

# Pulling HDPE and RJ-DIP in One HDD Installation

Matthew Olson, P.E.



Troy Tumbleson



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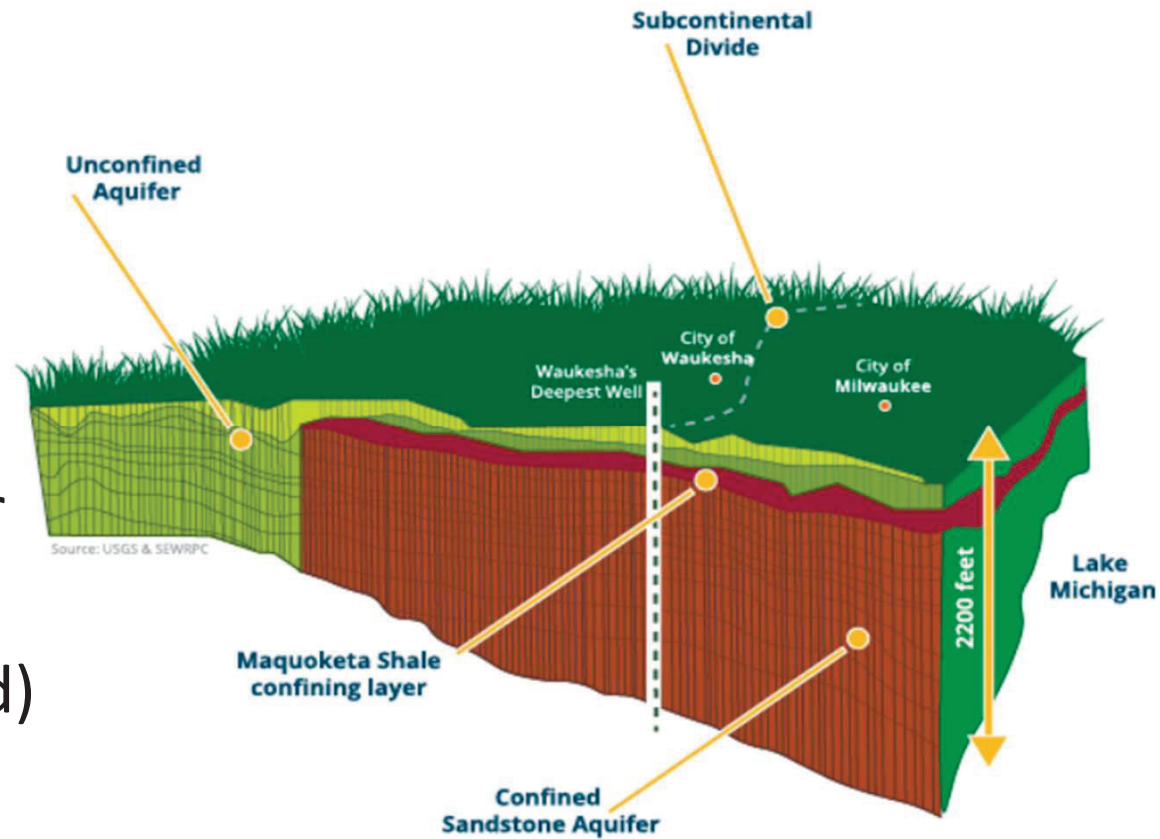
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# PROJECT NEED

- 1868: Spring City
- Early 1900s: 1,835' well - St. Peter Sandstone Aquifer
- Decreasing water levels
  - Overlying shale (aquitard)
  - Increasing salt, mineral
  - Long-term, sustainable source



