

Design and Implementation of the South Hartford CSO Tunnel

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Andrew Perham, The Metropolitan District

The Metropolitan District



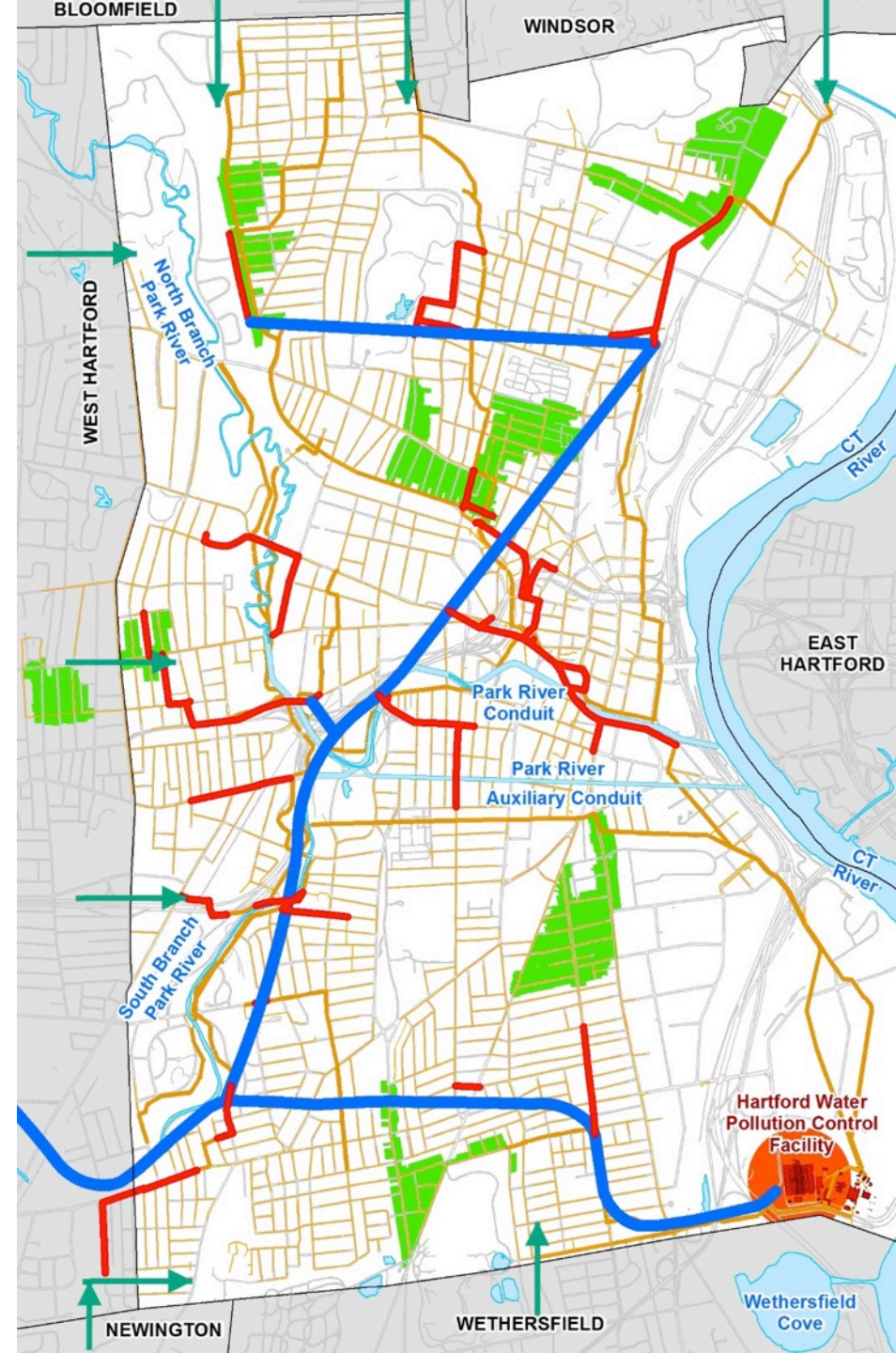
NEWEA – January 22, 2018



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The Clean Water Project

1. Expand HWPCF capacity to 200 MGD
2. 670 acres of sewer separation
3. Tunnel storage and conveyance
4. Reduce stormwater inflow/groundwater infiltration (I/I)



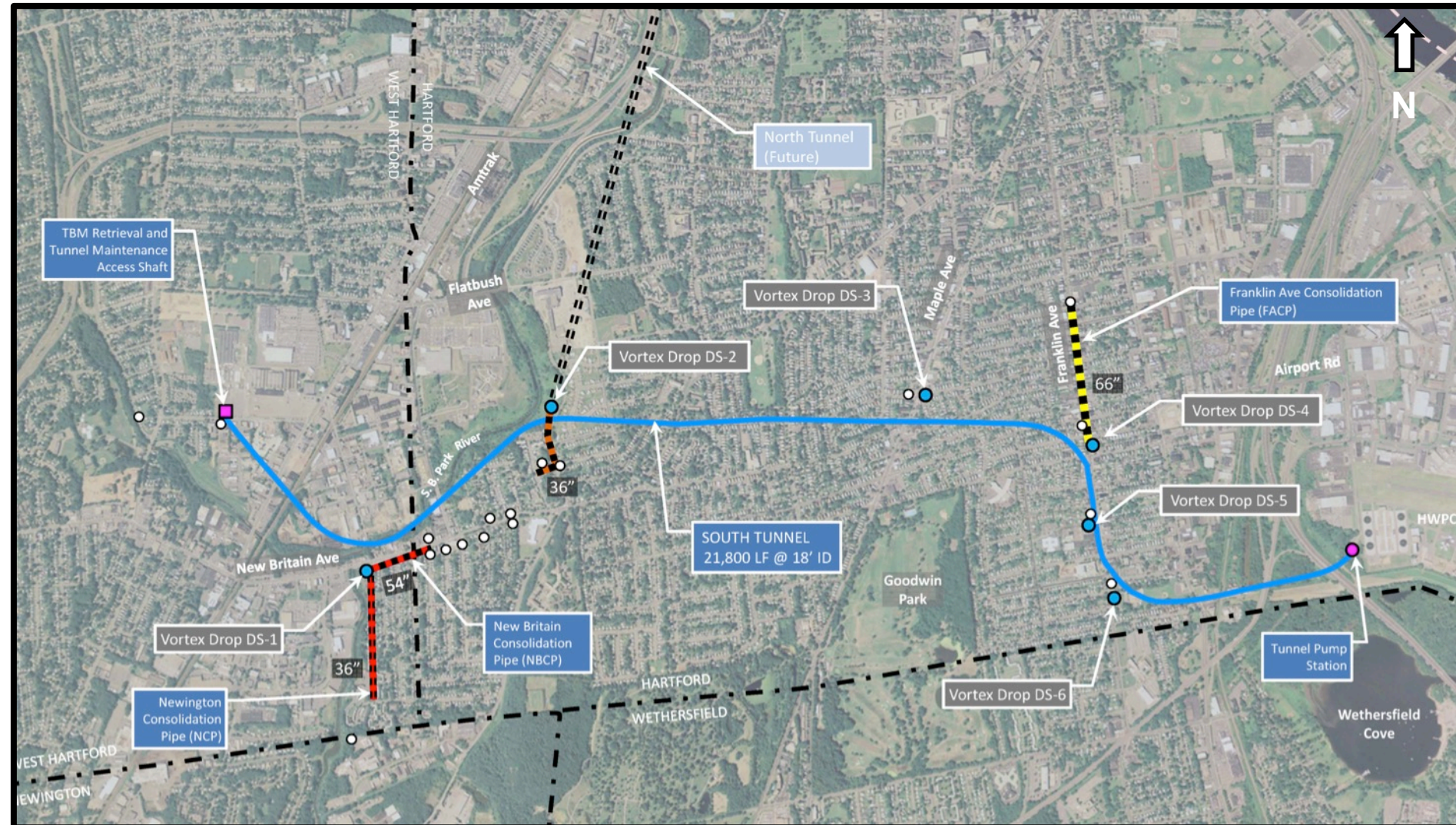
South Tunnel Project Team

- *Owner:* **The Metropolitan District**
- *Contractor:* **Kenny/Obayashi JV**
- *Design Engineer:* **AECOM / Black & Veatch**
- *Construction Manager:* **Jacobs Engineering / Parsons**
- *Program Manager:* **CDM Smith**

