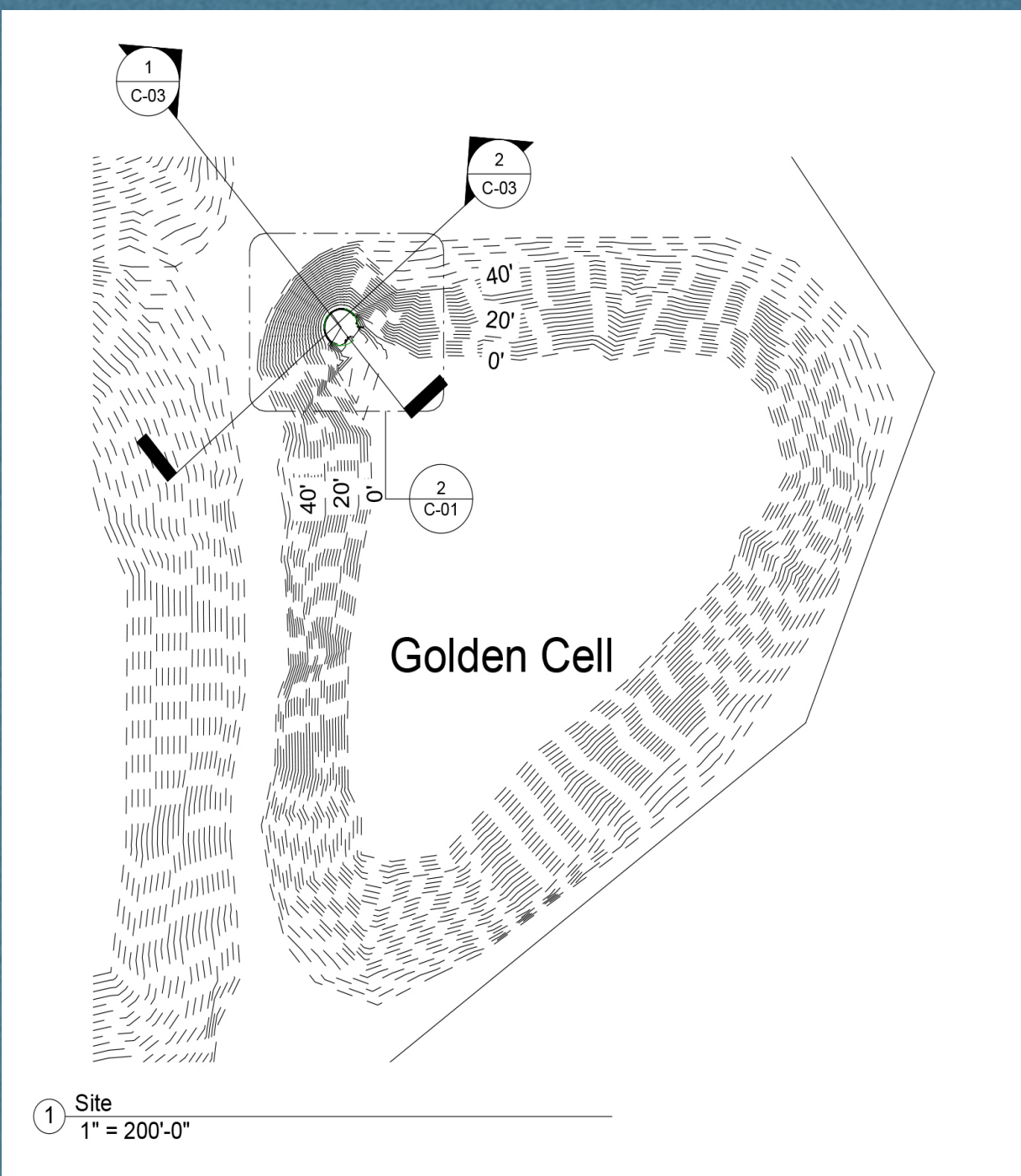


PUMP STATION EXCAVATION



Bear Engineering

Project Overview



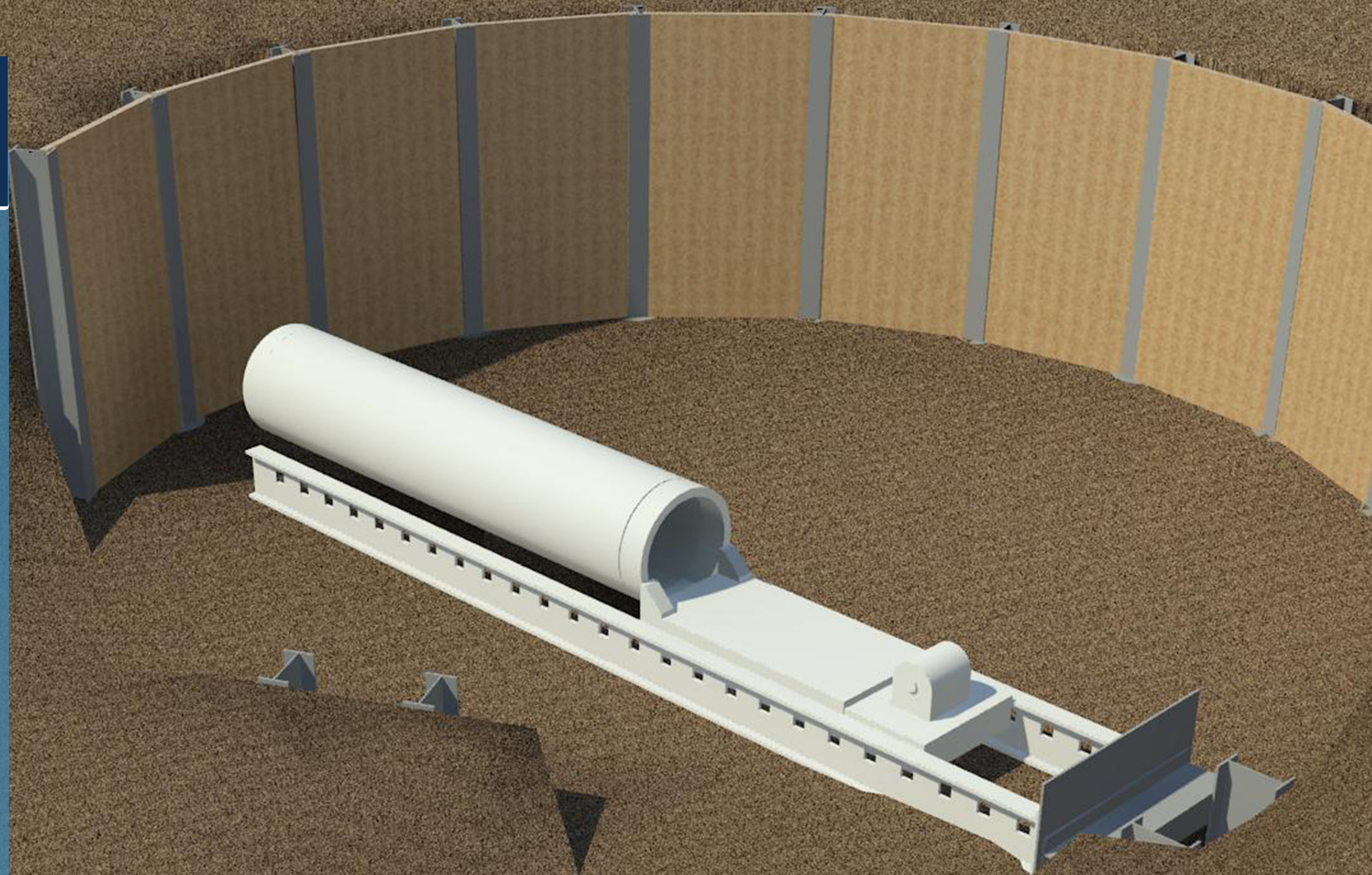
