ADDENDUM NO. 2
TO
CONTRACT DOCUMENTS
Euclid Creek Tunnel (ECT)
September 20, 2010

BID OPENING:  2:00 P.M. ON THURSDAY, OCTOBER 14, 2010

Addendum No. 2 consists of 9 pages and the following Attachments:

Attachment 1  Bidder Questions (submitted during bid period)
Attachment 2  Drawings
Attachment 3  Standard Plan for Egg Shaped Sewer
Attachment 4  02320 – Open Shield Pipe Jacking

ATTENTION BIDDERS:

All Bidders on the above titled Project are hereby advised of the following modifications to the Specifications and Drawings for the Project. This Addendum is issued to make certain revisions, additions, and clarifications to the original Contract Documents and shall be incorporated in the original Specifications. This Addendum takes precedence over any and all information previously issued. No other revisions to the Specifications are to be inferred.

This addendum shall be fastened to the Contract Documents and the Bidder must acknowledge receipt of this Addendum in the appropriate space in Volume 1 of the Contract Documents – Bid Booklet.

The following schedule is provided to prospective bidders to assist with preparation of their bid package. This is an anticipated schedule and is therefore subject to change:

September 17, 2010: Deadline to receive questions related to “Bid Documents” version of Contract Documents
September 24, 2010: Addendum No. 3
October 1, 2010: Deadline to receive questions related to clarification of previously issued addenda
October 7, 2010: Addendum No. 4 (last addendum)
A. VOLUME 2 – FRONT END DOCUMENTS & DIVISION 1 SPECIFICATIONS

Item No. AD2.0  Legal Notice

Replace the first paragraph with the following:

“Sealed Bids will be received at the office of the Director of Finance of the Northeast Ohio Regional Sewer District located at 3900 Euclid Avenue, Cleveland, Ohio 44115 until 2:00 P.M. Official Local Time on Thursday October 14, 2010 at which time Bids received will be publicly opened and read aloud for the construction of the Euclid Creek Tunnel (ECT).”

Item No. AD2.1  Agreement Between Owner and Contractor

Article 3 – Liquidated Damages, Item 3.2, insert the following amount for sewage discharge:

“…Five thousand and 00/100 Dollars ($5,000.00)…”

Item No. AD2.2  01025 – Measurement and Payment

Bid Item No. 01 – 24-ft Diameter Tunnel, Paragraph 1.a, replace item 8 with the following:

“8) Groundwater and construction water collection, conveyance, treatment and discharge for tunnel and Shaft 1-1, including but not limited to:

a. Design, installation, operation, maintenance, and control of dewatering systems and water treatment systems for removal and proper disposal of water;

b. Providing redundant power;

c. Discharge conveyance pipelines and connections to existing sewers;

d. Disposal of water consistent with the requirements as set forth in the Contract Documents;

e. Provisions and subsequent removal of the necessary settlement ponds and other water treatment requirements (including the use of chemical flocculants if necessary) for the discharge of water from the site;

f. Moving pumping equipment to suit the advancement of excavations;

g. Furnishing, operating, and maintaining volume/flow measuring devices; and

h. Surface facilities and installations required for the discharge of the water pumped from the underground works to a suitable drainage location and the procurement of any necessary permissions and permits.”
Item No. AD2.3  01025 – Measurement and Payment

Bid Item No. 07 – Standby Due to Gas in Tunnel Construction, Paragraph 1, replace item b with the following:

“b. Standby may be experienced in many events, i.e. 1 day, 3 days, 2 weeks, etc., but in aggregate will not exceed 30 days.
   1) In the event that standby time exceeds 30 days by more than 25% or contract stipulated percent, the rate will be renegotiated between the OWNER and CONTRACTOR;
   2) In the event that standby time is less than the bid item unit duration (1 day / 24 hours), the unit price bid will be prorated for the actual standby time based on the detailed breakdown described in this bid item. However, in no case, will the CONTRACTOR be eligible for payment in excess of the unit price bid for any one 24-hour period.”

Item No. AD2.4  01025 – Measurement and Payment

Bid Item No. 09 – Control of Groundwater at Shafts, Paragraph 1, delete Shaft 1-1 from item a.

Item No. AD2.5  01025 – Measurement and Payment

Bid Item No.12 – ECT-2 Site Work, Paragraph 1.b, add the following to the end of item 11:

“…replacement of sidewalk;”

Item No. AD2.6  01025 – Measurement and Payment

Utility Relocation Bid Item Nos. 25, 41, 52, 64, Paragraph 1.a, add the following to the end of item 5:

“…including control of groundwater;”

Item No. AD2.7  01025 – Measurement and Payment

Bid Item No. 42 – ECT-4 Site Work, Paragraph 1.b, add the following to item 9:

“…replacement of sidewalk;”

Item No. AD2.8  01025 – Measurement and Payment

Bid Item Nos. 45, 47, 48, Paragraph 1.a, delete item 5.

Item No. AD2.9  01025 – Measurement and Payment

Bid Item Nos. 56 and 57, Paragraph 2, delete item b.
Item No. AD2.10  01025 – Measurement and Payment

Bid Item No. 59 – CSO-210 Tie-in Structure 5-5, Paragraph 1.a, replace item 5 with the following:

“5) furnishing and installing check valve on the outfall pipe;”

Item No. AD2.11  01780 – Project As-Built Records

Paragraph 1.5, items E and F, replace with the following:

“E. The CONTRACTOR shall keep copies of the plans, Shop Drawings, and supplemental drawings at the CONTRACTOR’s field office in good order and annotated to show all changes made during construction. The annotated plan drawings shall be bound. Such drawings shall not be removed from the CONTRACTOR’s field office. One (1) complete progress set of Record Drawings shall be made available to the OWNER every 3 months for review.”

B. VOLUME 3 – TECHNICAL SPECIFICATIONS

Item No. AD2.12  02160 – Temporary Excavation Support Systems

Replace Addendum Item No. AD1.25 with the following:

Paragraph 1.6.A, delete item 10 (thus reinstating item 11).

Item No. AD2.13  02302 – Rock Tunneling

Paragraph 1.5.B.11, delete item “m” in its entirety, including subparagraphs.

Item No. AD2.14  02320 – Open Shield Pipe Jacking

Replace 02320 in its entirety with the version included in Attachment 4 of this Addendum.

Item No. AD2.15  02736 – Flow Control

Paragraph 3.4, add the following to the end of item O:

“…unless clean-up and restoration results from flow rates exceeding the design flow rates of 1.6 times the wet weather flow as shown on the Drawings.”

Item No. AD2.16  03408 - Steel Fiber-Reinforced Concrete for Precast Concrete Tunnel Linings

Paragraph 2.3.A, replace item 11 with the following:

“Permeability to water: maximum 10 x 10^{-13} m/s.”
Item No. AD2.17  15256 – Hydraulic System

Paragraph 2.2.A, replace the first sentence with the following:

“The hydraulic system shall be manufactured by the gate manufacturer per 1.1.D of this Specification and shall utilize pumps manufactured by Marzocchi, Parker or approved equal...”

Item No. AD2.18  16050 - Electrical General Provisions

Paragraph 1.6.F, add the following to the end of item 2:

“...Specifically, the Contractor should contact Joe Ricciarelli, Steve Holland, and Marvin Jones at 216-664-3297.”