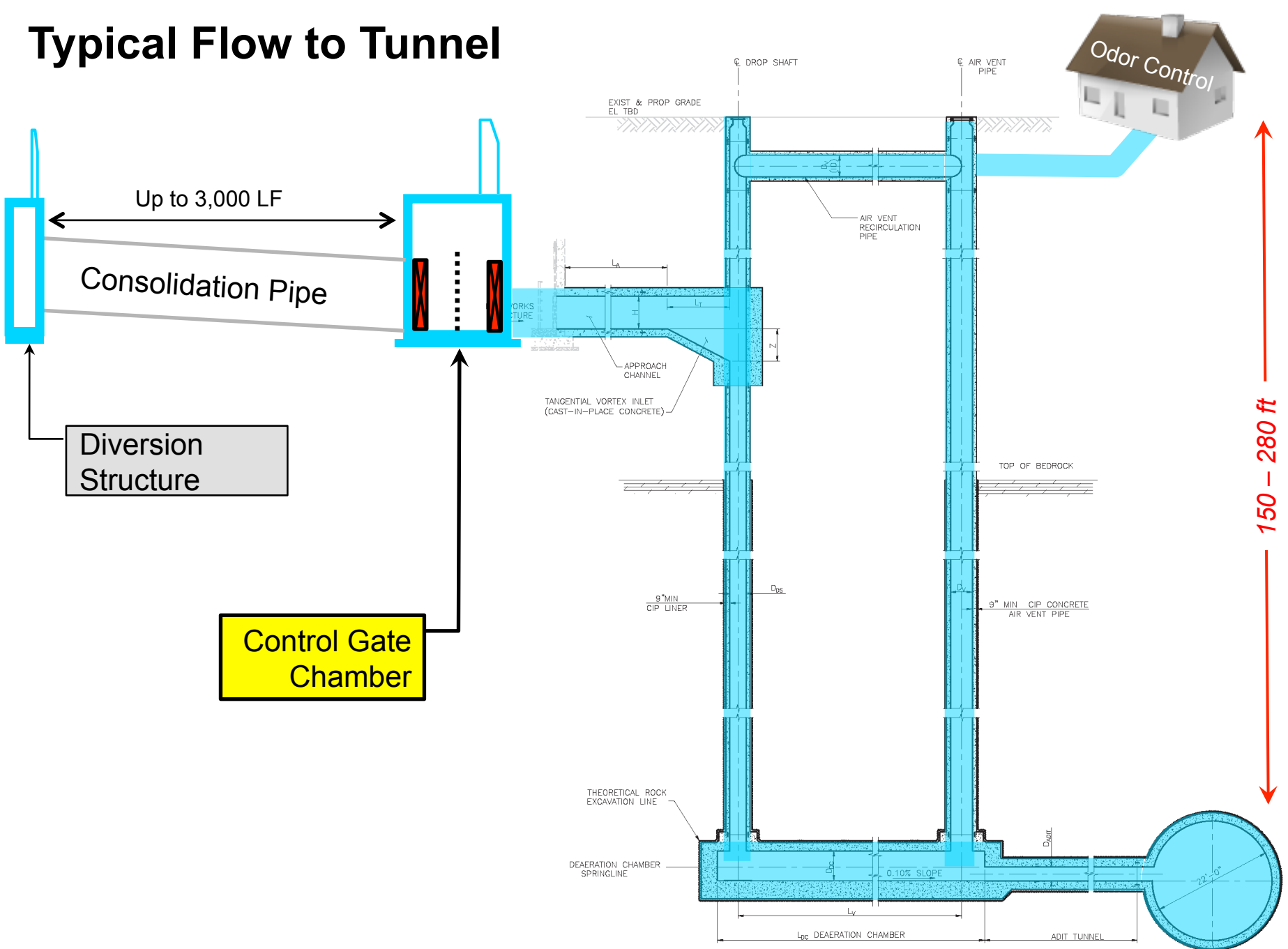


Project Components:

- 4 miles long (21,800 LF)
- 18 foot internal diameter
- 50 MGD deep pump station
- 6 Intermediate Hydraulic Drop Shafts and Retrieval shaft
- 7,300 LF of Consolidation Conduits