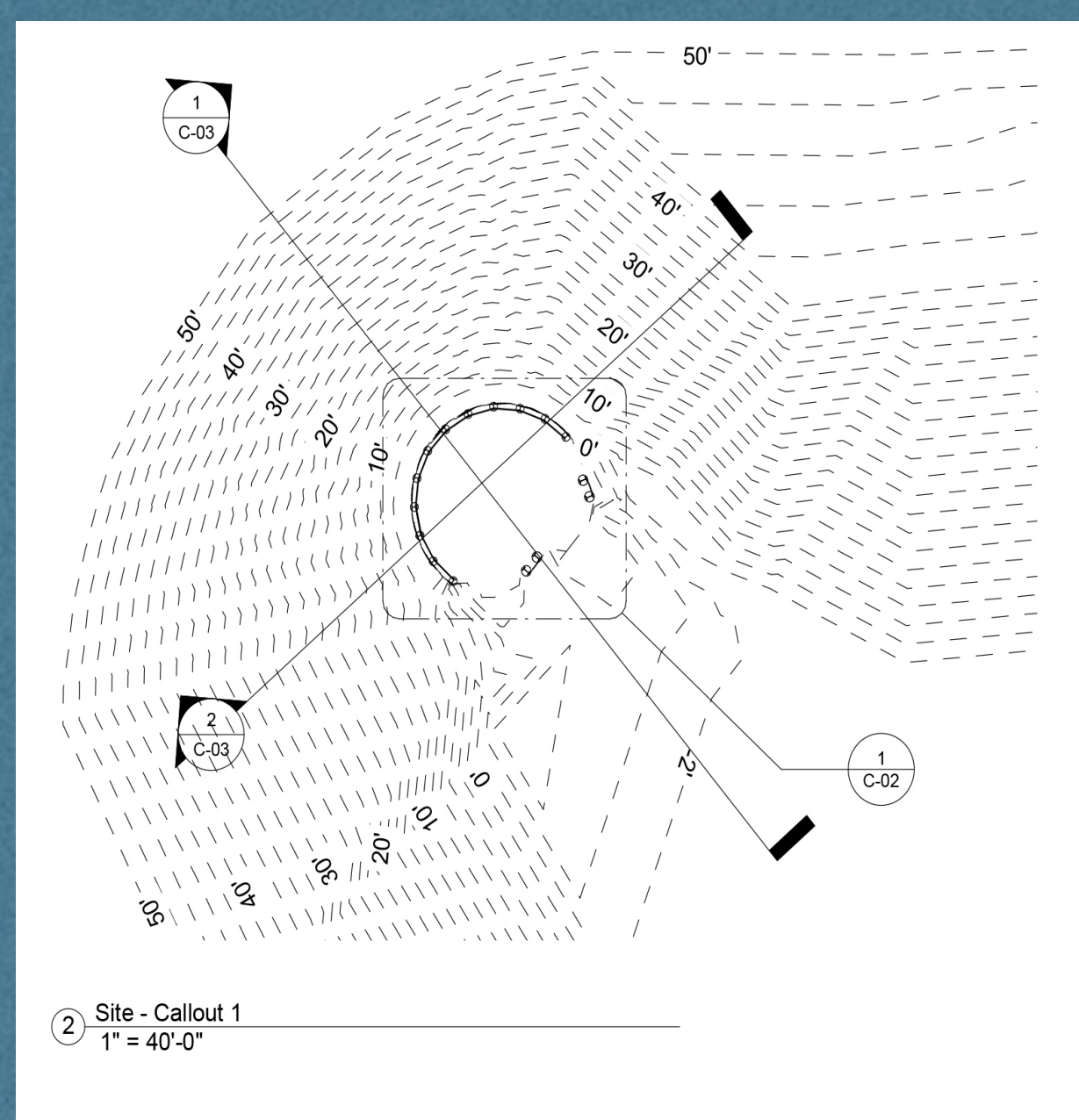
- The Everist Reservoir site is located in Weld County, Colorado on the bank of the South Platte River.
- The proposed construction consists of building a pump station connecting the Fort Lupton East, Hill