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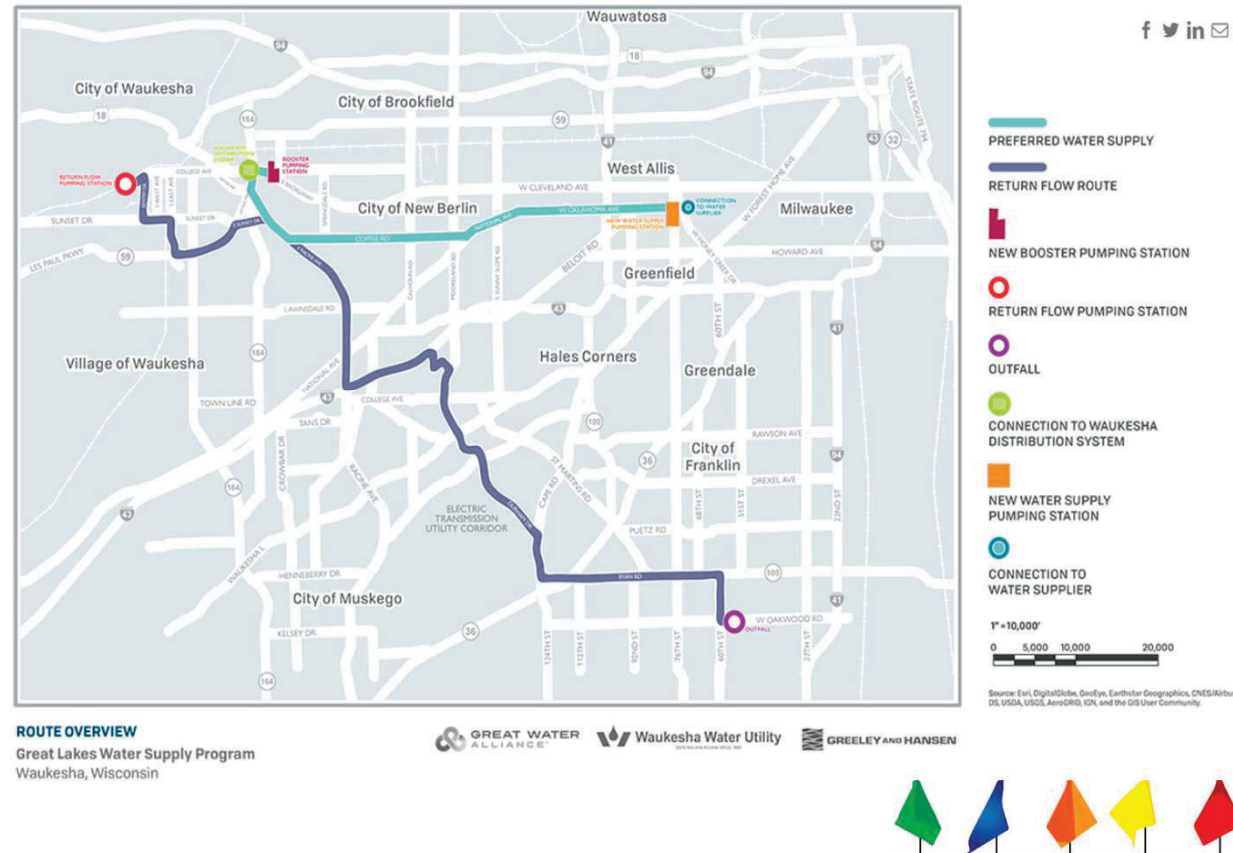
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# UMM, THERE'S A BIG LAKE OVER THERE...

- Great Lakes Council
- Local municipalities
- Water out = water back
- 36-mile pipeline
- Improved water quality in Root River



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# PROJECT STATS

## 36-mile pipeline (source & return)

- 8.2 MGD
- 16 local communities
- Several contracts with numerous tunnels & HDDs

## Other Infrastructure

Pumping stations, outfall station

## Contract 2A

8.5 miles of 30" water supply; 3 HDDs, 8 tunnels



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# PROJECT STAKEHOLDERS

- Great Water Alliance
- EPA; WI DNR
- Owner's Engineer: Greeley and Hansen
- Owner's Construction Representation: Black & Veatch
- Contractors: Super Excavators, RJ Underground, ECI Contracting, others
- Contractor's Engineer: Lithos Engineering (2 HDD packages)



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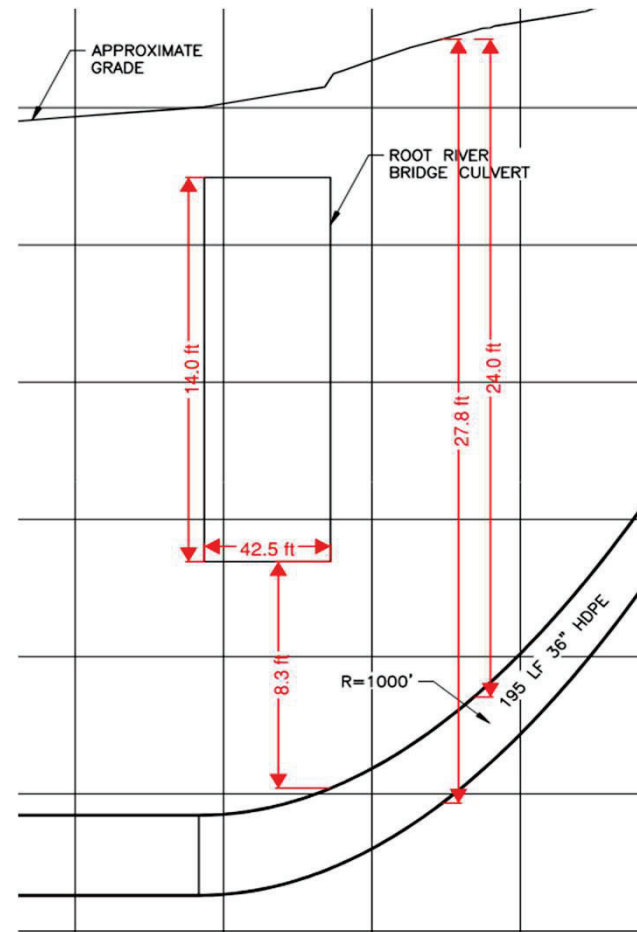
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# ORIGINAL DESIGN