Typical Flow to Tunnel



Grit & Screening Facility

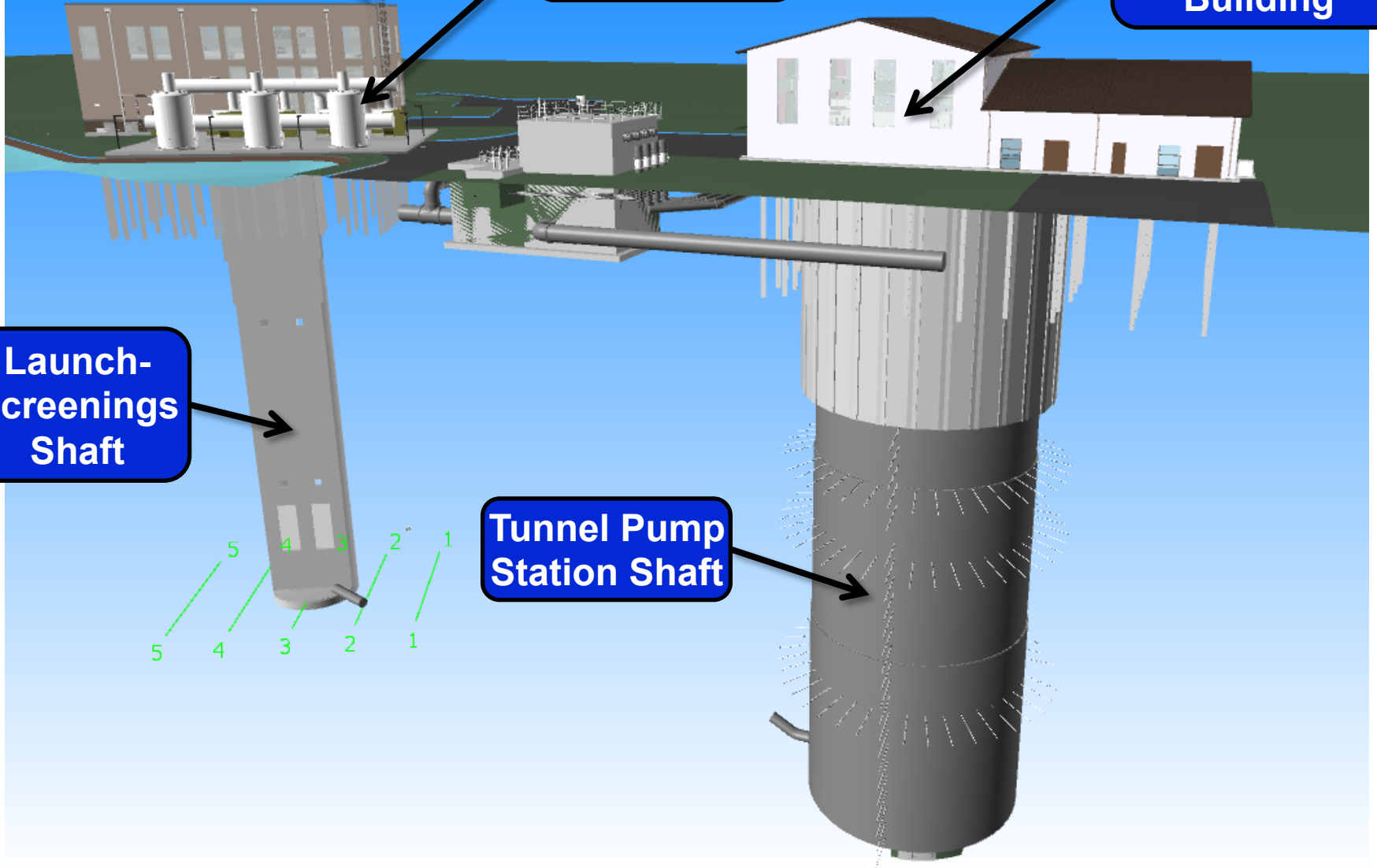
Odor Control Facility

Pump Station Control Building

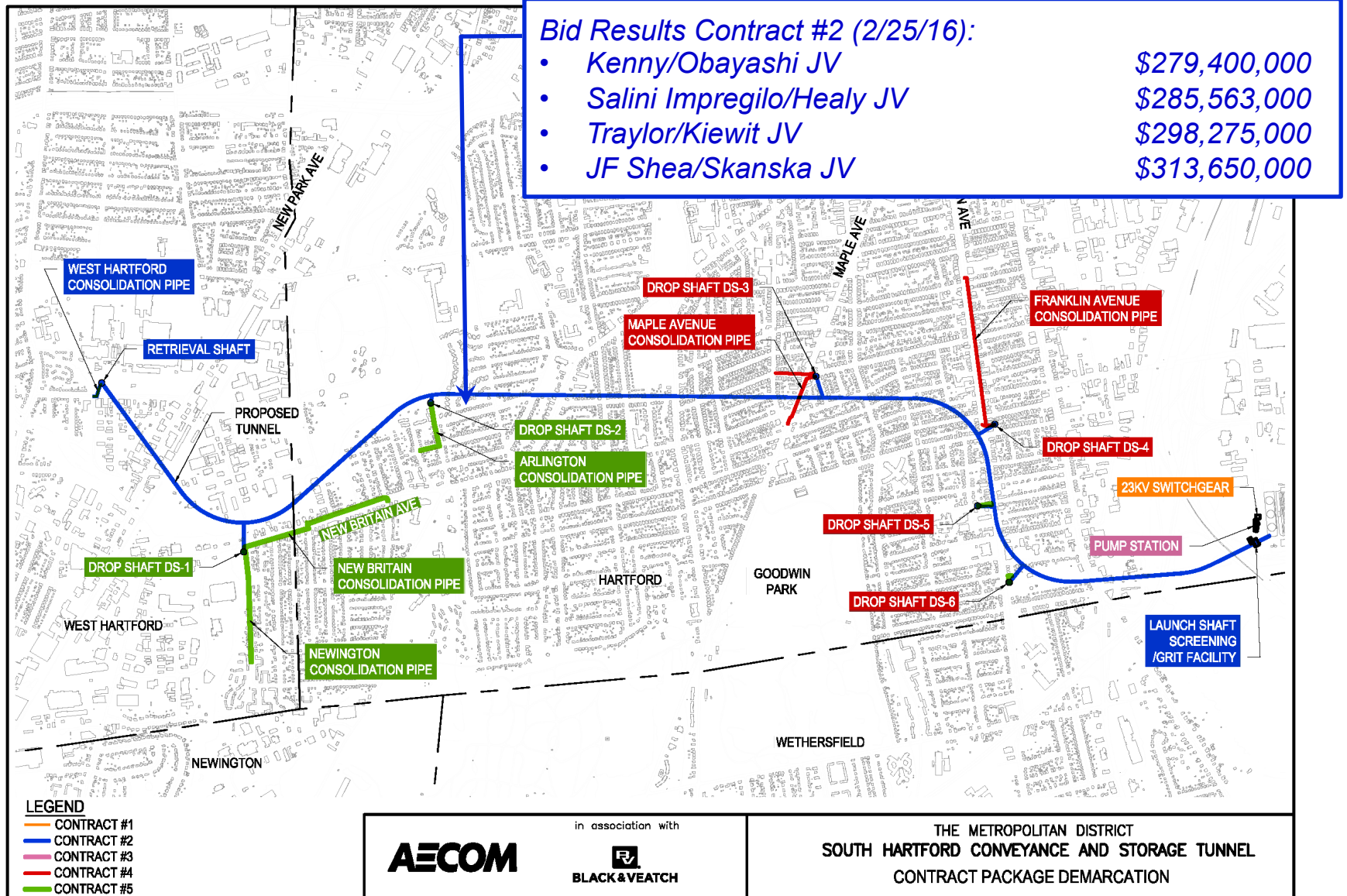
Launch-Screenings Shaft

Tunnel Pump Station Shaft

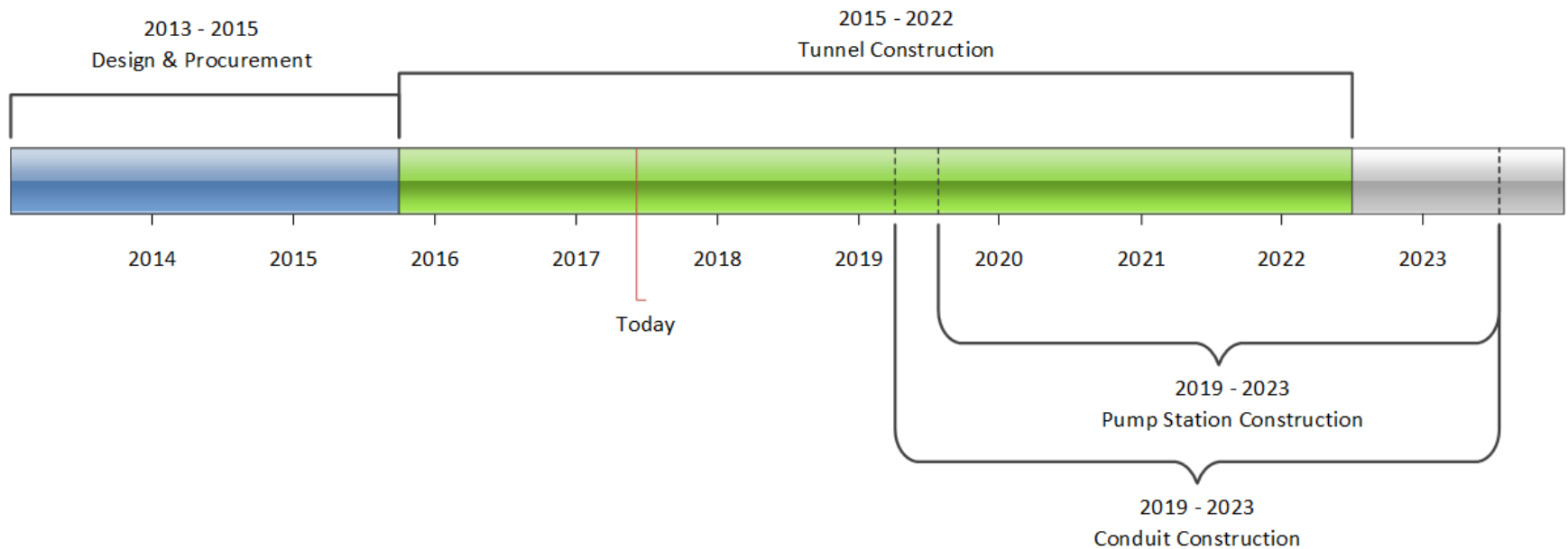
5
4
3
2
1



Contract Packaging



Schedule



Key Dates:

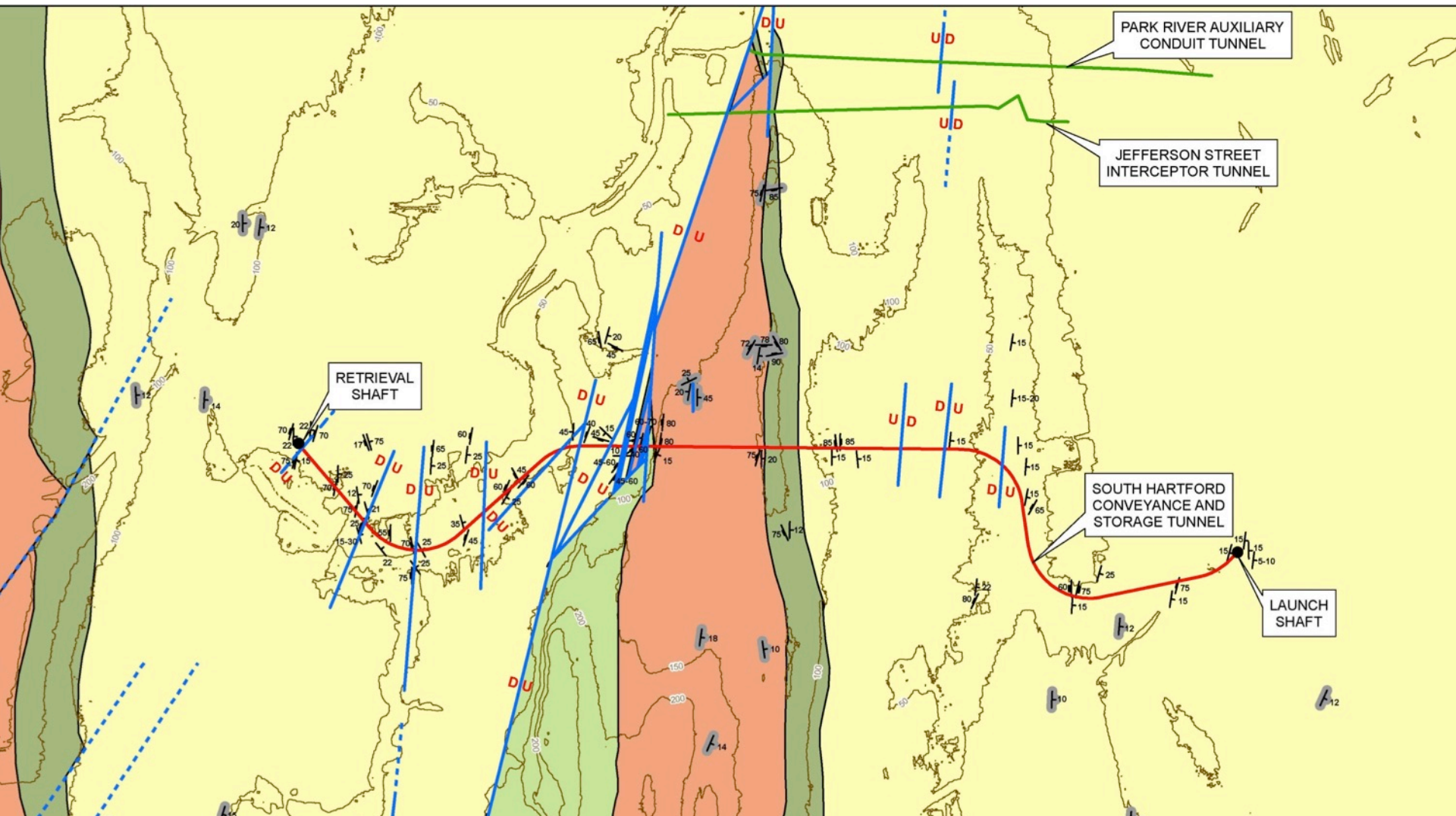
- October 2015 – Construction Began (Contract #1)
- August 2016 – Contract #2 NTP
- Summer/Fall 2018 – Tunnel boring begins
- Winter 2019 – Tunnel drive completed
- 2023 – Construction complete/facility in operation



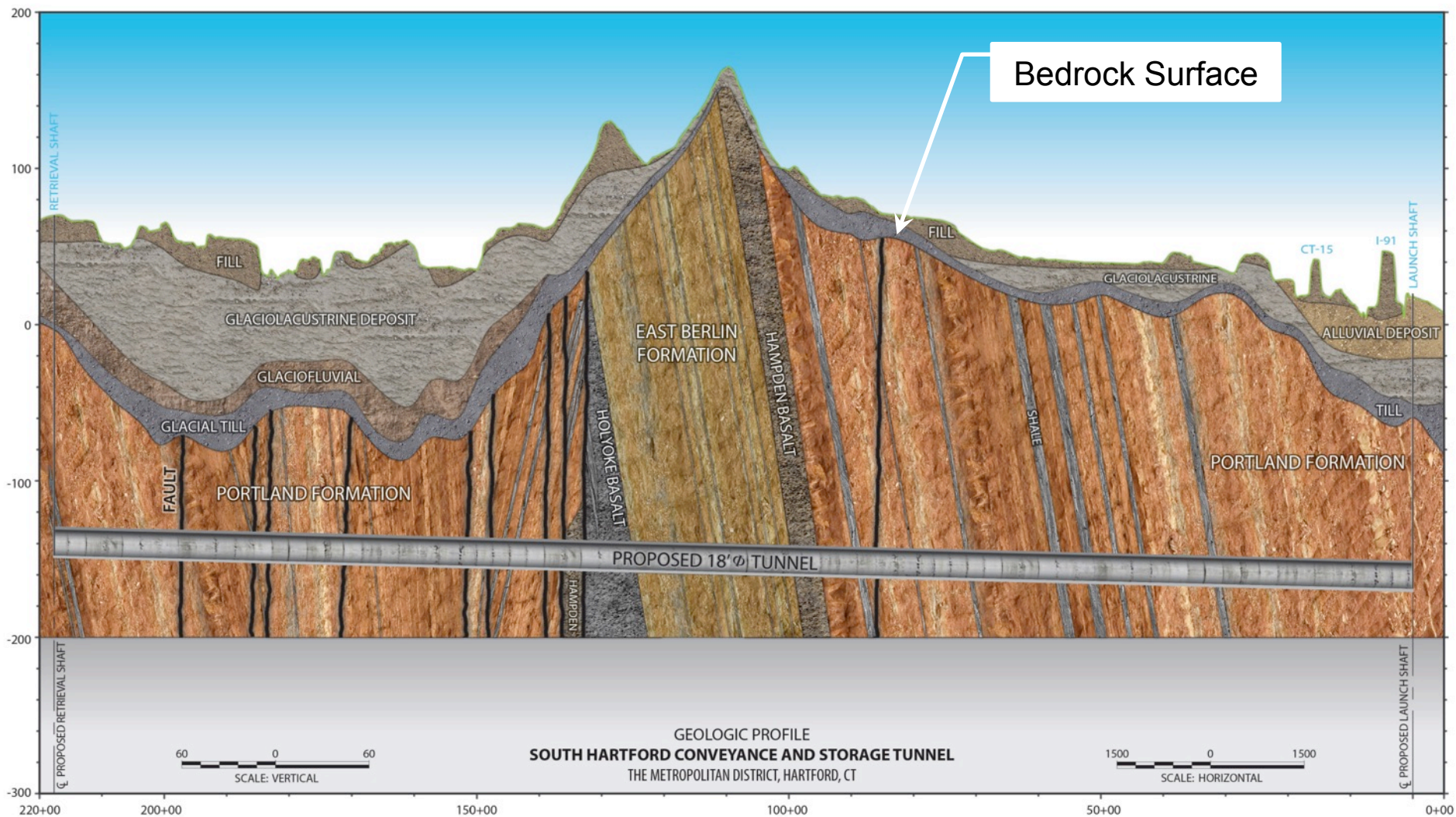


The Tunnel/TBM

Regional Geology



Geologic Profile



Single Shield Hard Rock Tunnel Boring Machine (TBM)