Item No. AD2.19  17100 - Process Control Instrumentation Systems

Paragraph 2.3, replace with the following:

“2.3 STANDBY POWER SUPPLIES (SPS)

i. General: The standby power supply shall be a ferroresonant battery backup power supply which supplies power to the control system.

ii. Provide continuous, power for the control system equipment and meet the following power conditioning requirements.

1. Input Power: 120 VAC, 60 Hz, Single Phase.
2. Input Connection: 5-15P.
3. Output Voltage: 120 VAC, 60 Hz, Single Phase.
4. Output Receptacles: Four, 5-15R.
6. Output Voltage Regulation: Plus or minus 3 percent for input voltages plus 15 percent to minus 20 percent.
7. Normal operating temperature range of 32 degrees F to 104 degrees F.
8. Transfer time: 0 milliseconds.
9. External battery pack with 15 Amp charger.

iii. Batteries

1. Provide External battery pack.
2. 7 hours 30 minutes of operating time at full load.
3. 22 hours 9 minutes of operating time at half load.

iv. Warranty: 2 years.

v. The standby power supply shall be as manufactured by Eaton, Model FA060BB2A0A0A0B with 24 me External battery pack.

Item No. AD2.20  17105 – System Start-Up

Paragraph 3.3.A, replace “ETC” with “ECT” for all occurrences in item 1.

C. VOLUME 4 – GEOTECHNICAL BASELINE REPORT

Item No. AD2.21  Table 9-A (page 63)

Replace Table 9-A with the following:

<table>
<thead>
<tr>
<th>Near Surface Structure or Sewer Component</th>
<th>Excavation Elevation Below Which Dewatering is Required</th>
<th>Required Final Dewatered Elevation</th>
<th>Dewatering System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversion Structure 2-2</td>
<td>566</td>
<td>540</td>
<td>Eductor and Deep Gravity Wells</td>
</tr>
<tr>
<td>Rockefeller Relief CSO Tie-In Structure 2-4</td>
<td>566</td>
<td>558</td>
<td>Eductor and Deep Gravity Wells</td>
</tr>
<tr>
<td>Open shield pipe jacking between Structures 2-2 and 2-1</td>
<td>566</td>
<td>540</td>
<td>Eductor and Deep Gravity Wells</td>
</tr>
<tr>
<td>Open cut construction between Structures 2-4 and 2-2</td>
<td>566</td>
<td>560</td>
<td>Eductor and Deep Gravity Wells</td>
</tr>
<tr>
<td>Manhole Structures 2-5, 2-6, and 2-7 and Regulator Structure 2-8</td>
<td>583</td>
<td>567</td>
<td>Eductor and Deep Gravity Wells</td>
</tr>
<tr>
<td>Open cut construction between Structures 2-7 and 2-8</td>
<td>583</td>
<td>568</td>
<td>Eductor and Deep Gravity Wells</td>
</tr>
<tr>
<td>Gate Structure 3-2 and Diversion Structure 3-4</td>
<td>565</td>
<td>540</td>
<td>Eductor and Deep Gravity Wells</td>
</tr>
<tr>
<td>Tie-In Structure 3-5</td>
<td>Ground surface</td>
<td>570</td>
<td>Deep Gravity Wells</td>
</tr>
<tr>
<td>Regulator Structure 3-11</td>
<td>Ground surface</td>
<td>575</td>
<td>Deep Gravity Wells</td>
</tr>
<tr>
<td>East 156th Street Relief Sewer (open cut) between Structures 3-5 and 3-11</td>
<td>Ground surface (as needed)</td>
<td>As needed</td>
<td>Vacuum Lances</td>
</tr>
<tr>
<td>Diversion Structure 4-2, and Manhole Structures 4-4 and 4-7</td>
<td>Ground surface (as needed)</td>
<td>As needed</td>
<td>Vacuum Lances</td>
</tr>
<tr>
<td>Regulator Structure 4-3, Flow Divider Structure 4-5, and CSO Tie-In Structure 4-6</td>
<td>Ground surface (as needed)</td>
<td>576</td>
<td>Deep Gravity Wells</td>
</tr>
<tr>
<td>Open cut construction between Structures 4-5 and 4-2</td>
<td>Ground surface (as needed)</td>
<td>As needed</td>
<td>Vacuum Lances</td>
</tr>
<tr>
<td>Open cut construction between Structures 4-6 and 4-2</td>
<td>Ground surface (as needed)</td>
<td>As needed</td>
<td>Vacuum Lances</td>
</tr>
</tbody>
</table>
Item No. AD2.22  9.7.2 Anticipated Ground Conditions and Behavior

In the last paragraph (4th paragraph), replace “Structure 4-5” with “these structures”.

Item No. AD2.23  9.7.3 Design and Construction Considerations

Delete the first paragraph, beginning with “Given the nature…” in its entirety.

D. VOLUME 7

Item No. AD2.24  Standard Plan for Egg Shaped Sewer

Append the “Standard Plan for Egg Shaped Sewer” included in Attachment 3 of this Addendum to Volume 7 – Appendix F of the Contract Documents.

E. DRAWINGS

Item No. AD2.25  Sheet No. ST.004

Replace the washer callout in Detail 1: “Bolt Detail at Radial Joint” with the following:

“Copolymer polypropylene washer and galvanized steel washer”

Item No. AD2.26  Sheet No. ST.008

Add ST.100 to the list of referenced sheet numbers for Section B “Adit Initial Support”.

Item No. AD2.27  Sheet No. SP.101

Replace note 9 with the following:

“9. NOT USED”

Item No. AD2.28  NOT USED

Item No. AD2.29  Sheet No. ST.100

Initial support clarified for TDPS Adit Connection. Replace the drawing with the updated drawing as included in Attachment 2 of this Addendum.

Item No. AD2.30  Sheet Nos. ST.106 and ST.107

Revise all Access Structure 1-1 Concrete Cap top of concrete elevation references to TOC. EL. 606.5
Item No. AD2.31  Sheet No. CP.200

Revise note 5 reference in profile to “See note 4”.

Item No. AD2.32  Sheet Nos. EL.200, EL.300, EL.500

Replace all occurrences of “3WP” with “WP”,

Item No. AD2.33  Sheet No. ST.200

Section A, revise the “Temporary construction grade for consolidation sewer construction” callout to reference notes “12 & 13” instead of “notes 13 & 14”.

Item No. AD2.34  Sheet No. ST.413

Adjust arrow in detail 1 for ¾” SS Bar to point to horizontal bar.

Item No. AD2.35  Sheet No. SP.502

Note 3, replace “Bulkhead” with “Check Valve”.

Item No. AD2.36  Sheet No. SP.502

Add the following note to detail “Structure 5-5 Electric”:

“Note: Standard Electric new manhole size is approximately 6’x8’x7’. Sufficient space will be required in the field for these manholes if ductbanks are rerouted.”

Item No. AD2.37  Sheet No. ST.500

Initial support clarified for shaft/tunnel junction. Replace the drawing with the updated drawing as included in Attachment 2 of this Addendum.

