Unique Horizontal Drain Installation under a Building
Using Pilot Tube Guided Auger Bore Methods

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AGENDA

• History of the site
• Trenchless considerations
• Trenchless design
• Pre-construction
• Construction
• Lessons learned
History of the site

- Built in the 1960s in a flood plain
- Additions added over decades at different elevations
- Original design included waterproof membranes, sub-slab drainage, and perimeter drains
- Subsequent additions experienced flooding
• Vertical dewatering wells installed around perimeter in 1990s
• Worked well until 2010
• Investigation found that the wells had reduced capacity due to being fouled with iron-fixing bacteria
• Additional wells were installed in 2014 but only worked for a few years
Trenchless Considerations

- 400-foot installation length
- Both 6-inch and 10-inch diameter installations
- No construction access inside the building during horizontal drain installation
- Granular soils with a high groundwater level
- Installed well screen needed to be robust to allow for post-installation (long-term) cleaning.
Trenchless Options

• Horizontal Directional Drilling
  • Settlement potential with overcut borehole
  • Low accuracy (no access to building)
  • Curvature of pullback could damage drains

• Auger Boring
  • Low accuracy
  • Oversize casing

• Pilot Tube Guided Auger Boring
  • Very accurate
  • Unique install w/oversize casing
Benefits of Pilot Tube Guided Auger Bore

• All steering and guidance is located in the launch pit
• Straight pit-to-pit installation method, no curves
• No drilling fluid is typically used during installation that could foul the well screens
• The amount of over-cut is considerably smaller than HDD, which reduces the potential for settlement
Trenchless Design
Trenchless Design

Existing building

327° Stainless steel perf. pipe
Pre-Construction Considerations

• Contractor submits a change
  1. Pilot tube install
  2. Follow with sizing tool
  3. Product pipe jacked

• Trenchless work plan indicating:
  • the equipment layout
  • the reaction wall locations for each splay within the shoring and
  • the well casing/ adapters

• Pre-Construction verification of screen strength
  • Expect minimal increase in jacking force (7 3/8” vs 6”)
  • Pre-construction testing of screen strength
  • Johnson Screens on-site

• Typically cannot reverse, except in pilot mode
• Delays
  • Mobilized November 26th (in Minnesota)

• Order of construction
  1. Excavate launch shaft
  2. Additional dewatering
  3. Storm drain line install
  4. Excavate the launch shaft further
  5. HD 4 through HD 1

Added complication:
Looming Government Shutdown starting December 22nd
Starting on November 28th:
- Anticipated high quantities of groundwater
- Planned to use water auger
- Encountered clay, which plugged auger
- Jacking forces climbed
- Water soluble lubricant clumped and caused system to repeatedly plug
- Switched to regular bentonite-based lubricant since storm drain wasn’t a drain -- Jacking forces reduced

- 2 days for pilot tube installation, 2 days for auger/casing, 2 days for 10-inch drain installation
Storm Drain Construction
Horizontal Drains 4 and 3

• HD 4
  • Started on December 10th
  • Went very well
  • 3 days for horizontal drain installation

• HD 3
  • Started on December 13th
  • Went very well
  • 2 days for horizontal drain installation
Horizontal Drains 4 and 3
Horizontal Drains 4 and 3
• Started on December 15th
• Very oblique angle. The waler near the bottom of the excavation resulted in a long section of exposed pipe
• Within 15 feet of progress, well casing became cross-threaded
• Tried to pull casing, even though machine not geared for it; damaged pipe further
• Tried innovative approach to push the damaged drain casing out
Horizontal Drain 2

- Innovative approach
  - Cut off exposed tail end of horizontal drain
  - Cut off threaded end of pilot tube resulting in a blunt end
  - Pilot tube was pushed inside remaining (damaged) portion of the horizontal drain
  - Pilot tube then pushed damaged section of drain screen out of the alignment
• Unexpected benefit: the damaged section of screen acted like an HDD pre-ream
• The installation of second screen was very easy
• Entire installation took 4 days
  • With a quick trip to Johnson Screen
• Started December 20th (two days before government shutdown)
• Last one: went very well
• Finished just in time
• Drove off with 26 minutes to spare before mandatory site closure due to government shutdown
• Cross-over adapter: Make with tool steel, not mild steel

• Shoring system: Waler placement is important
  • Caused jacking frame placement too far from the wall
  • Caused an increase in exposed drain pipe length
  • Created unforeseen lateral forces on the drain pipe, especially for the more oblique installations

• Dewatering contractor: should be required to provide drawdown curves showing the construction dewatering area of influence so the trenchless contractor can better plan for conditions
Jacking Forces

- Calculated Ultimate Capacity (142T)
- Calculated Allowable Capacity (71T)
- Calculated Allowable Capacity (42T)

Graph showing various jack forces with different categories and lengths.
Thank you

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