- 36" IPS DR 9 HDPE
- 1,610 LF
- 1,000' vertical-bend radii
- 11° entry & exit angles
- 80 LF entry length
- 65 LF exit length
- 8' clearance



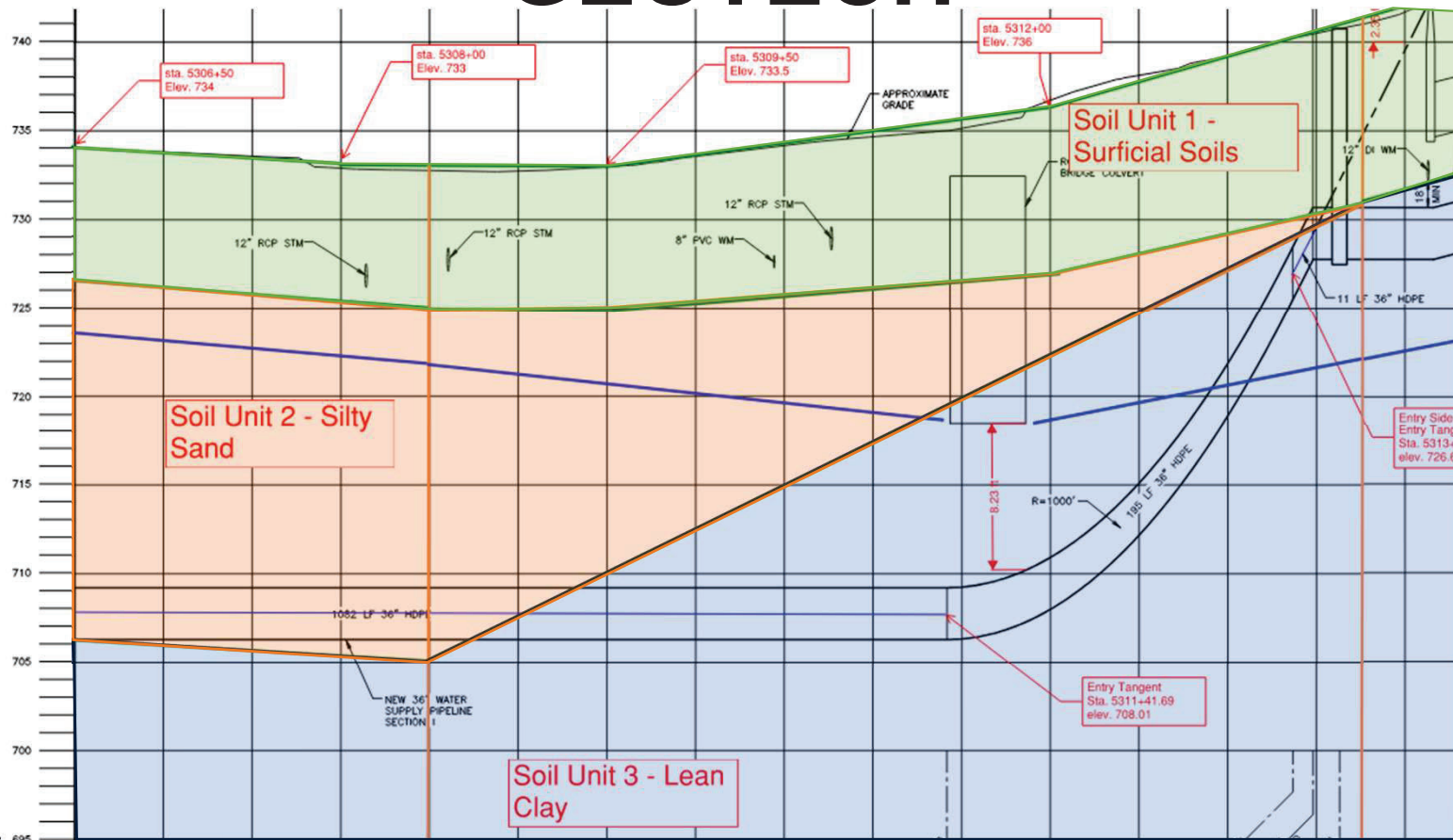
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# GEOTECH