Item No. AD2.38  Sheet No. ST.514

Insert the following note after note 11 and rename current notes 12 and 13 to “12.a” and “12.b” respectively:

“12. The following notes provide a suggested construction sequence. The Contractor may elect to modify the construction sequence to suit its means and methods:”

Item No. AD2.39  Sheet No. ST.515

Insert the following note after note 3 and rename current notes 4 and 5 to “4.a” and “4.b” respectively:

“4. The following notes provide a suggested construction sequence. The Contractor may elect to modify the construction sequence to suit its means and methods:”
Item No. AD2.40       Sheet No. MD.002

Replace the Reinforcing Bar Splices and Development Lengths table with the revised table included in Attachment 2 of this addendum.

Item No. AD2.41       Sheet Nos. MD.011 and MD.012

“Flow Control Notes”, add the following to the end of note 2:

“… The Contractor shall design flow control systems to 1.6 times the WWF.”

Item No. AD2.42       Sheet No. MD.012

Plan view for “Regulator L-34”, revise the size of the “72” Brick” to be “66” Brick”.

Item No. AD2.43       Sheet No. MD.015

Detail 2, “Corner Brace Detail”, revise waler callout to “W14x145”.

Item No. AD2.44       Sheet No. MD.026

Detail “Electrical Details at Typical Gate Structure”, add the following callout for the XP fixture:

“Appleton Cat. No. CJFB3275BU fixture or equal.”

Item No. AD2.45       Sheet Nos. ST.202-203, ST.302, ST.402, ST.503-504

Use the “Typical Hook for Baffle-to-Wall Connection” detail 1 included in Attachment 2 of this Addendum for all baffle-to-wall connection occurrences.

END OF ADDENDUM NO. 2
1. **Question:** After visiting Access Structure 1-1 location, the area appears to be prone by flooding and possibly considered a wet land. Does the Engineer require a specific ground elevation for this work area during construction of the project? Also, we cannot clearly identify what areas, elevations and materials the Engineer requires for final grading at this location. Please advise where we can find this information.

   **Response:** Yes, this site contains wetland areas and details for site provisions will be provided in future addenda.

2. **Question:** Bid Item No. 49 has water main relocation work associated with it, but the bid item description does not list this work. The Utility Allowance bid item states it is for UNKNOWN water and sewer work. Under which bid item should the costs for the water line work fall under?

   **Response:** Water main relocation work associated with Bid Item No. 49 shall be covered under Bid Item No. 52 – ECT-4 Utility Relocations.

3. **Question:** Bid Item No. 49 – where should the cost of the base concrete restoration be included?

   **Response:** Base concrete restoration for Bid Item No. 49 shall be covered under Bid Item No. 42 – ECT-4 Site Work.

4. **Question:** SP.201, SP.303, SP.401, SP.502 require the Contractor to remove/relocate utilities for water, sanitary sewer, storm drain, gas, underground electrical, loop detectors, telephone line and overhead electrical lines. Bid Item Nos. 25, 41, 52, and 64 cover the costs only for water, sanitary and storm utility relocation at Site ECT-2, 3, 4, and 5. Confirm that utility relocations for gas, underground electrical, overhead electrical and telephone lines will be paid for under Bid Item No. 76, “Utility Allowance”.

   **Response:** Refer to question and response # 3 from Pre-bid Conference Q&A in Attachment 2 of Addendum No. 1.
5. **Question:** Gas, underground electric line, telephone lines, overhead electrical line relocations shall be performed by utility companies. Please provide schedule duration allowances for the Contractor to consider for bid purposes. If the project schedule is impacted beyond the Contractor’s control due to delay by utility companies, please clarify who is responsible for the delay and the costs caused by the delay.

**Response:** As indicated at the Pre-Bid Conference, the Contractor is responsible for coordinating with the utility owners and developing the durations required for the respective relocation. The Contractor will then incorporate this information into the CPM Schedule. See Specification 02550, 1.5.B.2 for details of specific requirements provided by particular utilities and Addendum Item No. AD2.18 for Cleveland Public Power contact information.

6. **Question:** Scope of Bid Item No.1, a-8) states the payment for this bid item includes Groundwater treatment and discharge associated with TBM excavation. Scope of Bid Item No.9 a-1) states the payment for this bid item includes water treatment systems associated with shaft excavation. In ECT-1 site, most likely the same water treatment system (settlement pond and treatment plant) will be utilized to treat groundwater from both shaft excavation and TBM excavation. In this case, how should the Contractor price these 2 bid items?

**Response:** See Addendum Item Nos. AD2.2 and AD2.4

7. **Question:** Referring to Bid Item No. 7 - Since the Bid item is paid on unit price per workday, how will Contractor be paid for standby due to gas if the gas event is less than 24 hours?

**Response:** See Addendum Item No. AD2.3.

8. **Question:** Referring to Bid Item No. 76 - Will the Utility Allowance Bid Item cover ALL temporary relocation of telephone, gas, and electrical utility services?

**Response:** Provided that the Contractor submits documentation for the utility owner charges, the costs billed directly from the utility owners for the known utility relocations identified in the Contract Documents will be covered under Bid Item No. 76. Owner-approved unknown utility relocations may also apply for payment under this bid item. However, convenience-type utility relocations or utility relocations required as a result of proposed means and methods different than that which is shown on the Drawings will not be paid for by the Owner, and the cost will therefore be borne by the Contractor.

9. **Question:** Bid Item No. 76 “Utility Allowance”; please confirm our understanding that this allowance will be used to reimburse the Contractor for actual costs incurred to relocate existing utilities, shown on the drawings or unknown, to safely construct the work on this project.
**Response:** Refer to question and response # 3 from Pre-bid Conference Q&A in Attachment 2 of Addendum No.1.

| Section | 16050 – Electrical General Provisions  
| Drawing: | 16111 – Underground Raceway Systems  
| Details: | Overhead Utility Relocations  
|  
|  
|  
|  

| 10. **Question:** Note 9 on Drawing SP.101 refers to relocating overhead lines underground per the Typical Ductbank Detail on MD.026. Note 9 is not referenced on the drawing other than under “Notes”. Overhead lines are located to north of the sound barrier and to the south of the temporary construction fence. Please provide the specific overhead line locations to be relocated underground. Confirm that 3-4" conduits are required at the ECT-1 as shown on the Typical Ductbank Detail on MD.026. Verify whether or not the Note 9 underground utility relocation work will be covered and paid for under Bid Item No. 76 allowance.  
|  
| **Response:** See Addendum Item No. AD2.27. Overhead electric line relocation only required if deemed necessary by Contractor per its means and methods. If deemed necessary, the Contractor shall include this cost in Bid Item No. 10 – ECT-1 Site Work.  
|  

| Section | N/A  
| Drawing: | MD.007  
| Details: | Site Drainage at ECT-1  
|  
|  
|  
|  

| 11. **Question:** The access road detail on MD.007 shows the asphalt swale to be a minimum of 2'-0" below the road surface and that it is drain to the west toward the ECT-1 site. The site along the access road is almost level. Based on the elevations that can be picked up from the survey control drawings and SP.101, there is not enough change in elevation at the ECT-1 site to convey and discharge the storm water. Where is the storm water from the ECT-1 access road swale intended to discharge? Confirm that there is enough elevation change within the ECT-1 site to accommodate flows from the access road swale.  
|  
| **Response:** Per access road detail on MD.007, the swale required is to be stabilized with rock fill and seeded to allow it to naturally revegetate. The stormwater from the access road is intended to collect in the drainage swale and discharge to a culvert pipe to be reconstructed by the Contractor near the entrance to the Nine Mile Creek Site. The reconstructed pipe culvert will match existing pipe culvert invert elevation which is EL. 604. The new 24” diameter pipe culvert will allow for conveyance of water to the north portion of the Nine Mile Creek Site and will perpetuate the existing drainage pattern. Drainage
swale should begin approximately 100 feet west of E.140th St. where the access road width transitions from enlarged apron to the 28 feet width and the contractor should follow Ditch Design Criteria in the ODOT Location and Design Manual. Contractor is responsible for designing access road and drainage culvert in accordance with the requirements on MD.007 and in the GBR and may need to cut or fill for proper construction of the access road and drainage swale to accommodate flow.