Oakley, and the Golden Reservoir cells through conduits. Other structures include a discharge conduit near the river and an electrical control building adjacent to the pump station.

- The main objective of the project is to build a pump station in a 60 ft. deep and open excavation on the northwest corner of the Golden Reservoir Cell.

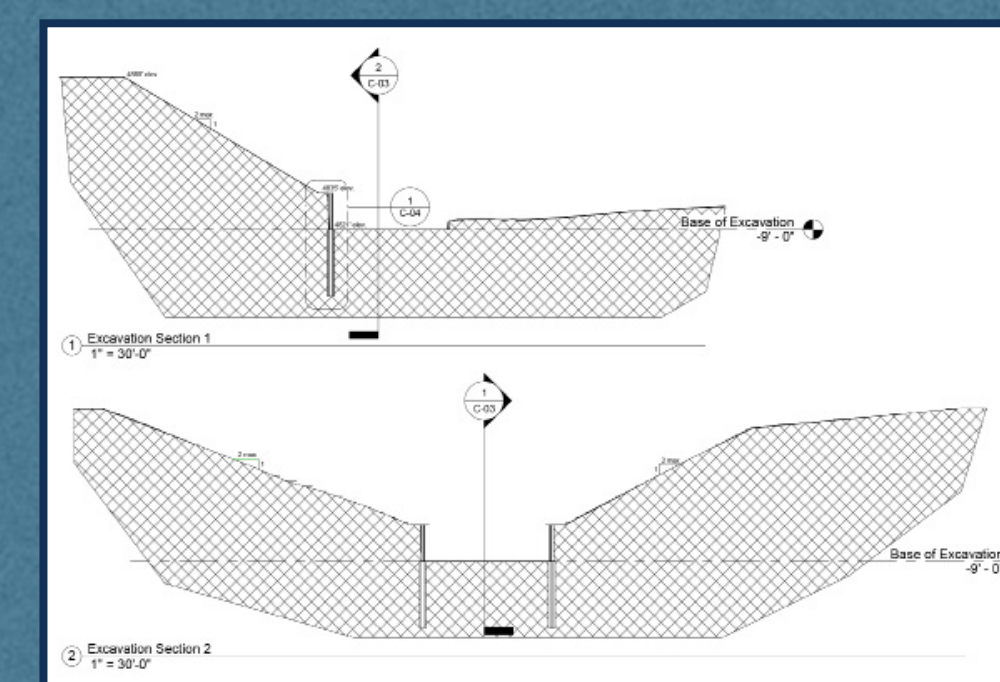
- The microtunnels to the Hill-Oakley Reservoir and East Fort Lupton cells will be constructed using a Tunnel Boring Machine (TBM).

- Significant aspects include the excavation design as well as the creation of the TBM thrust-wall. The project will allow for the efficient flow of water within the Golden, Hill-Oakley and East Fort Lupton cells.

