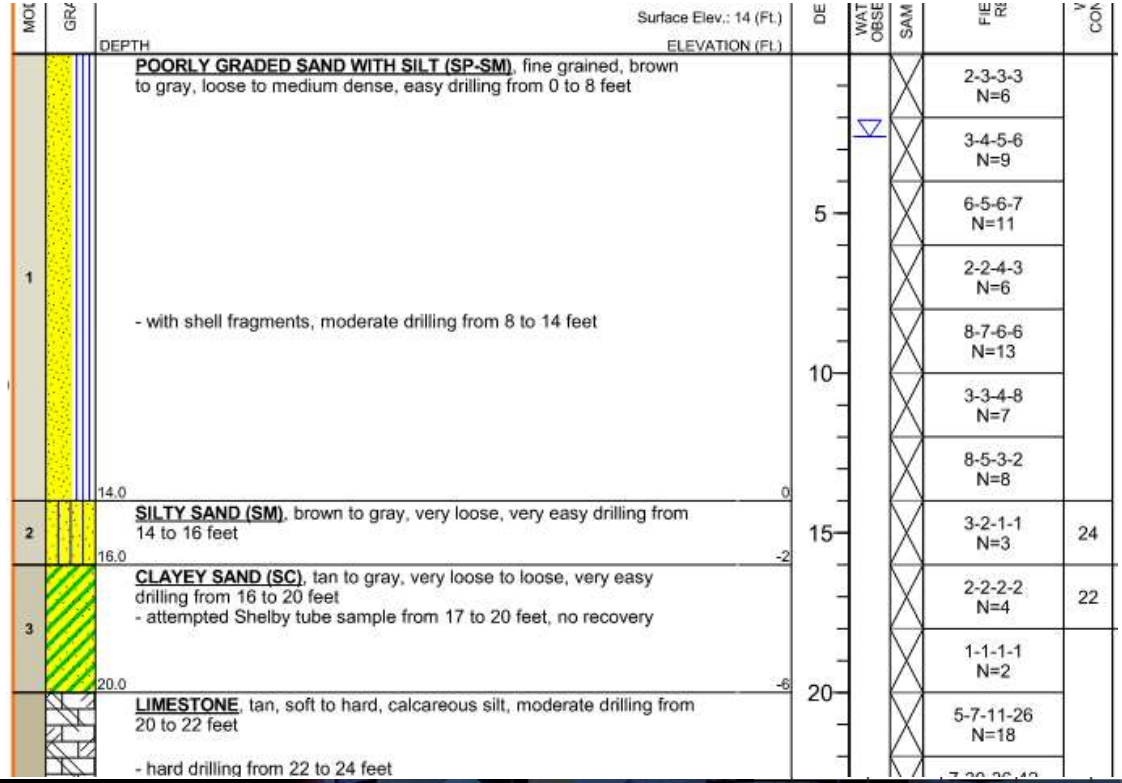
Geotechnical Investigation Scoping



Geotechnical Investigation Scoping

Guidance for borings:

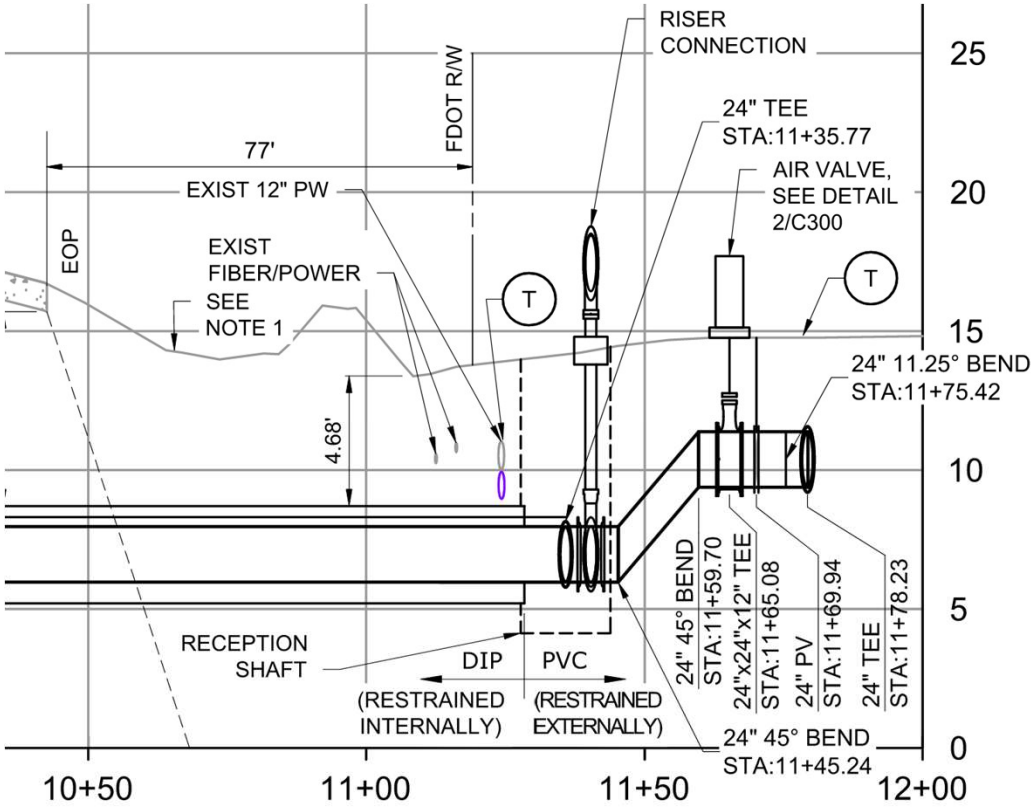
- Depth
- Rock coring
- Continuous sampling
- Surveyed elevations
- Lab testing
- Rock core storage



Obtain Adequate SUE

Project Example – Florida

- Existing 12” PW deeper than expected
- Require rerouting before tunnel construction
- Cost impact: Four – 45 bends & labor/equipment
- Schedule impact: None



Submittal Reviews

Don’t review submittals in isolation

Project Example – Iowa

- Trenchless Submittals: Tunnel Work Plan, Tunnel Shafts, Casing Pipe, Casing Spacers, Carrier Pipe, Grouting, and Dewatering
- Annular space for grouting
- Groundwater level

Information on Drawings

If it's important, put it on the drawings!

- *Note: Access road to reception shaft is prone to flooding during significant rain events. Contractor to maintain safe access to the work site.*
- *Note: Access to the middle portion of HDD alignment is severely restricted and requires specialized equipment or temporary bridge structure.*
- *Note: Steep entry angle required to pass below existing sheet pile bulkhead. Tip of sheet piles estimated at Elevation -34. See Record Drawings in Appendix A.*

Information on Drawings

Communication and Collaboration

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Questions?

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