<table>
<thead>
<tr>
<th>Section:</th>
<th>Bid Booklet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing:</td>
<td>N/A</td>
</tr>
<tr>
<td>Details:</td>
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</tr>
</tbody>
</table>

12. **Question:** In the Bidder’s Qualification Questionnaire on page BB-5 it states, Proof of training certification from manufacturer shall be provided. Is this a requirement that should be turned in with the bid?

**Response:** Yes.

13. **Question:** Should all Non-Disclosure Forms be submitted to the Owner when received by the Contractor or submitted altogether with the bid?

**Response:** Non-Disclosure Forms shall be submitted altogether with the bid.

14. **Question:** The current Date of Bid is September 30, 2010. We are respectfully requesting a postponement of four (4) weeks to the current Date of Bid *(request has been paraphrased due to multiple bidders issuing similar requests)*.

**Response:** See Addendum Item No. AD2.0

<table>
<thead>
<tr>
<th>Section:</th>
<th>Various</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing:</td>
<td>N/A</td>
</tr>
<tr>
<td>Details:</td>
<td>Project Site Security</td>
</tr>
</tbody>
</table>

15. **Question:** Section 01520, 3.1.A states, Owner requires the Contractor to provide a security watchman 24-hrs per day, 7 days per wk at the ECT-1 site, is this a requirement for other sites as well?

**Response:** This is a contract requirement at the ECT-1 Site. The Contractor is responsible for determining this requirement at the other sites based on the selected means and methods.

16. **Question:** 01570, A.3- "On-site hours and durations of officers shall be as directed by the local Municipality." A.4- "The costs for these services shall be included in the Contractor's Bid". In what situations will the local Municipality direct the use of officers? What are the hourly rates for these officers?
**Response:** The Contractor is responsible for coordinating with local Municipalities and determining this requirement based on the selected means and methods.

17. **Question:** 02305, 3.1.B - Is it the Owner's intention for the Contractor to provide a security watchman 24-hrs per day, 7 days per wk for all the shaft sites in addition to Lights, barricades, signs, and fencing. Please clarify and expand on the Owner's requirements listing the number of watchmen and duration(s) that they shall be provided.

**Response:** See previous questions and responses.

<table>
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<tr>
<th>Section</th>
<th>02310 – Microtunneling</th>
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</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>Details:</td>
<td>Article 3.8-C</td>
</tr>
</tbody>
</table>

18. **Question:** Is the contractor required to finish the pipe joints? If so, provide acceptable materials for this use. Will this requirement apply to both concrete and CCFRPM pipe?

**Response:** No special finish material is required after installation for the pipe joints on this project.

<table>
<thead>
<tr>
<th>Section</th>
<th>02556 – Reinforced Concrete Sewer Pipe</th>
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</thead>
<tbody>
<tr>
<td>Drawing:</td>
<td>02610 – Reinforced Concrete Jacking Pipe</td>
</tr>
<tr>
<td>Details:</td>
<td>Sheet Nos. 68, 69, and 73 of 274</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
</tr>
</tbody>
</table>

19. **Question:** Note 4 on Drawing 68; The Contractor can provide 90” I.D. RCP as an alternative to the 90” diameter CCFRPM open cut pipe. Note 2 on Drawing 69; The Contractor may substitute 48” diameter reinforced concrete jacking pipe for 42” diameter CCFRPM jacking pipe. Note 5 on Drawing 73; The Contractor can provide 48” I.D. RCP as an alternative to the 42” diameter CCFRPM open cut pipe this sheet. Please confirm our understanding that the concrete pipe alternative (if used) will be the carrier pipe, and that no lining system for this pipe is required.

**Response:** Concrete pipe will be the carrier pipe and does not require a corrosion resistant lining for this project.
20. **Question:** The above-referenced section of the GBR states: "The soils in Shaft 4-1 will be excavated without pre-excavation dewatering and will exhibit Firm to Slow Raveling behavior during excavation". However, in GBR Table 9- A, pre-excavation dewatering is required for all other near surface structures and sewer excavations in ECT-4 site. Please confirm the Owner’s intention that the specified excavation method (support with liner plate) will enable to excavate the Shaft 4-1 without pre-excavation dewatering.

**Response:** The specified excavation method for Structure 4-1 will allow excavation without dewatering. Dewatering is required for the structures that tie into existing sewer or structures (4-3, 4-5, 4-6). See Addendum Item Nos. AD2.21 and AD2.23 for revisions to dewatering at Site ECT-4.

21. **Question:** The above-referenced section of the GBR states: "Geotechnical instrumentation is to be installed and monitored to track ground displacements and surface settlements along the Consolidation Sewer alignment, as indicated on the Drawings". There is no drawing showing the geotechnical instrumentation along the East 156th Street Relief Sewer. Please confirm that no geotechnical instrumentation is required for the East 156th Street Relief Sewer.

**Response:** Geotechnical instrumentation is not required for the E. 156th Street Relief Sewer. However, this does not limit the Contractor’s liability for the repairs associated with damage caused by the Contractor.

22. **Question:** The above-referenced section states: "Cobbles with unconfined compressive strength up to 30,000PSI can be expected intermittently at random intervals along the alignment in soils". For bidding purpose, we request that the Owner shall provide bidders with more specific baselines of expected cobbles (i.e. how many/ how often).

**Response:** Per the referenced GBR section, the MTBM must be capable of excavating cobbles occurring intermittently at random intervals. Furthermore, the baseline assumption is that naturally-occurring deposits of nested cobbles
and boulders are not anticipated. The bidders shall use the baseline presented in the GBR to develop a basis for bidding.

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<thead>
<tr>
<th>Section</th>
<th>GBR 9.2.3 &amp; 02360 – Instrumentation and Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing</td>
<td>N/A</td>
</tr>
<tr>
<td>Details</td>
<td>Construction-Induced Settlement – Near Surface Facilities</td>
</tr>
</tbody>
</table>

23. **Question:** The above-referenced section of the GBR states: "Specifications require the Contractor to repair any damage caused by settlement resulting from or associated with open-shield pipe jacking or microtunneling operation to at least pre-construction condition". Will the Contractor still be responsible for any damage even if the settlement is within the values in GBR and Specifications?

**Response:** In the event that damage occurs and the Contractor has not exceeded the allowable settlement limits, the Contractor will repair the damage, and the cost for repairs will be negotiated with the District via a Change Order.

<table>
<thead>
<tr>
<th>Section</th>
<th>02736 – Flow Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing</td>
<td>MD.012</td>
</tr>
<tr>
<td>Details</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Paragraph 3.4.O states: "Contractor shall be responsible for all clean-up and restoration of Work if capacity of the flow bypass system is exceeded during wet weather events. No additional payment will be made".