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# CONTRACTUAL REQUIREMENTS

## Contractor

- Responsible for design
- Determine zone of influence, safe burial depth, offset from existing utilities
- Assure alignment provides sufficient burial depth & offset



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# ENGINEERING SUPPORT

## Initial review & recommendations

- Deepen alignment to gain separation on box culvert
- Contractor advised against – Bedrock impact to schedule & constructability

## Calculations

- Pull force & pipe stress (ASTM F1962)
- Inadvertent Returns (IRs)
- Settlement

## Summary Memorandum

- Calculation results & explanations
- Request for modified HDD tolerances



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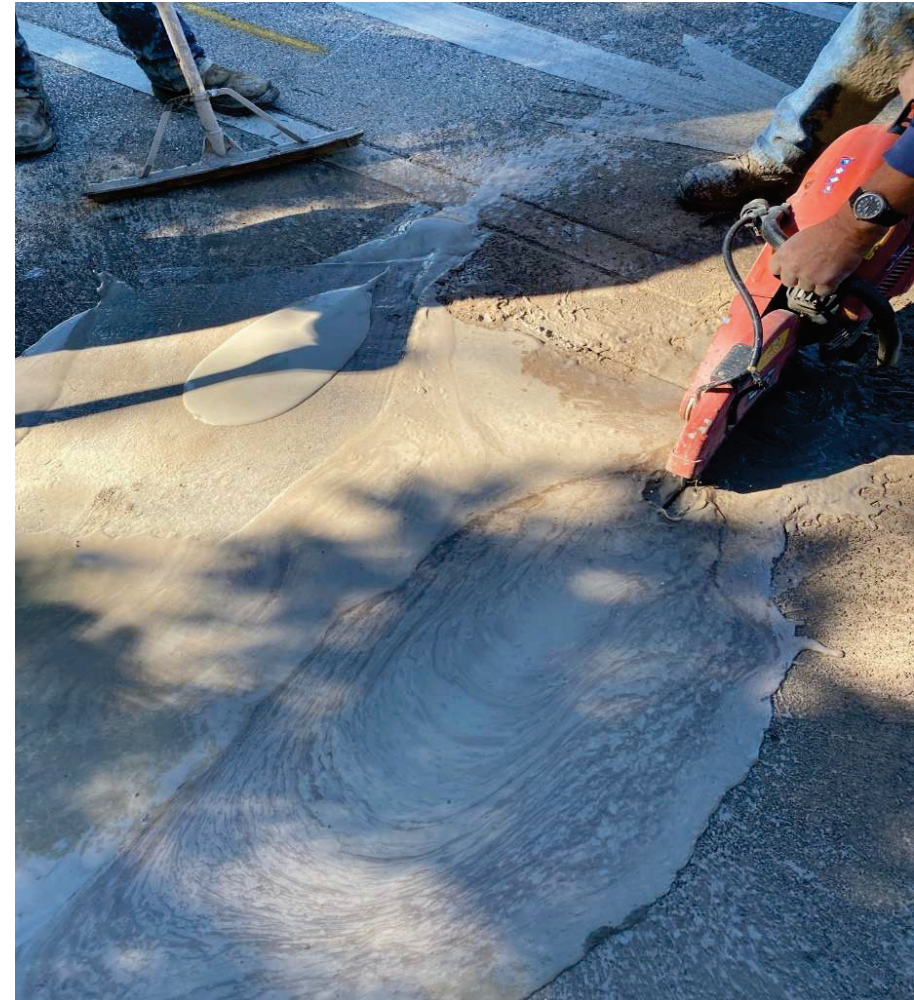
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# CONSTRUCTION ATTEMPT #1

## Pilot Bore

- Production averaged 400 LF per day; 16" steel casing
- Ran into something early
- Cut relief pits to contain any potential IRs



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# REVISED DESIGN FEATURES

- Deeper & longer
- Additional geotechnical exploration
- Final design P&P
- DIP in contaminated soil
- Innovative connection
- Pull force, stress calculations