Named “IRIS”



Key TBM Components

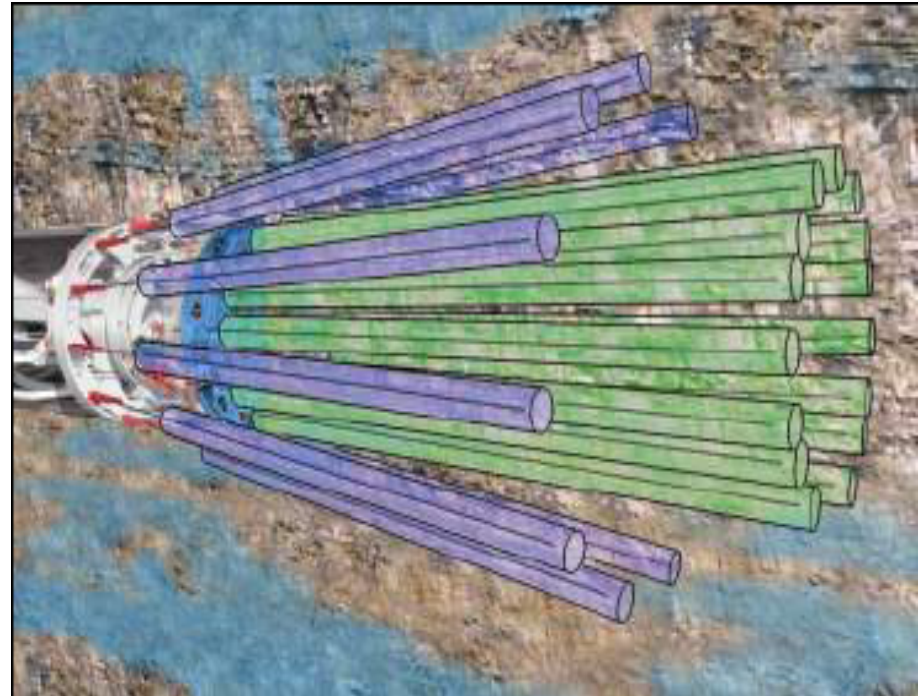
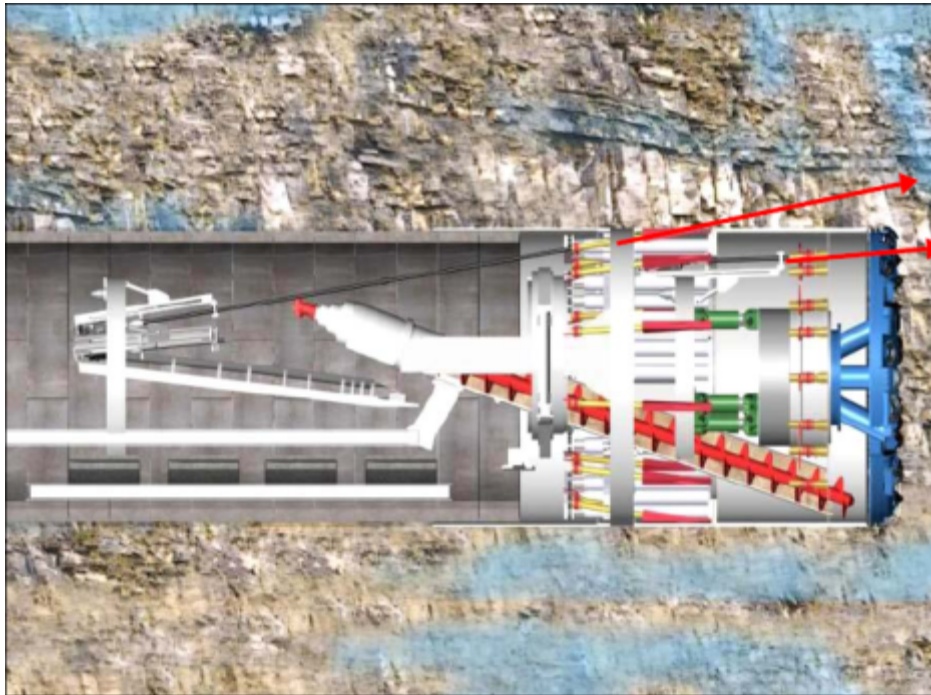
Segment Erector



Thrust Cylinders

Probing and Pre-Excavation Grouting

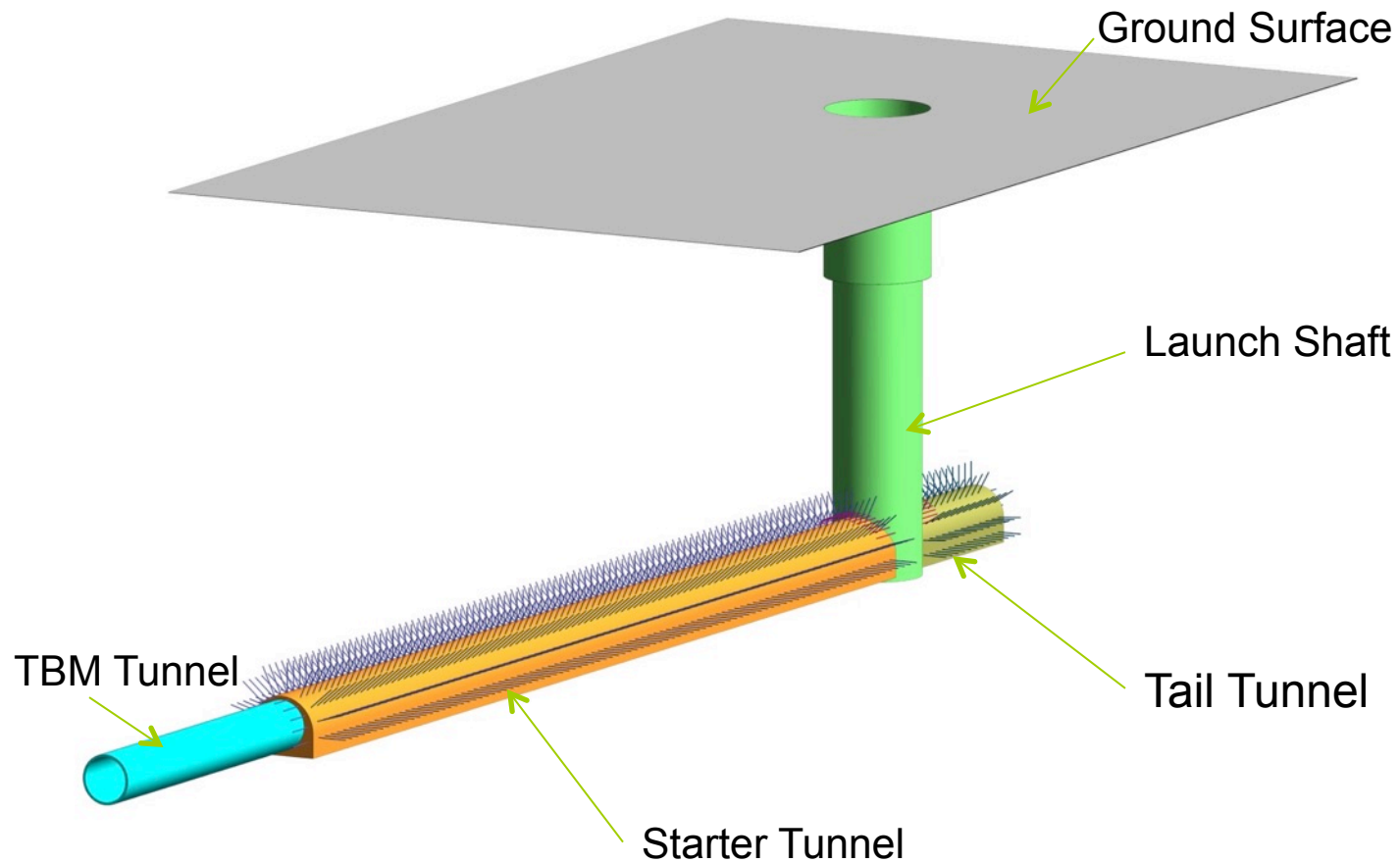
- Ground protection when crossing fault zones
- Stabilization of loose material ahead of the excavation face
- Improvement of mechanical properties of the rock mass
- Sealing and stopping of groundwater inflows into the tunnel



TBM Cutterhead (video)