Drawing MD-012 shows "Wet Weather Flows" expected in one-year rain event, but Note 2 states "The Contractor shall expect that larger storms may occur, which will result in higher flow rates than those that have been listed".

24. **Question:** For bidding purpose, we request that the Owner shall provide the maximum flow rates so that the Contractor can design the system and estimate the costs accordingly. Unless otherwise it is difficult for us to take financial responsibility as specified.

**Response:** See Addendum Item Nos. AD2.15 and AD2.41.

<table>
<thead>
<tr>
<th>Section</th>
<th>02320 – Open Shield Pipe Jacking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing</td>
<td>N/A</td>
</tr>
<tr>
<td>Details</td>
<td>N/A</td>
</tr>
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25. **Question:** 02320, 2.6.E states: "Excavated material shall be handled in the underground opening and transported to the jacking shaft, where it shall be hoisted and loaded for offsite disposal. Stockpiling of spoil shall not be
permitted. Is it acceptable to temporarily stockpile the excavated material while working, but remove the material at the end of each working shift or day?

**Response:** Stockpiling is permitted. See the referenced specification section as included in Addendum Item No. AD2.14.

26. **Question:** GBR section 9.2.1 states: "Ground pre-treatment is required at the tunnel eye prior to launching or receiving the open shield pipe jacking or microtunneling equipment, with the exception of ECT-5". Specification Section 02320 3.1.Q. states: "The Contractor shall improve the ground outside of the jacking and receiving shaft to facilitate launch and retrieval of open shield pipe jacking equipment". Please clarify which statement governs for the shaft penetrations of Open-Shield Pipe Jacking of the ECT-5 Consolidation Sewers.

**Response:** The statement referenced in the GBR governs. See the referenced specification section as included in Addendum Item No. AD2.14.

27. **Question:** Open Shield Pipe Jacking at ECT-2 is for 48 lineal feet of 90” Fiberglass jacking pipe to be installed. Can we use a steel hood to handmine from to complete this work? The specification section allows hand mining, but I want to make sure I’m clear on what the specification allows. The soil boring B-310 indicates good clay soils to hand mine in. It seem unnecessary to require such a short run to be machine tunneled.

**Response:** Hand mining with a shield is acceptable. See Addendum Item No. AD2.14.

<table>
<thead>
<tr>
<th>Section:</th>
<th>N/A</th>
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</thead>
<tbody>
<tr>
<td>Drawing:</td>
<td>ST.514 and ST.515</td>
</tr>
<tr>
<td>Details:</td>
<td>Open Shield Pipe Jacking</td>
</tr>
</tbody>
</table>

28. **Question:** The above-referenced drawings do not show a temporary construction grade for Open-Shield Pipe Jacking operations in the Two-Way Jacking Shaft 5-4. The note 10 and note 4 on the same drawings state: "only after consolidation sewer installation is completed shall the contractor advance excavation below temporary construction grade", respectively. Please clarify the contractor can excavate the Two-Way Jacking Shaft 5-4 down to Elev.583.5 prior to the completions of both the ECT-5 Consolidation Sewers.

**Response:** We assume that the referenced notes are #12 on ST.514 and #4 on ST.515. See Addendum Item Nos. AD2.38 and AD2.39.
29. **Question:** The above-referenced drawings do not show a mud slab concrete. Is it left out intentionally or it is up to the Contractor depending on the site conditions?

**Response:** The Contractor shall install a mud slab in this structure should it be deemed necessary based on the Contractor’s selected means and methods.

30. **Question:** ...We do not see any specific locations shown on the drawings [for the RSMs]. Does the term railroad crossing refer to the passage of the tunnel under the tracks? Please clarify the locations of the “railroad crossings”.

**Response:** See Addendum Item No. AD1.46 for the the SSP (Surface Settlement Point) required to monitor settlement near CSX rail lines. RSMs are provisionally included in the Contract Documents to be used on an as-needed basis as determined by the Owner and the Bidders are not required to include the price of RSMs in their bids.

31. **Question:** CP.200 - The Profile view has a note that states “See Note 5”. Note 5 is not listed on that page. Should this reference be deleted or is there a note that was not put on the drawing?

**Response:** See Addendum Item No. AD2.31.

32. **Question:** ST.200 - The Section view has a note that states “(See Notes 13 & 14)”. Note 14 is not listed on that page. Should the reference to Note 14 be deleted or is there a note that was not put on the drawing?

**Response:** See Addendum Item No. AD2.33
33. **Question:** Sections 1, 2, and 4 have notes that indicate that the size of the walers are W14x145. Section 2 indicates that the waler size is W24x162. Is the size of the waler on Section 2 supposed to be the same as shown on the others?  

**Response:** See Addendum Item No. AD2.44

34. **Question:** The required splice (or overlap) length on the following structure drawings is unclear. Please clarify the required length for splicing.  

**Response:** See Addendum Item No. AD2.40.

35. **Question:** Shaft Lining to Tunnel Junction overlap length (note 3 on ST.102, same for other shafts, S2 to S5). Is the overlap length governed by the Specification 03200 3.3 C. “overlapping shall be not less than 32 diameter of the smaller bar in the lap”, or by the MD.002 reinforcing bar splices table per ACI 318? Please clarify.  

**Response:** See previous question and response.

36. **Question:** Shaft hoop bar (ST.102, same for other shafts S2 to S5). Can the shaft hoop reinforcement be considered as “compression bar”?  

**Response:** No.

37. **Question:** Tail Tunnel/Junction Arch bar (ST.103, same for S2 to S5). Can the Tail Tunnel Hoops/Junction Horseshoe Arch reinforcement be considered as “compression bar”?  

**Response:** No.

38. **Question:** Hook Length of the baffle slab (ST.202, same for S3 to S5). How long is the hook bar in the baffle slab horizontal reinforcement tied to the shaft lining? Is it governed by the Standard Hook Development or by Class “B” Splice Length as indicated by MD.002 Standard Structure Details?  

**Response:** The 90 degree hook referenced is governed by the ACI 318 “Standard Hook Development” length found in the table in Addendum Item No. AD2.40. Also, see Addendum Item No. AD2.45 for revised hook configuration detail for baffle-to-wall connections.
39. **Question:** Please clarify the details of the stirrup of the Junction Structures (ST.102, same for S2 to S5). Are all stirrups intended to be CRSI T9 (135 degree hook on one end, 90 degree hook on the other end), T1 (enclosed square shape with 135 hooks), or T2 (enclosed square shape with 90 hooks)?

**Response:** All "J" shaped shear stirrups are ACT 318 standard 135-degree hooks on one end, 90-degree hooks on the other end. All enclosed ties are square with ACI 318 standard 135-degree hooks.

<table>
<thead>
<tr>
<th>Section:</th>
<th>02305 – Tunnel Shafts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing:</td>
<td>N/A</td>
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<td>Details:</td>
<td>N/A</td>
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40. **Question:** Paragraph 3.7 - Please confirm that the Owner will compensate all costs for the construction of the recovery (or rescue) shaft in the event "underground obstruction encountered", which occurs beyond the Contractor’s control.