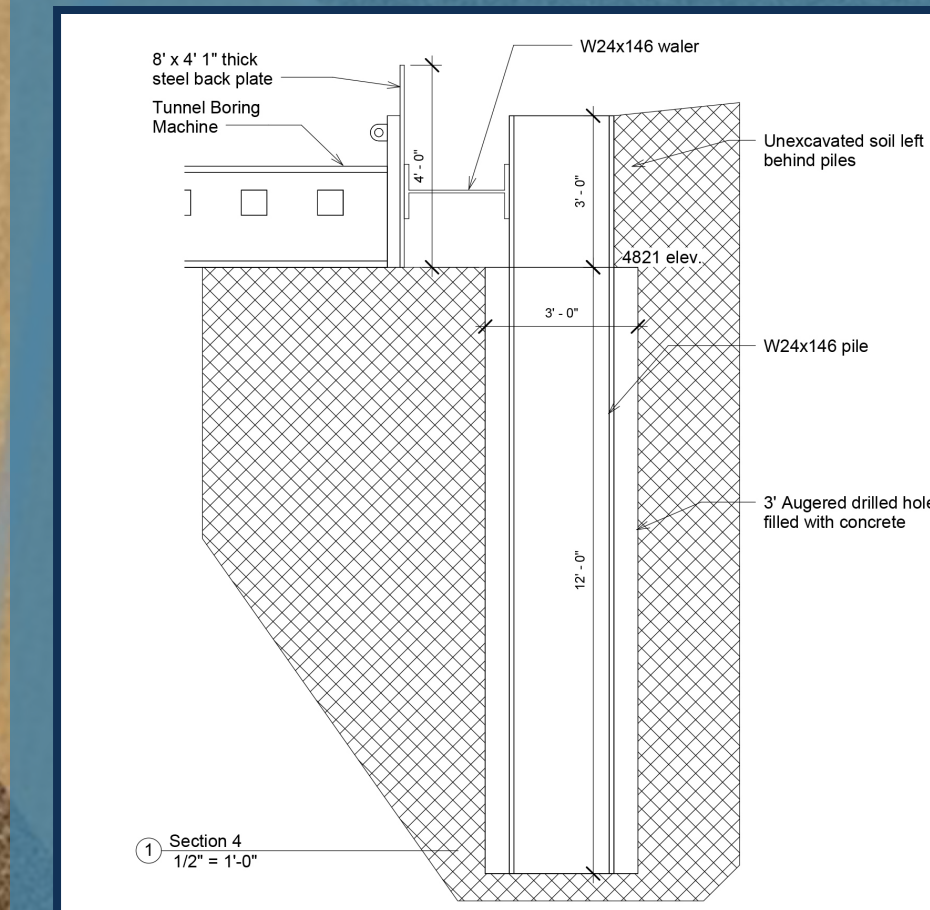


Excavation Design

- The design for pump station excavation will consist of an open slope excavation paired with a vertical earth retaining system in the lower 14 feet of the excavation.
- The open slope will be graded at a slope ratio of 2:1 (Horizontal:Vertical) to a depth of 45 feet below the top of the cut slope.
- The final 14 feet of the excavation will be vertically supported using soldier piles and wood lagging.
- The soldier piles will be W 12x35 steel shapes spaced 8 feet on center around the vertical portion of the excavation in 24 inch drilled shafts backfilled with 100-psi lean-mix concrete. Each pile will be a minimum of 28 feet long, 14 feet of which will be placed below ground.
- UTexas 4 was used in the slope stability analysis of the excavation. The factors of safety for the two failure planes were 1.2 and 1.3.



Thrust Wall Design

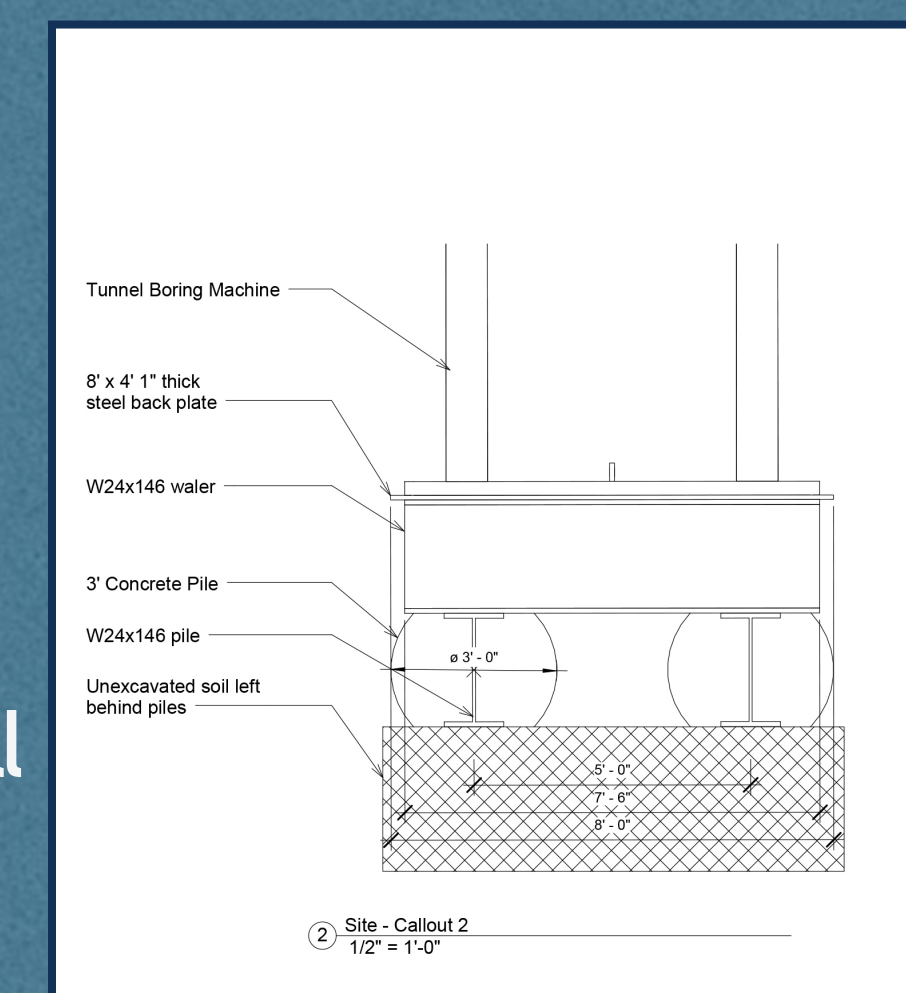


- Two thrust walls are needed to complete the tunnel boring for the conduits. They will need to resist a force of approximately 700 kips applied by the TBM jack.
- The two piles for each thrust wall will be steel W 24tx146 shpaes, 15 feet long

and placed in 36 inch drilled shafts. They will be spaced 5 feet apart on center. The shafts will be back filled with lean mix, 100 psi concrete.

- The water is also a W24x146 steel shape. It will be 7.5 feet long, centered between the pile pairs and connected 1.5 feet from the top of the pile with respect to the waler's center. The factors of safety against bending and shearing are 6.87 and 2.01 respectively.

- Each thrust wall will be positioned in order for the TBM to drill in the appropriate direction.



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