Launch Shaft and TBM Starter and Tail Tunnels



TBM Delivered to Hartford

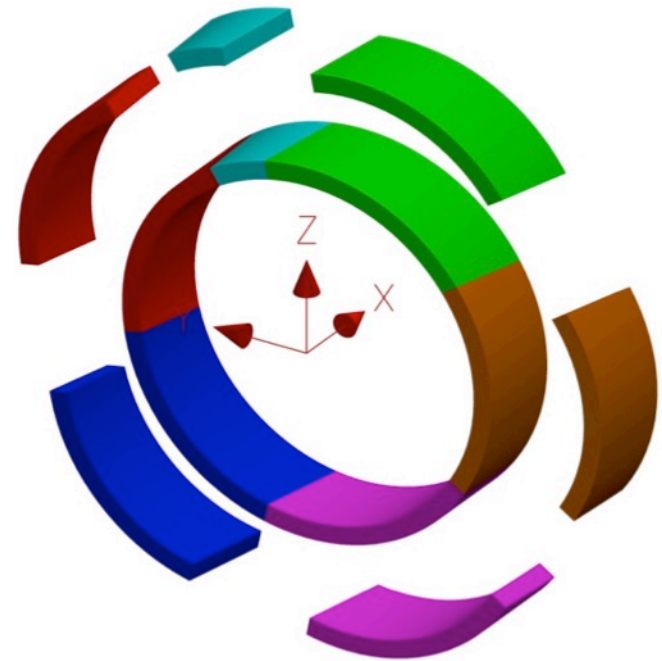


TBM Delivered to Hartford

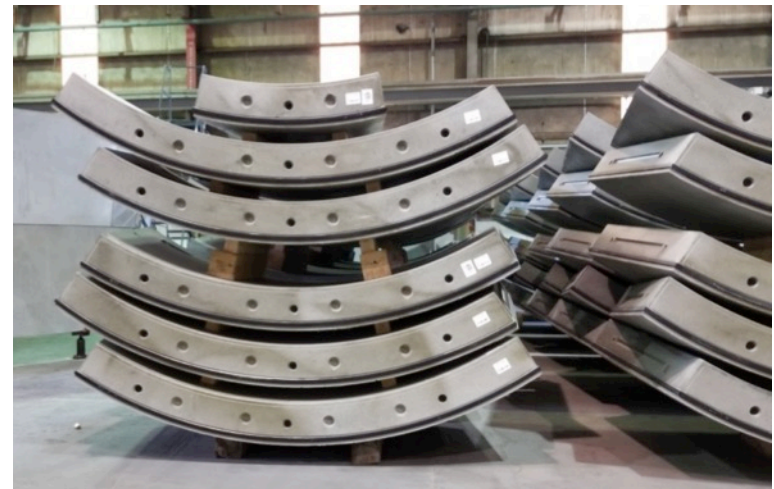


Tunnel Will be Lined with Pre-Cast Concrete Segments

- One-Pass Segmental Lining System
- Internal Diameter: 18 ft
- Ring Length: 5 ft
- 5+1 Universal Ring Geometry
- Advantages:
 - Negotiate Tight Curves
 - Requires Only One Set of Molds



Source: London Crossrail

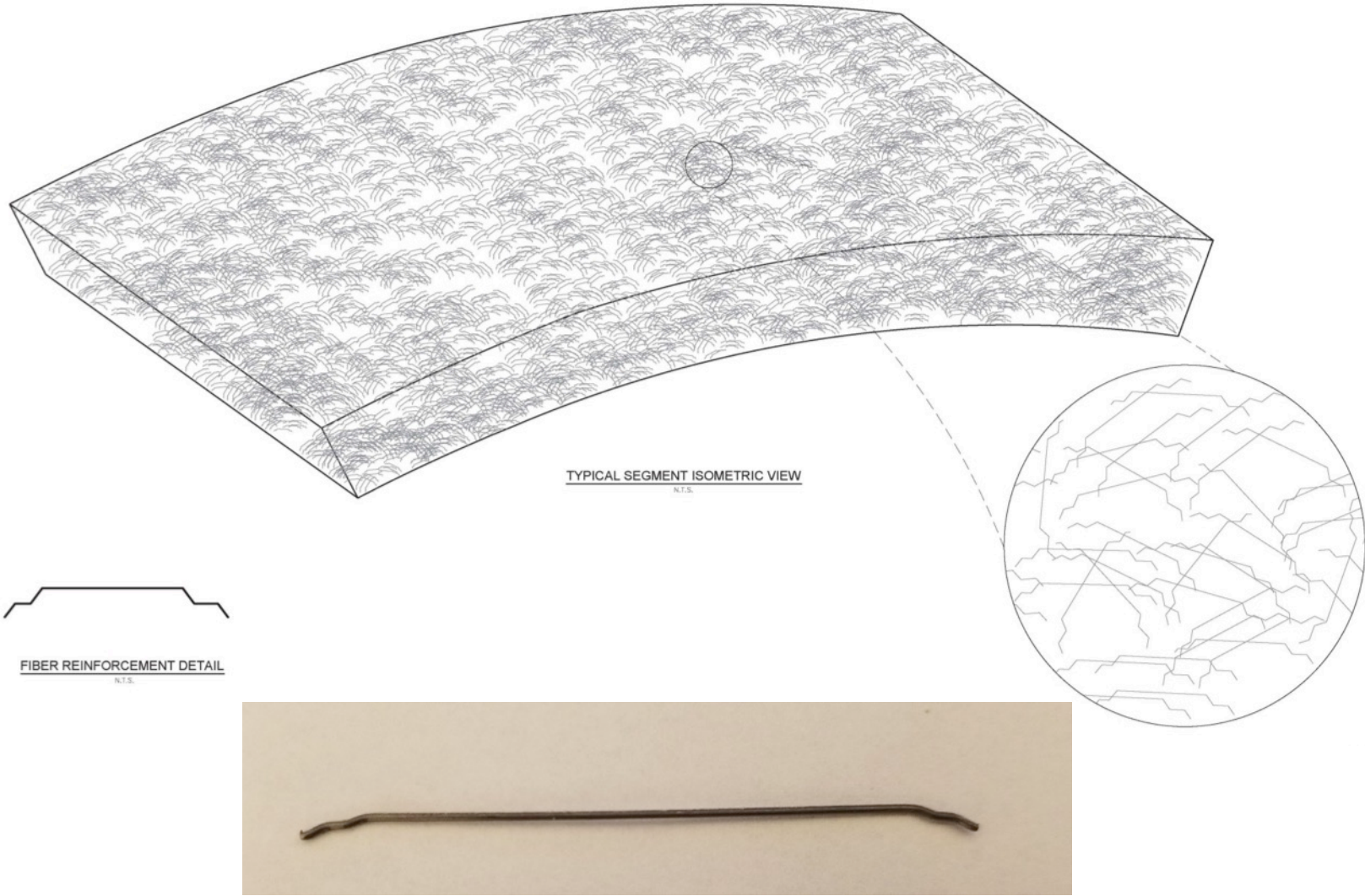


Segmental liner – Calcareous Concrete



- 100 year design life
- Concrete containing calcareous aggregate
 - Selected as a measure to mitigate acid attack
 - Coarse aggregate (Lime Stone) sourced from Thomaston, Maine.