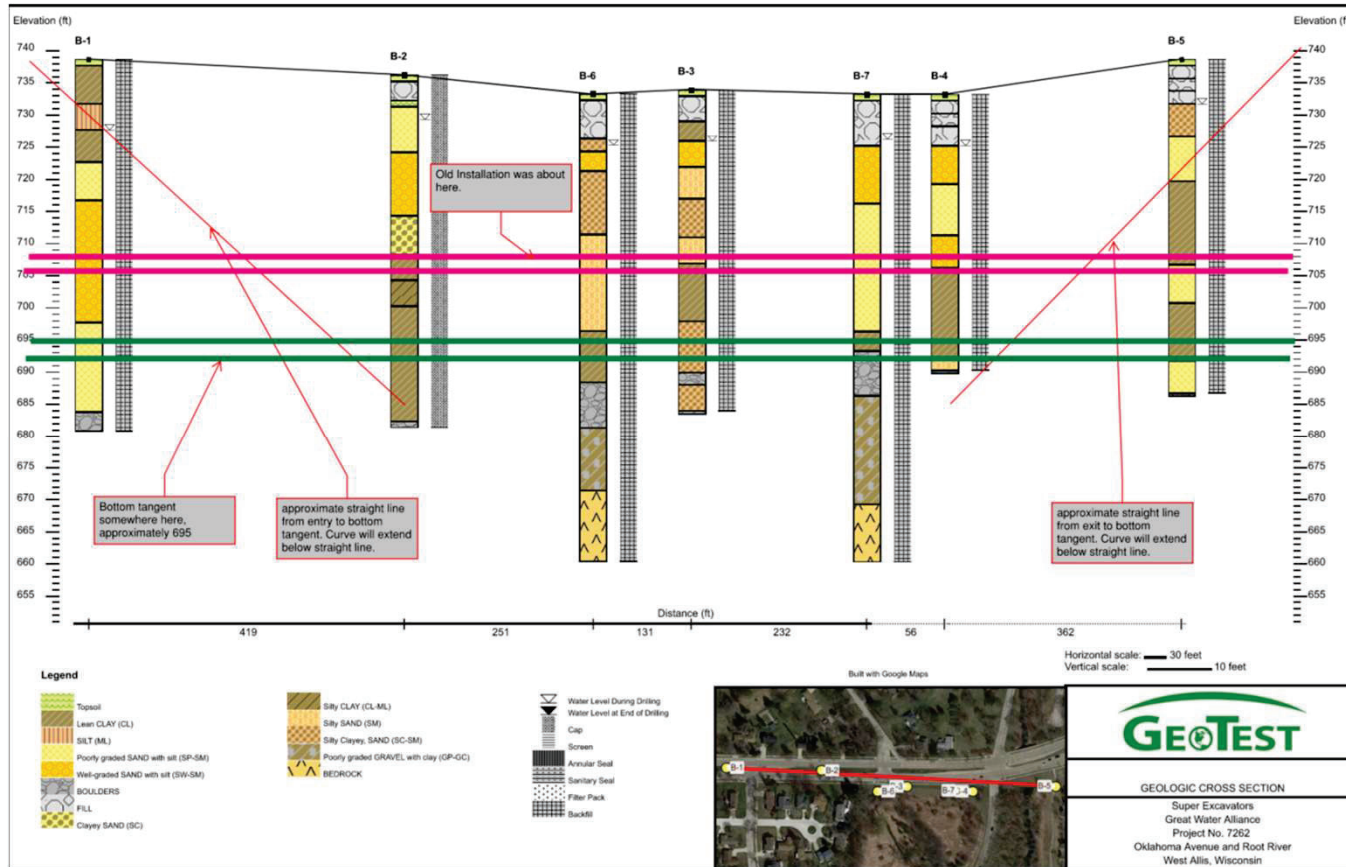
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# ADDITIONAL BORINGS