**Response:** Refer to last paragraph under “Obstructions” in Geotechnical Baseline Report, Section 9.2.1.

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<tr>
<th>Section:</th>
<th>N/A</th>
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<tbody>
<tr>
<td>Drawing:</td>
<td>SP.100, MD.023</td>
</tr>
<tr>
<td>Details:</td>
<td>Gravel Base – Work Area Details on MD.023</td>
</tr>
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</table>

41. **Question:** 02305, 1.6.A & AD1 Question 27 - Provided the contractors means and methods generate loads equal to or less than the loads shown on Fig. 12 of GBR, and no modification to the support systems in the Contract Drawings are required, please clarify that the contractor is not required to provide the design calculations prepared by an Ohio PE per 02305-1.5-C.

**Response:** The Contractor is required to submit documentation stamped by a licensed Engineer in the State of Ohio that demonstrates that the proposed means and methods will conform to the design in the Contract Documents.

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<th>Section:</th>
<th>N/A</th>
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</thead>
<tbody>
<tr>
<td>Drawing:</td>
<td>SP.100, MD.023</td>
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<tr>
<td>Details:</td>
<td>Gravel Base – Work Area Details on MD.023</td>
</tr>
</tbody>
</table>

42. **Question:** The Gravel Base – Work Areas detail on MD.023 Key item 2 calls out for “4-inches of No. 1 and No. 2 for construction”. The detail proportion of layers appears that the Key item 2 section is deeper than the 4” section above and the 2” section below it. Is the detail calling out for 4” of No. 1 AND 4” of No. 2 for a total of 8”? Is the total Gravel Base section 10” thick or 14” thick?

**Response:** Total gravel base section is 10” thick. As noted on drawing, detail is not to scale.
43. **Question:** Damages for sewage discharge to a creek - is blank. Please provide the amount?

**Response:** $5,000.

44. **Question:** The specification for the Euclid Creek Tunnel sound wall calls out for a 12’ wall that can be expanded to 18’ if needed. The issue that exists is that the steel for an 18’ wall is larger than the 12’ wall... Please advise as to which system we should assume for the base bid.

**Response:** Wall panels and steel pile length shall be supplied for 12-ft high wall; however, foundation and steel section size shall be sized for 18-ft high wall to provide Owner with the flexibility of extending the wall height. Base bid shall assume this design, as specified in the Contract Documents. If implemented, the cost for the wall extension beyond the 12-ft high base bid will be compensated by the Owner.

45. **Question:** What are the pre-qualification requirements for supplying the precast concrete tunnel liners?

**Response:** There are no pre-qualification requirements for the segment manufacturer. Reference 03480 paragraph 1.5.A for qualification submittals required after Notice to Proceed.

46. **Question:** There are 40 Spiles to be installed before excavation over the crown of the Tail Tunnel; however, there are no Spiles detailed in the drawings for the pre-extraction support of the TDPS excavation also in Shaft 1-1. Please confirm that no Spiles are required for the TDPS excavation.
Response: Spiles are required. See Addendum Item Nos. AD2.26 and AD2.29.

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<th>Section:</th>
<th>N/A</th>
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<tbody>
<tr>
<td>Drawing:</td>
<td>SP drawings</td>
</tr>
<tr>
<td>Details:</td>
<td>Work Limits for Near Surface Structures</td>
</tr>
</tbody>
</table>

47. Question: Please define the limits of work area for the following structures: 2-5, 2-6, 2-7, 2-8, 3-5, 3-6, 3-7, 3-8, 3-9, 3-10, 3-11, L-26, 4-3, 4-4, 4-5, 4-6, 4-7, 5-5.

Response: Per 01570, 1.5.A.1, the Contractor is required to meet with City representative prior to construction to develop a traffic plan for the overall project and for each individual location. Refer to 01570, Paragraph 3.2 for site-specific traffic control. In addition, for Structure 5-5, refer to Section 01313, Constraint No. 3.4 – Structure 5-5.

<table>
<thead>
<tr>
<th>Section:</th>
<th>03300 – Cast-in-Place Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing:</td>
<td>N/A</td>
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<td>Details:</td>
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48. Question: Section 03330, 2.2.A-C - Due to in ability to pump a concrete with the 1 1/2inch aggregate required in 8" (+) walls; is it acceptable to use smaller aggregate in the mix provided the mix is develops the specified characteristics, and w/o segregation.

Response: Yes, provided that the mix meets the performance requirements of the specifications.

49. Question: 03300, 2.3.H states “Only steel forms shall be used for cast-in-place tunnel linings.” Does this requirement include the TDPS, CSO.001 and 140th St Adit Connections and the ECT-2, ECT-3 and ECT-4 Tunnel Flow Adits or is the “TUNNEL” reference only a requirement for the Tail Tunnel and the optional Starter Tunnel? Considering the limited use of the steel forms this requirement will come at a significant cost premium.

Response: The requirement for steel forms only applies to the 24-ft diameter starter and tail tunnels.

<table>
<thead>
<tr>
<th>Section:</th>
<th>Instructions to Bidders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing:</td>
<td>N/A</td>
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<tr>
<td>Details:</td>
<td>Article 6</td>
</tr>
</tbody>
</table>

50. Question: Please confirm that no Alternate Bid Items exist for this bid, or provide the location and format for submitting such information.

Response: There are no alternate bid items.
51. **Question:** With regards to the fiberglass dowels; the dwgs states to install dowels at an 8ft x 8ft pattern below spring line, and at an 4ft x 4ft pattern above spring line. Please confirm the spacing and location of the two up-sloped dowels shown at the crown.

**Response:** See Addendum Item No. AD2.37.

52. **Question A:** Paragraph 1.6 D of Section 02306 sets out the following requirement for the TBM and the Segmental Lining: "After the TBM has been completely assembled in working order in the plant, the Contractor shall satisfactorily demonstrate the erection of one fully bolted and gasketed precast concrete segment tunnel lining ring within 30-minute period. The test shall be performed using a minimum of two full rings". How is this test to be performed? Is the Contractor/TBM supplier supposed to build two full rings in the TBM fabrication plant?

**Question B:** Paragraph 1.5.D.2 - "Report and video footage demonstrating the erection within 30 minutes of pre-cast concrete segmental ring in the factory." Given the following information:
- approximately 52% of the main tunnel's alignment is in a curve
- the vertical tolerances on main tunnel alignment
- the reaction framework necessary to build a ring in the factory
- The Contractual Time to Substantial and Final Completion.

Why is the Owner requiring this costly factory and time dependent requirement?

**Response:** Two full rings shall be manufactured and erected at the TBM fabrication plant. The intention of this requirement is to prove the efficacy of the ring erection system. The requirement stands.
53. **Question:** Under Preconstruction submittals for the PCS tunnel lining rings, it is listed that the Contractor is to submit "Procedures and materials for filling of bolt pockets and shear keys". Are bolt pockets and shear keys to be filled?

**Response:** No. See Addendum Item No. AD2.13.

54. **Question:** Please verify that the response to Delete Item 11 was incorrect, and should have meant Delete Item 10.

**Response:** Item 11 shall remain. See Addendum Item AD2.12.

55. **Question:** Please confirm that of the permits in Volume 7 of 7, Appendix B to be released by addenda will include the Street and Sidewalk Obstruction Permits from the City of Cleveland.