Segmental liner – Steel Fiber Reinforcement



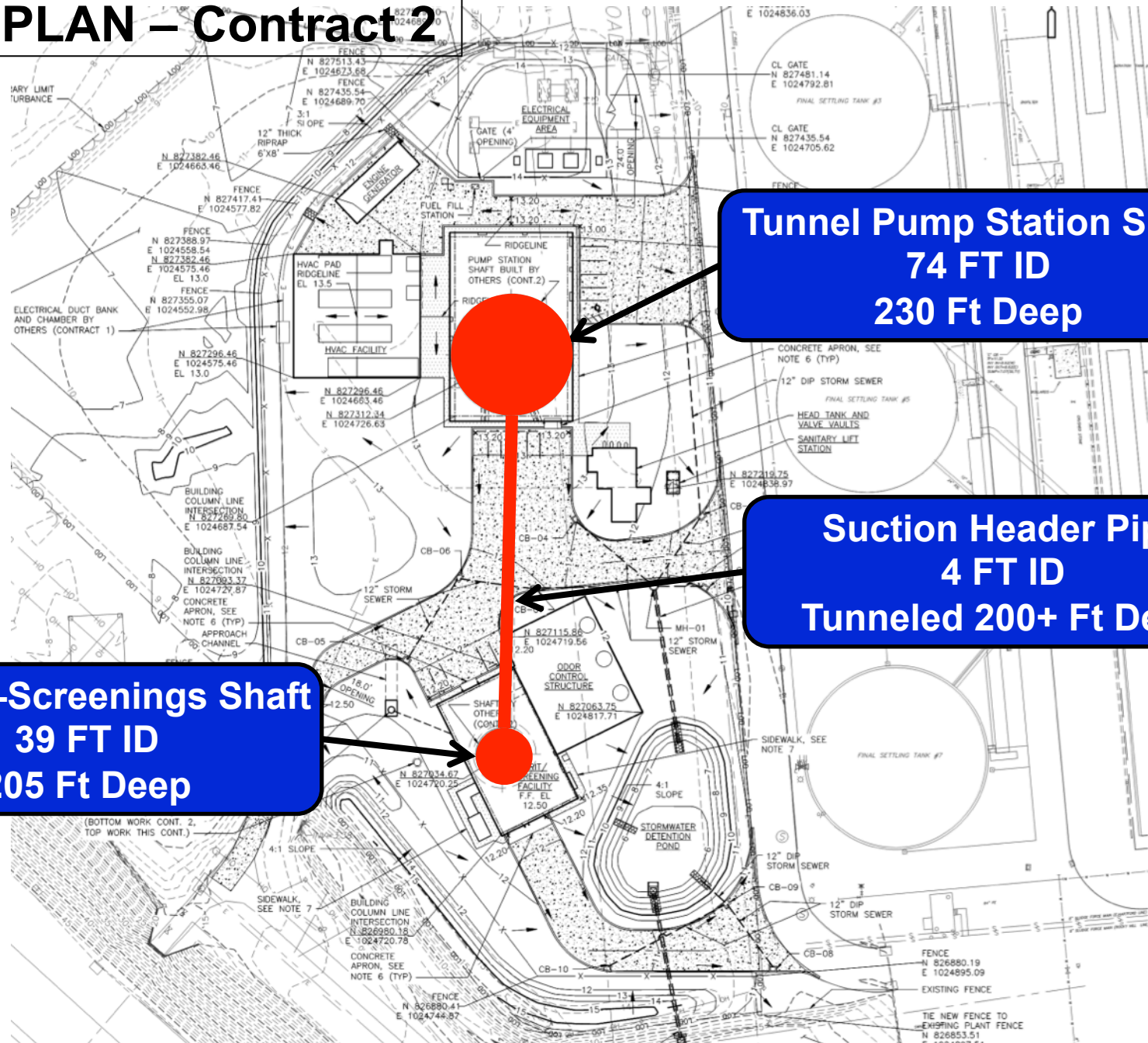
Large Diameter Shafts

Launch Shaft, Pump Station Shaft, and Retrieval Shaft



AECOM

SITE PLAN – Contract 2



Tunnel Pump Station Shaft
74 FT ID
230 Ft Deep

Suction Header Pipe
4 FT ID
Tunneled 200+ Ft Deep

Launch-Screenings Shaft
39 FT ID
205 Ft Deep

SITE PLAN – Contract 3

Control Building

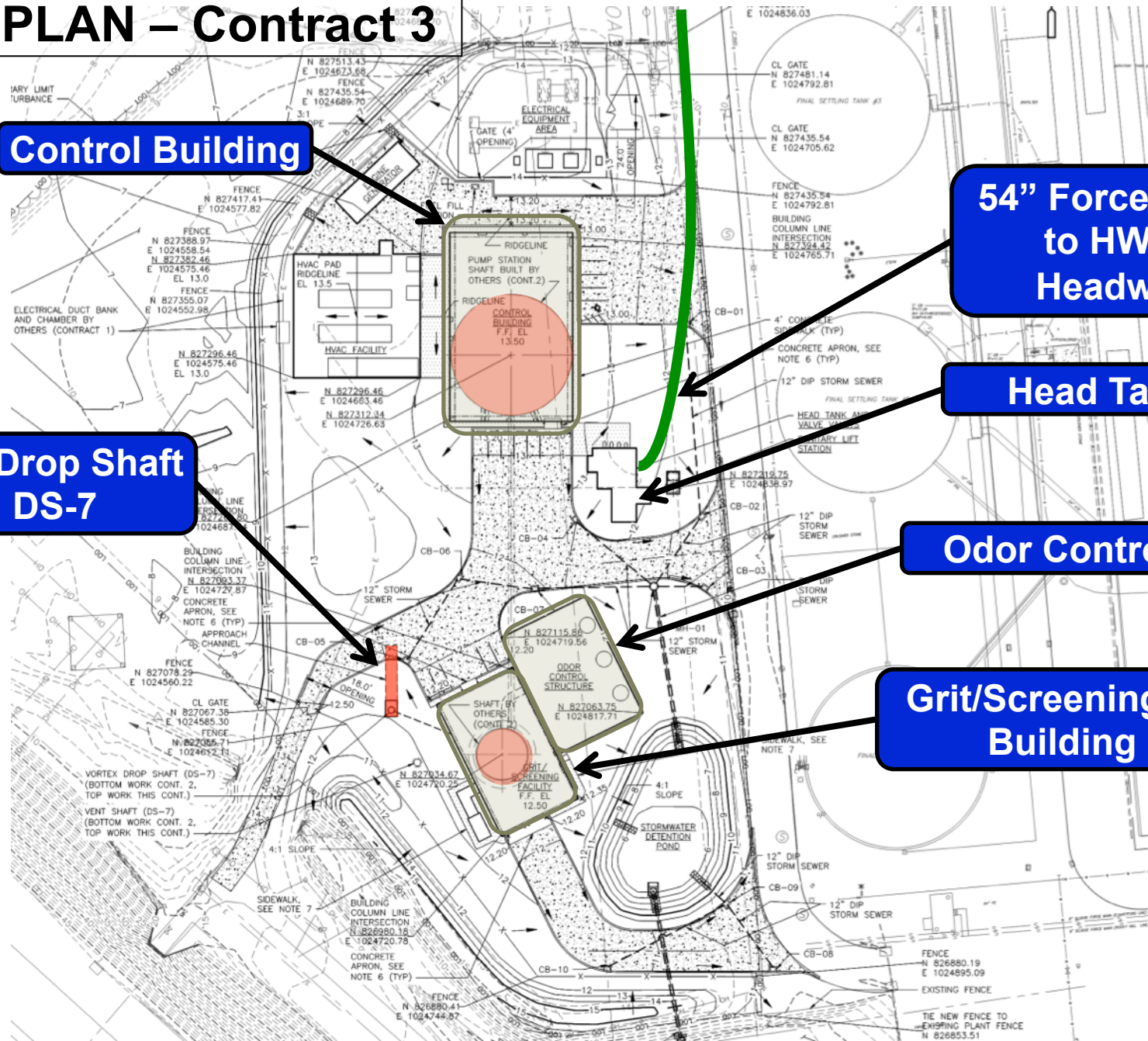