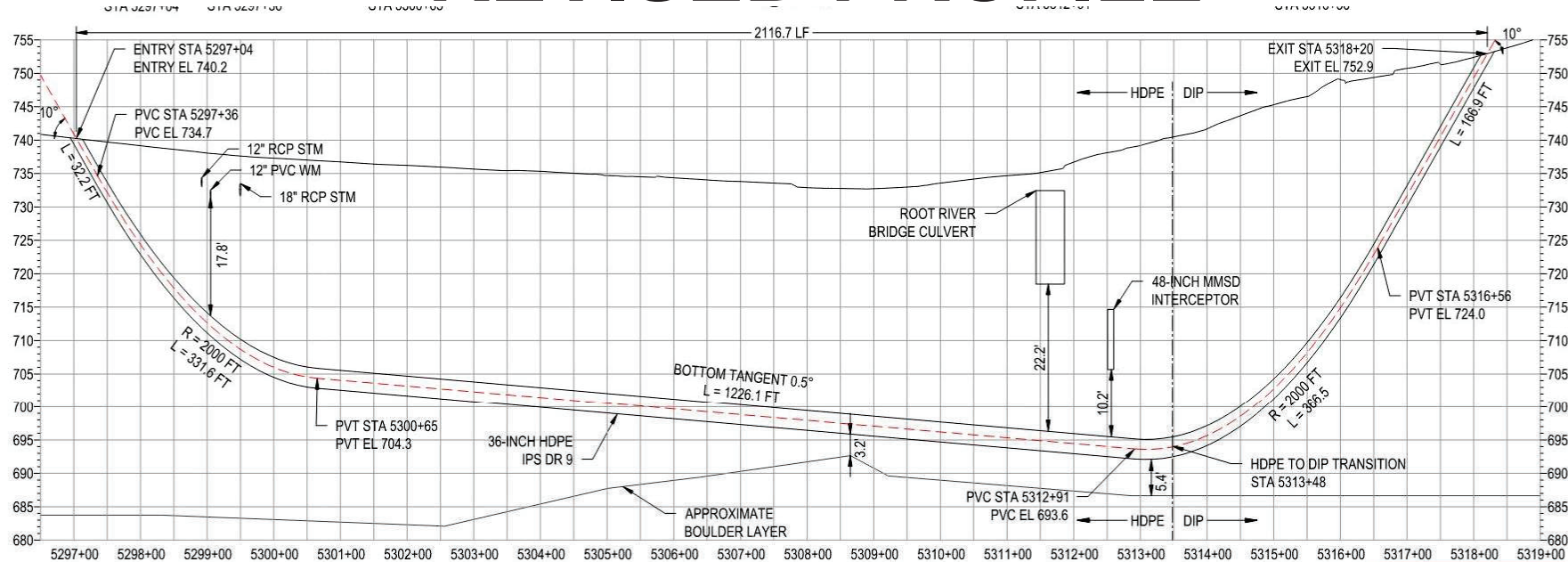
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# REVISED PROFILE



## HDD GENERAL NOTES:

1. HDD DRILL PIPE CENTERLINE AND 36-INCH HDPE IPS DR 9 SHOWN. STATIONING AND ELEVATION ARE FOR DRILL PIPE CENTERLINE.
2. HDD ENTRY REFERS TO WHERE DRILL PIPE FIRST ENTERS THE GROUND DURING THE PILOT BORE.
3. THE LENGTH OF PIPE/BORE PATH IS 2123.3 FEET.
4. TRANSITION FROM HDPE TO DIP AT STA 5313+48.
5. "L" REFERS TO LENGTH OF SECTION AND "R" REFERS TO VERTICAL RADIUS.
6. THE BLUE LINE REPRESENTING THE APPROXIMATE BOULDER LAYER WAS BASED ON INTERPRETATION, INTERPOLATION, AND EXTRAPOLATION OF GEOTECHNICAL BORINGS COMPLETED BY OTHERS.
7. POTHOLING AND/OR A SUBSURFACE UTILITY ENGINEERING (SUE) INVESTIGATION WAS NOT COMPLETED AS PART OF THIS WORK AND AN UNDERSTANDING OF SUBSURFACE UTILITIES IS NOT IMPLIED BASED ON THE PRESENTED ALIGNMENTS. EXISTING UTILITIES SHOWN ARE BASED ON THE PROJECT'S CONTRACT DRAWINGS PREPARED BY THE PROJECT ENGINEER AND DRAWINGS PROVIDED TO LITHOS BY RJ UNDERGROUND. WE ANTICIPATE OTHERS WILL COMPLETE THE NECESSARY UTILITY INVESTIGATION(S) PRIOR TO CONSTRUCTION. IF UTILITY CONFLICTS ARE IDENTIFIED, LITHOS SHOULD BE CONTACT TO REVIEW AND APPROVE MODIFICATIONS TO THE PRESENTED HDD PLAN AND PROFILE.

8. LITHOS HAS NOT CONSIDERED PERMITS OR EASEMENTS NECESSARY TO COMPLETE THE PROPOSED CONSTRUCTION AND UNDERSTANDS THIS HAS BEEN CONSIDERED BY OTHERS.
9. LITHOS HAS NOT EVALUATED THE SITE FOR POTENTIAL ENVIRONMENTAL CONTAMINATION OR HAZARDOUS MATERIAL. THE TRANSITION LOCATION FROM HDPE PIPE TO RESTRAINED JOINT DUCTILE IRON PIPE (DIP) WAS DETERMINED BY OTHERS.
10. LITHOS UNDERSTANDS DIP WILL BE CARTRIDGE LOADED DURING PULLBACK SUCH THAT TRANSITIONING THE DIP FROM THE HDD ALIGNMENT TO THE GROUND SURFACE WILL NOT CAUSE MANUFACTURER'S MAXIMUM DEFLECTION ANGLES FOR THE DIP CONNECTIONS TO BE EXCEEDED.