**Response:** Street and Sidewalk Obstruction Permits will not be obtained by the Owner. The contractor is responsible for obtaining all necessary permits from local municipalities. The cost of all non-utility related permits shall be included in bid item #73.

56. **Question:** What is NEMA enclosure classification required for gate control structure? Is this gate control structure is classified as Class 1, Division 1, Group D? As per above drawings all panels and switches are NEMA 4X.

**Response:** The interior of the Gate Structure is a classified location. The Gate Control Structures shown on drawings EL.200, EL.300, and EL.500 are not classified locations.
Provide NEMA 4X stainless steel for outdoor locations. Unless otherwise noted, provide a minimum of NEMA 12 stainless steel inside Gate Control Structures.

Refer to drawings EL.201, EL.301, EL.501 and Section 16050, paragraph 1.8 for additional information.

57. Question: Dwgs. EL.200; EL.300; and EL.500 depict a nomenclature “3WP” for Switches and GFI, the Standard Symbols Dwg. GN.009 does not reference or explain the “3WP” nomenclature nor does Specification 16140. Can you provide us with a description for 3WP?

Response: “3” is a typographical error. See Addendum Item No. AD2.33. WP designation indicates with weather-proof cover per Note 2.

58. Question: Dwgs. EL.200; EL.300; and EL.500 depict a Sump Control Panel, but no details were provided. Can you send to us a detail of it?

Response: The sump pump control panel is provided with the sump pump. Refer to Specification Section 15000, paragraph 2.1 for details.

59. Question: Dwgs. EL.200; EL.300; and EL.500 depict Telephone Connection Cabinet, but no details has been provided. Can you send to us a detail of it?

Response: Provide panel per Telephone company requirements.

60. Question: Specification Section 16500 does not detail Explosion Proof Light Fixtures, nor does Lighting Schedule on Dwgs. EL.200; EL.300; and EL.500. Electrical Details at Typical Gate Structure shown on Dwg MD.026 depicts XP Light, but there is no specifications for it. Can you send to us the specifications for it?

Response: See Addendum Item No. AD2.44.

<table>
<thead>
<tr>
<th>Section:</th>
<th>16110 – Electrical Raceway Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing:</td>
<td>GN.007</td>
</tr>
<tr>
<td>Details:</td>
<td>Electrical General Note No. 18</td>
</tr>
</tbody>
</table>

61. Question: Specification Section 16110 and Electrical General Notes #18 (Dwg. GN.007) states PVC Coated Rigid Steel Conduit. Historically the NEORSD has abandoned this type of raceway and replaced by Copper Free Rigid Aluminum Conduit. Can you confirm the requirement for PVC Coated Rigid Steel Conduit?

Response: PVC Coated Rigid Steel Conduit is the intent.
Article 2.6.7, "In addition, if the overtime Work will violate the ordinances in the jurisdiction where the Contractor is performing work, Contractor shall be solely responsible for obtaining written permission to extend the maximum length of the workday or work week." Given the limited amount of time to examine the contract documents, there does not appear there is enough time available to the contractor to research local city ordinances, where individual jurisdictions prevail.

62. Question: Please provide all applicable ordinances which will be affected by the Work, performed by the Contractor.

Response: The Contractor is required to coordinate with the local municipalities and determine which local ordinances will be affected by the Work based on the Contractor’s means and methods.

63. Question: Constraint No. 3.3: ECT-5 Blasting - this restriction will seriously impede the excavation of Baffle Drop Structure 5-1. The top of rock at this location is approx 9 feet below ground surface. The structure is to be excavated at a 56’ diameter in rock to a total depth of approx 223 feet. The use of non-blasting methods to excavate this shaft through the rock will be very expensive as compared to the cost using drill and blast methods. Would it be possible to relax the no-blast constraint at a certain depth below the ground surface? We are confident that with the proper blasting expertise and the establishment of suitable vibration criteria, this shaft could be safely excavated with drill and blast methods.

Response: For bidding purposes, please bid as shown.

Paragraph 2.2.B.3 provides information related to the compressive strength of the annular grout. It states "Compressive Strength: Minimum 500 psi at 28 days, as measured in accordance with ASTM C39, Maximum 2,000 psi at 28 days."

64. **Question:** We interpret this to mean that the specification allows the 28 day compressive strength of the annular grout to be anywhere between 500 and 2,000 psi. Is the correct?

**Response:** Yes.

65. Can the minimum compressive strength for the annular grout be reduced to less than 500 psi? If so to what value? *Given the chemical reaction which occurs within the (specified) A/B grout process, initial annular grout gel times have to occur faster in order to deliver initial support to the segments, as a requirement of the tail can grouting, ring build time, and TBM non-advancement criteria. This faster gel time (accelerator dosage), and/or rapid setting of grout reduces 28-day strength.*

**Response:** No.

66. **Question:** Paragraph 2.2.K provides requirements for backfill grout materials. Can the precast concrete tunnel linings utilize A/B grout for Contact grouting?

**Response:** No.

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<table>
<thead>
<tr>
<th>Section:</th>
<th>02302 – Rock Tunneling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing:</td>
<td>N/A</td>
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<td>Details:</td>
<td>Heading access to the Owner</td>
</tr>
</tbody>
</table>

67. **Question:** Paragraph 3.17.A requires that the Owner shall be provided access to the heading of the tunnel to perform mapping. How much time should the Contractor allocate for this as part of the excavation cycle?

**Response:** During the regular excavation cycle, the Contractor does not need to allocate time for the Owner at the heading to perform mapping. Mapping at the heading will be performed in the event of a dispute and during scheduled periods of non-mining.

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<table>
<thead>
<tr>
<th>Section:</th>
<th>02160 – Temporary Excavation Support Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing:</td>
<td>N/A</td>
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<tr>
<td>Details:</td>
<td>Paragraph 3.1.F</td>
</tr>
</tbody>
</table>

68. **Question:** This section indicates that pre-drilling is required and that impact or vibratory methods are prohibited. It is understood that in some areas pre-drilling will be required due to the shale elevation but why must pre-drilling occur at the other areas? This would be very costly to the NEORSD. Can the spec be changed to allow impact or vibratory installation?

**Response:** No, please bid as shown.
69. **Question:** A temporary asphalt pavement detail is shown on drawing MD.020. What is the intent of this detail? How and where shall this be utilized?

**Response:** The temporary asphalt pavement on MD.020 is a minimum standard if the contractor chooses to temporarily pave roadways. It shall be used wherever there is existing asphalt pavement that is removed and not immediately and permanently restored.

70. **Question:** On Revised drawing SP.303, will the 8” and 2” services shown at Structure 3-11 require new vaults and internal piping or will they be connected before the existing vault? Will the 8”, 6” & 2” services be connected to the relocated 12” water by tapping sleeve & valves?

**Response:** The 8” and 2” services shown at Structure 3-11 do not require new vaults and should be connected outside of the existing vault. The 8”, 6” and 2” services shall be connected to the relocated 12” water with tees and local shut-off valves.

71. **Question:** Please provide information relative to the depth of the existing 30” storm that is to be relocated at Structure 5-5 as shown on Revised Drawing SP.502.

**Response:** Refer to GN.014 for existing sewer information. As shown on the SP drawings, the upstream and downstream manholes from Structure 5-5 are STMH-1035 and STMH-1041, respectively.