54" Forcemain to HWPCF Headworks

Head Tank

Vortex Drop Shaft DS-7

Odor Control

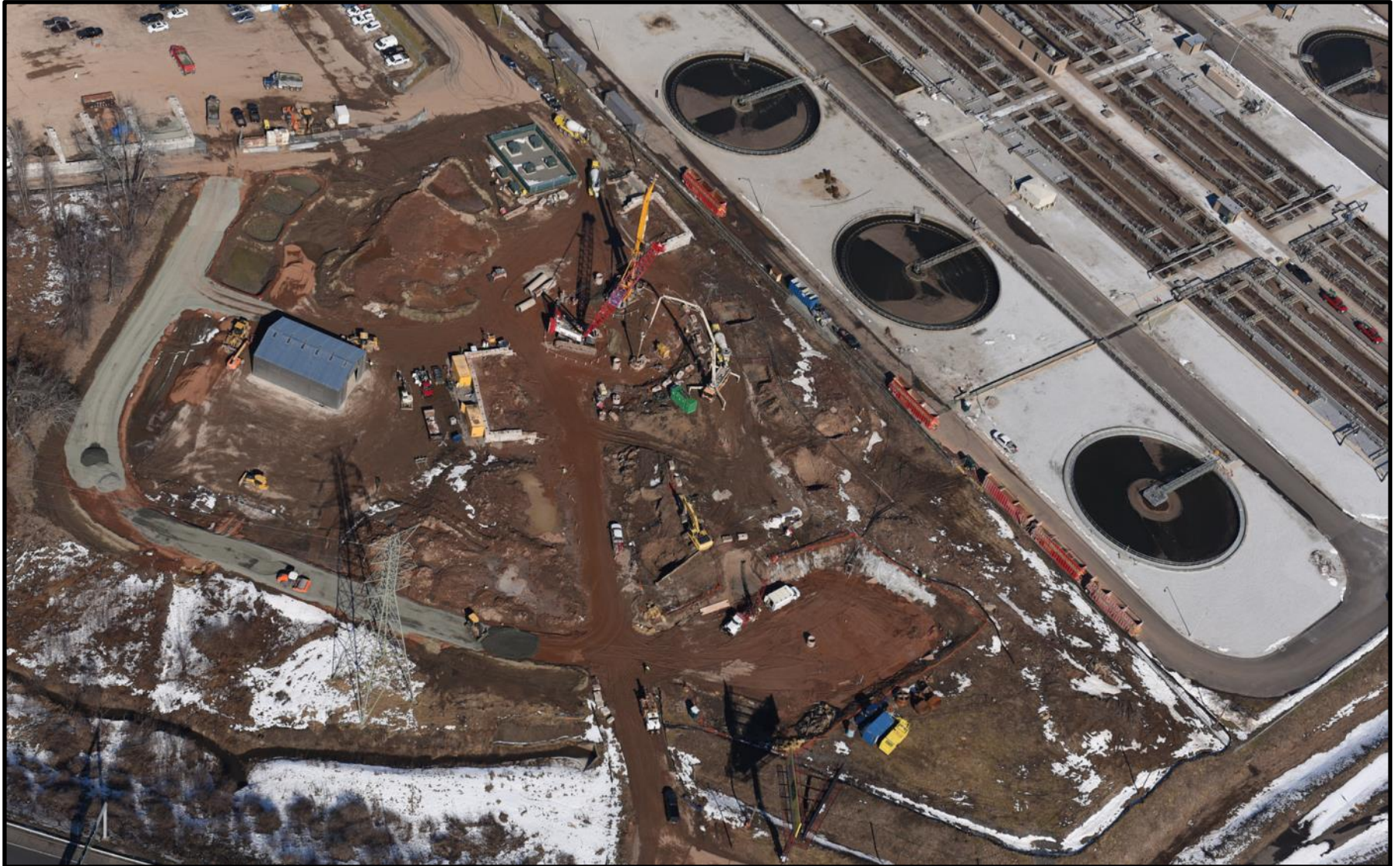
Grit/Screening Building



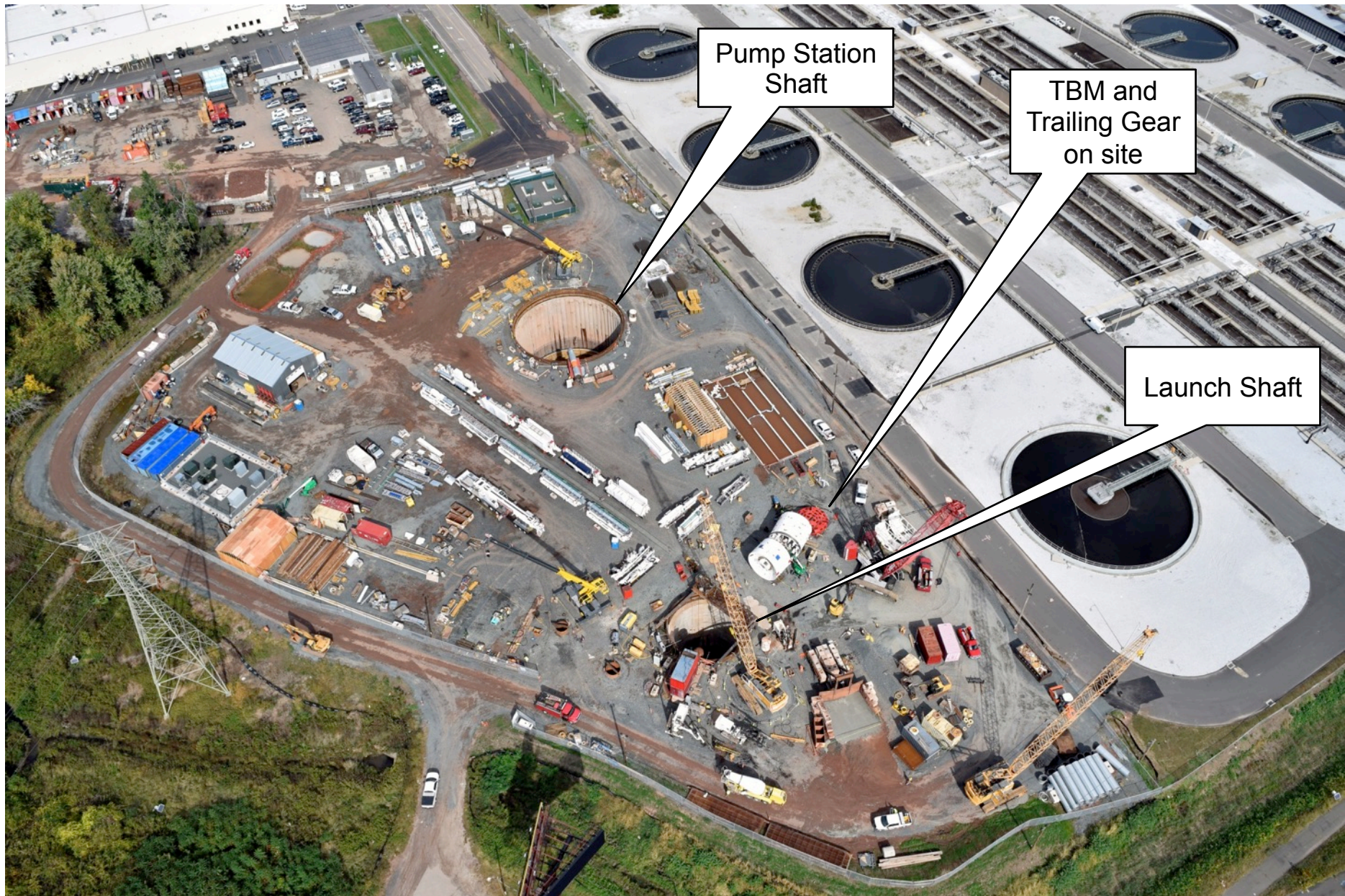
Main Work Site – Summer 2016



Main Work Site – January 2017



Main Work Site – October 2017



Launch Shaft Secant Pile Guidewall – January 2017



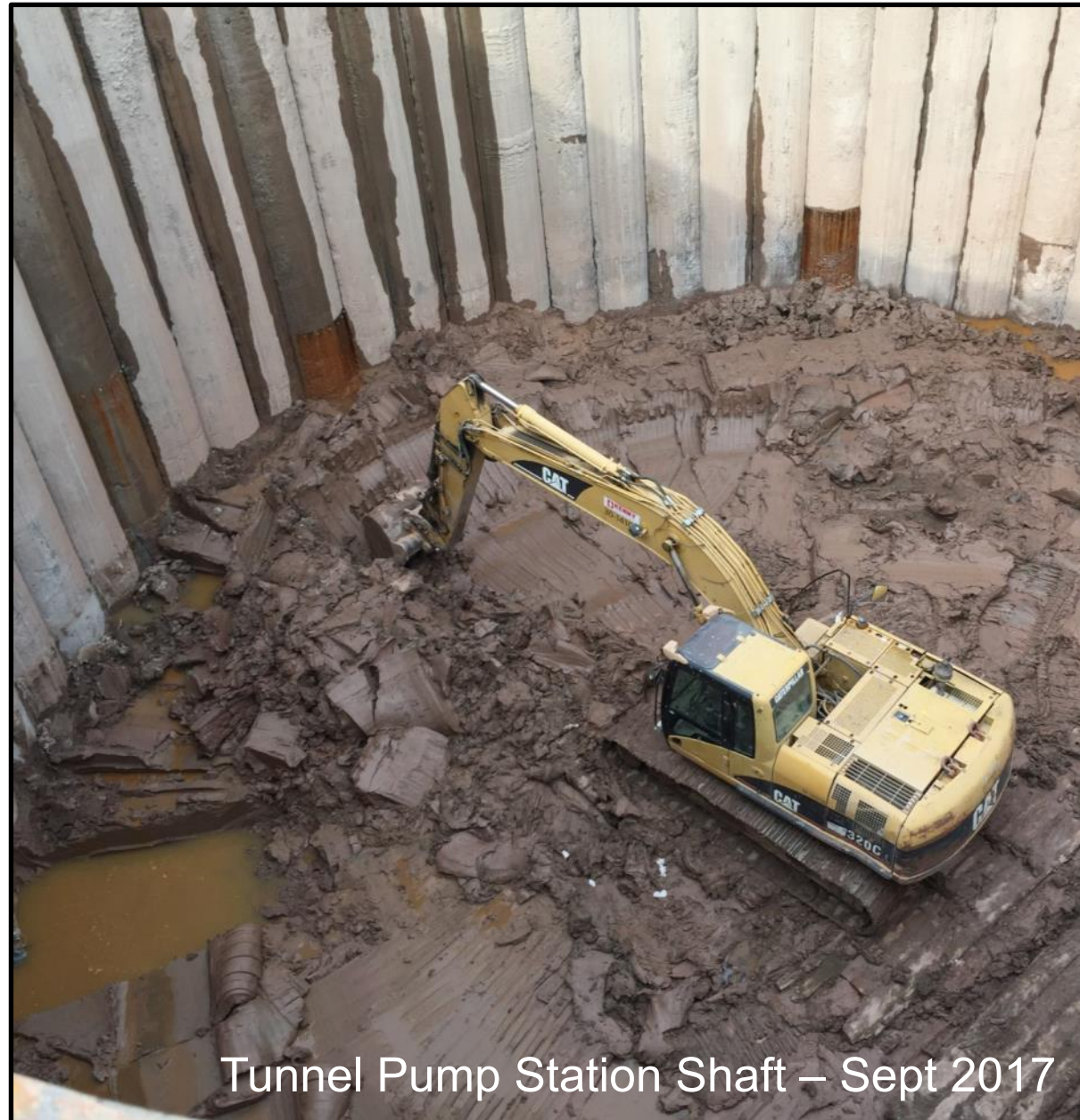
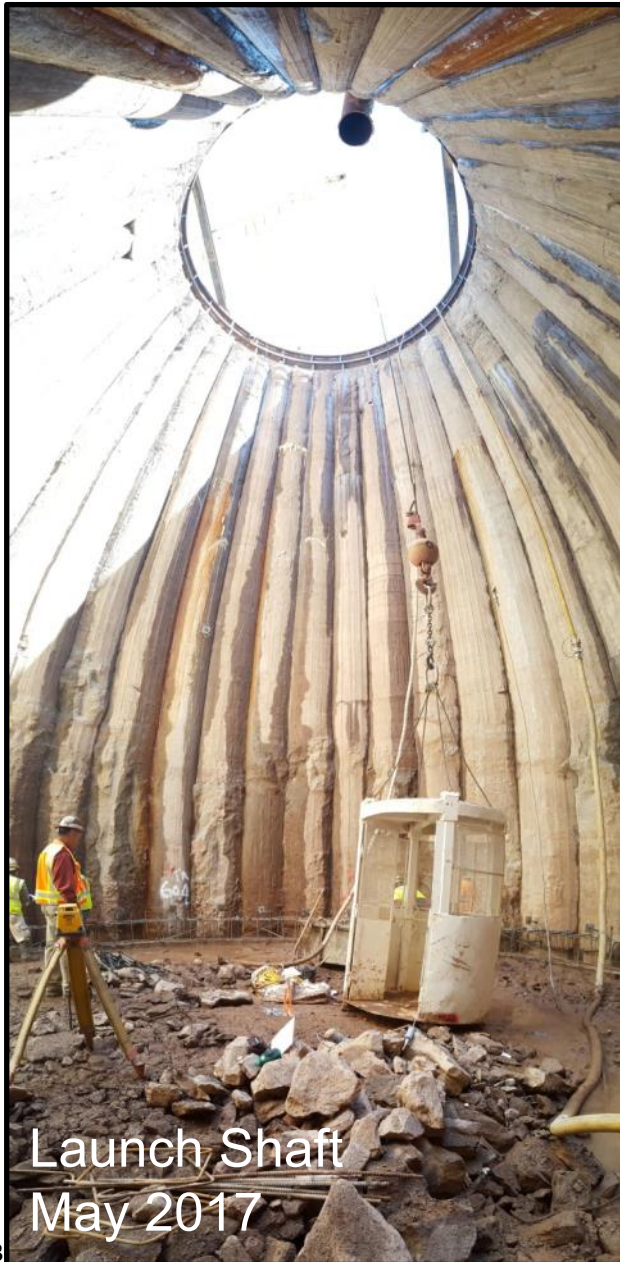
Secant Pile Drill Rig – Bauer BG 39