## HDD TOLERANCES:

1. NO GREATER THAN 5 FEET LEFT OR RIGHT OF ALIGNMENT
2. NO GREATER THAN 2 FEET HIGH OR 10 FEET BELOW PROFILE
3. NO GREATER THAN 5 FEET SHORT OR 10 FEET LONG OF EXIT LOCATION
4. NO BENDING RADII LESS THAN 1600 FEET

SHEET	DRAWN BY AW	DESIGNED BY MO	CHECKED BY BS	DATE 10/26/2022	SHEET OF 1	PROJECT	HORIZONTAL DIRECTIONAL DRILLING (HDD) WORKING DRAWINGS PLAN AND PROFILE	SHEET TITLE	GWA CONTRACT PACKAGE 2A - WATER SUPPLY PIPELINE	OWNER	WAUKESHA WATER UTILITY
										CLIENT	RJ UNDERGROUND, INC.
										PROJECT NO.	20127
										LOCATION:	CITY OF NEW BERLIN, WI

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# HDPE TO RJ-DIP CONNECTION



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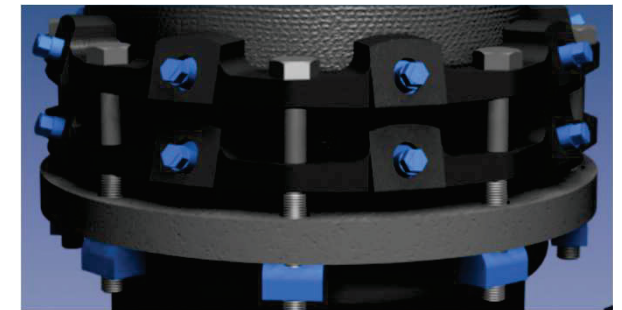
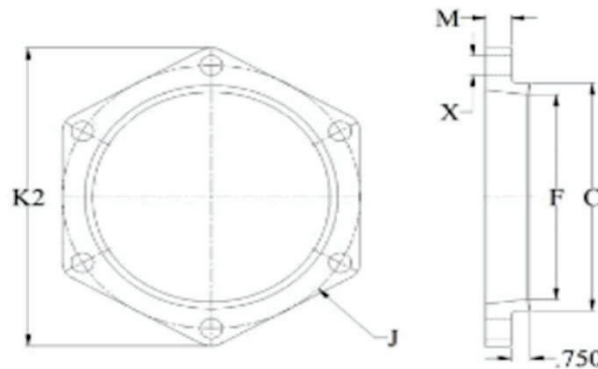
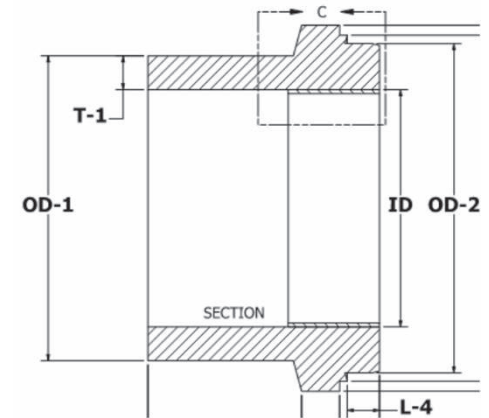
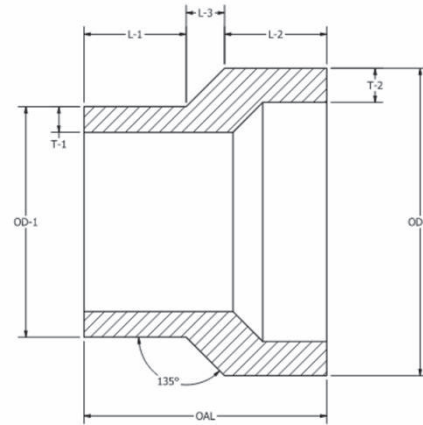
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# HDPE TO RJ-DIP CONNECTION PIECES

1. 36" IPS DR 9 HDPE Pipe
2. 36"x30" HDPE Reducer
3. 30" HDPE MJ Adaptor
4. C110 Gland
5. 30" MegaLug
6. MJ Sleeve
7. 30" MegaLug
8. 30" TR Flex RJ DIP
9. Steel sleeve



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# PULL FORCE & PIPE STRESS CALCULATIONS

## Pull force

ASTM F1962 and Dorwart DIP

## Pipe Stress

Unconventional calculations for connection appurtenances:

- Tensile capacity for MegaLug
- Tensile capacity for HDPE Reducer
- MJ fitting bolt tensile strength
- Flange shear stress & hoop stress for MJ adapter



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# CONSTRUCTION ATTEMPT #2

## Mitigation tactics

- Low side drilling
- Maximize pipe radii
- Environmental control devices
- Tooling: variety of reamers for multiple soil conditions



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# CONSTRUCTION STATS

**Attempt 1: Oct. 2021**

**Attempt 2: Apr. 2023**

**Project Duration: 62 Days**

- Pilot Time: 20 Shifts
- Ream Time: 28 Shifts  
(2 Passes + 550' of  
54" Pass)



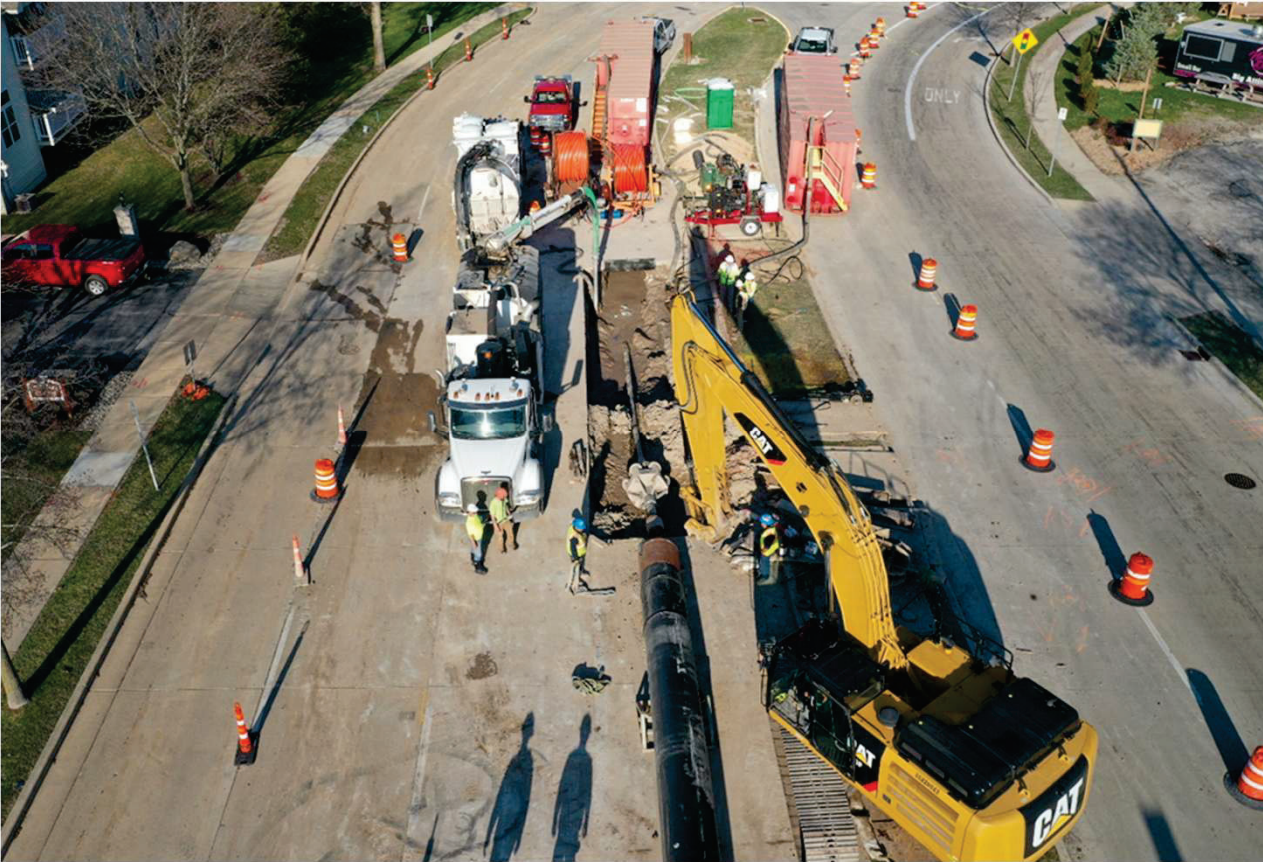
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# CONSTRUCTION STATS



## Project Duration (cont'd.)

- Swab time: 2 Shifts
- Pullback HDPE:  
9 am-5 pm (8 hrs)
- Transition installation:  
5-7:20 (2.3 hrs)
- Pullback DIP:  
9 pm-4 am (7 hrs)



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# QUESTIONS?



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