Launch Shaft



2017/01/16

Shaft Excavation



CIP Concrete Ring Beam / Pump Station Shaft

September 2017



Placing the Launch Shaft CIP Concrete Liner

June 2017



Pump Station Final Liner in Overburden



Launch Shaft - Drill and Blast Rock Excavation September 2017



Launch Shaft - Drill and Blast Rock Excavation September 2017



Bottom of excavation – Launch Shaft – January 2018



Launch Shaft - January 2018

Rock Support for Starter Tunnel – December 2017



Suction Header Tunnel – January 2018



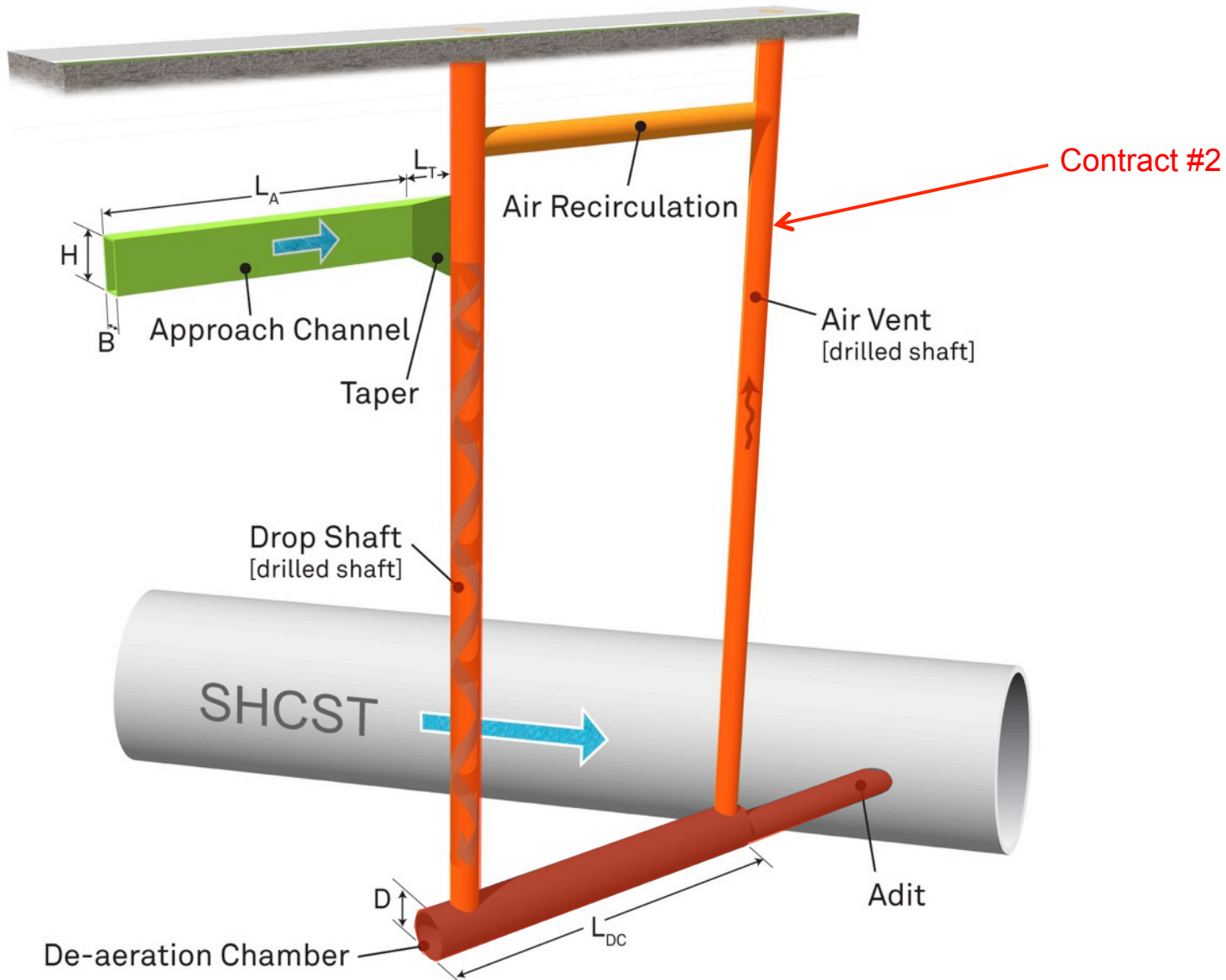
TBM Retrieval Secant Pile Guidewall – August 2017



Vortex Drop Shafts



Hydraulic Drop Shaft Construction



Drop Shaft #4 Site Preparation (484 Franklin Ave)



Casing Installation



Wirth Rock Recirculation Drilling (Franklin Ave. DS-4)



Rock Drill String Cutterhead for Wirth Rig



Drill String for DS-7 at Launch Shaft



Installing the Drop Shaft Carrier Pipe – DS-7



Installing the Drilled Shaft Carrier Pipe (DS-7) – Oct 2017



Carrier pipe during installation



Installed Carrier Pipe

Field Application of Lining on Carrier Pipe Joints



Vortex Shaft Construction Status

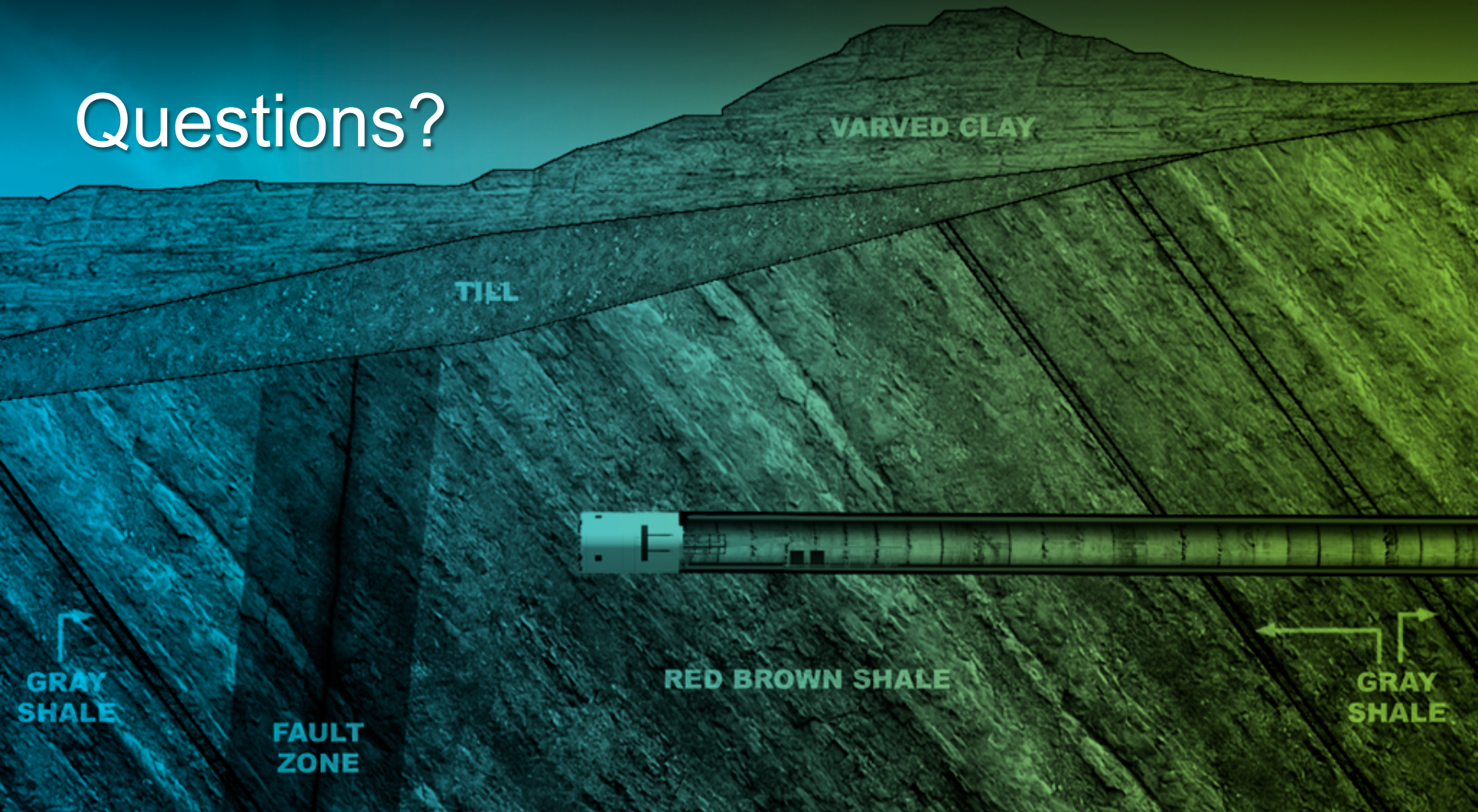
- Overburden for all eight vortex drops and vent shafts have been drilled.
- Rock has been drilled for 9 of the 15 shafts/vents



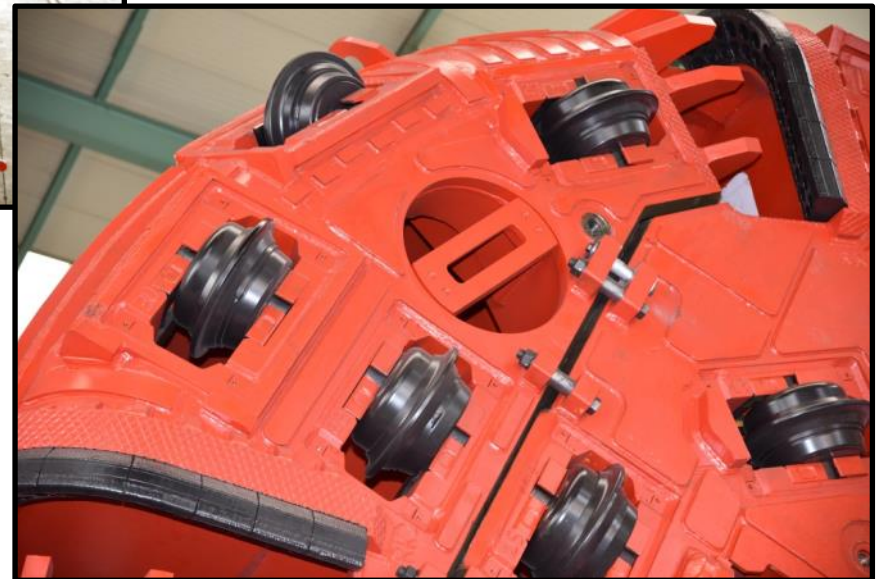
IDENTITY: FORT LINDSEY TIA & ADJUTANT GENERAL
SOUTH-WESTERN CONCRETE AND STORAGE TUNNEL
CONTRACT: 2015-107
VOLUME: 1011 - 101
PHOTO: 12/04/15-107 DATE: 11/25/2017
BARNETT ASSOCIATES PHOTOGRAPHY

- Carrier Pipe has been installed in 6 of the 15 shafts/vents.
- Deaeration Chambers and Adits to be installed from within the Tunnel

Questions?



TBM Factory Visit – Herrenknecht AG, Schwanau, Germany



Franklin Ave. DS-4 – Mixed Use/Residential Area