72. **Question:** The above-referenced section states: "A drawdown of the groundwater level in the beach/terrace deposits to El.517 is required prior to start of shaft excavation in soil". Note 8 of the Drawing ST.200 also states: "The
Contractor shall install eductor wells and deep wells as described in the specifications and in the GBR for dewatering soil from El.543 to El.517 prior to the start of excavation". From the GBR/GDR, there is a layer of the glacial till below El.517 and a similar dewatering system is required in this glacial till for excavation of Shaft 1-1. Please clarify the glacial till below El. 517 can be excavated without pre-excavation dewatering.

Response: Correct. Shaft 2-1 can be excavated below El. 517 without pre-excavation dewatering.

| Section: | 02307 – Tunnel and Shaft Initial Support Systems  
| GBR 8.2.2 |
| Drawing: | ST.100, ST.200, ST.300, ST.400, ST.500 |
| Details: | Excavation Support |

In the GBR Section 8.2.2 "Initial Supports - General", the 4th paragraph indicates that the shaft excavation support systems designs specified in the Contract Documents are presented to develop a uniform bidding basis, and all Contractors are required to bid these systems as shown. The 5th paragraph goes on to say that should the Contractor wish to propose an alternate shaft lining system, lateral pressure diagrams to be used...are shown in Figure 12.

The Contract Drawings indicate the excavation support to be used in overburden soils at the shafts as follows:
- ECT-1 Access Str 1-1 - Sheet ST.100 - Liner Plates and Ribs
- ECT-2 Baffle Drop Str 2-1 - Sheet ST.200 - Liner Plates and Ribs
- ECT-3 Baffle Drop Str 3-1 - Sheet ST.300 - Secant Pile Wall
- ECT-4 Baffle Drop Str 4-1 - Sheet ST.400 - Liner Plates and Ribs
- ECT-5 Baffle Drop Str 5-1 - Sheet ST.500 - Liner Plates and Ribs

Spec Section 02307 "Tunnel and Shaft Initial Support Systems" paragraph 1.7.A.1 states that minimum designs for shaft and tunnel initial support are shown on the drawings/spec. Initial supports as indicated on the drawings may be modified based on the nature and behavior of the ground.

In the GBR section 8.2.5 regarding excavation support in overburden soils, the 2nd paragraph states that at Shafts 1-1 and 2-1 either a pre-excavation dewatering program will need to be implemented (as indicated on Sheet ST.100 Note 11), or a pre-excavation installed shaft support system consisting of secant piles or diaphragm wall socketed into the bedrock will need to be constructed in lieu of the steel liner plate and steel rib support system.

73. Question: The Contract Documents state that all Contractors are required to bid shaft excavation support systems as shown, so as to develop a uniform bidding basis. If this is the case, why are alternate methods described elsewhere in the Contract Documents?
Response: The Bidder is required to bid the systems shown.

74. **Question:** If the Contractor wants to propose an alternate shaft lining system, at what point in time would this be done?

**Response:** During construction.

75. **Question:** If this is done after the bidding stage, would the Owner wish to negotiate a cost change based on the cost of the as-bid vs. proposed shaft excavation support system?

**Response:** Yes. See General Terms and Conditions, Article 12 – Work Orders, Change Orders And Construction Change Directive.

76. **Question:** What if the cost of the proposed shaft excavation support system is higher than the as-bid system? If the Owner specified shaft excavation support systems are found to be insufficient or do not work, would a change order be issued to correct the situation?

**Response:** If the specified systems are determined to be insufficient at no fault of the Contractor, a Work Order would be negotiated.

<table>
<thead>
<tr>
<th>Section:</th>
<th>N/A</th>
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</thead>
<tbody>
<tr>
<td>Drawing:</td>
<td>ST.504</td>
</tr>
<tr>
<td>Details:</td>
<td>Connection of Baffles and Baffle Wall to Shaft Final Lining</td>
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</table>

Contract Drawing Sheet ST.504 shows a "Plan Typical" of the interior baffle wall. A callout pertaining to the connection of the baffle wall to the shaft final lining refers to Note 1. Note 1 states that "Connection of baffles and baffle wall to the shaft final lining is shown to be monolithically cast to the shaft final lining. The Contractor may propose and submit for approval alternative means and methods of constructing the baffle and baffle wall connections to the shaft final lining.

77. **Question:** Based on Note 1 we assume that we could propose a construction joint at the connection between the baffle wall and the shaft final lining. Is this correct? Would this connection require the use of mechanical rebar connectors, or could the horizontal rebar that penetrates the proposed joint be bent vertically into a pre-formed key/blockout in the shaft final lining and then bent back down horizontally to be spliced onto the horizontal bars in the baffle wall?

**Response:** Yes, the assumption is correct. Any method other than monolithic pour shall provide ACI-318 compliant rebar continuity by either mechanical rebar connectors or rebar splicing to bent bars incorporated in the shaft final lining.
78. **Question:** Baffle Structures 2-1, 3-1 and 4-1 also include interior baffle walls and slabs. Although the drawings depicting these baffle structures do not contain a note similar to Note 1 on ST.504, we assume that interior baffle walls and slabs would not have to be poured monolithically with the shaft final lining. In some cases pouring monolithically would certainly be cost prohibitive if not impossible to perform. Please let us know if our assumption is correct.

**Response:** See Addendum Item No. AD1.47.

<table>
<thead>
<tr>
<th>Section:</th>
<th>General Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing:</td>
<td>N/A</td>
</tr>
<tr>
<td>Details:</td>
<td>Article 8.9.2.2</td>
</tr>
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</table>

79. **Question:** Article 8.9.2.2 allows the Owner the right to modify or alter the Contractor’s Work with the work of Owner’s other contractors. In addition, Article 13.2.8 allows the Contractor additional time and money to the extent the critical path is extended in the event the Owner modifies the Contractor’s Schedule. However, additional costs can be incurred to work activities if the Owner alters the Contractor’s Schedule and there is no impact to the critical path. We request that the language in Article 13.2.8 be modified to include additional compensation for non-critical path work activities under this condition.

**Response:** The Contract already has provisions in place. Refer to Articles 12 and 13 of the General Terms and Conditions.

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<tr>
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<tr>
<td>Details:</td>
<td>Soldier Pile and Lagging</td>
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80. **Question:** Are all the soldier pile and wood lagging shafts required to have grout backfill behind the wood lagging?

**Response:** Only structure excavations specified in Section 02160-3.1.G.3 are required to use grout for void backfilling behind the lagging.
**Typical Hook for Baffle-to-Wall Connection**

**Notes:**
- **Use Detail 1 for all baffle-to-wall connection occurrences.**

**Scale:** N.T.S.

---

**Replace Bar Splice / Development Table on MD.002 with the following table:**

### Replacing Bar Splices Per ACI 318-13

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>Class 9&quot; Splice</th>
<th>Compression Splice</th>
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<td>Other Bars³</td>
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### Replacing Bar Development Per ACI 318-13

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<td>7'-3&quot;</td>
<td>2'-3&quot;</td>
<td>2'-3&quot;</td>
</tr>
</tbody>
</table>

**Notes:**

1. Tabulated values are for uncoated bars and normal weight concrete.
2. Top bars are horizontal reinforcement placed such that more than 12" of concrete is placed below the bar.
3. Tabulated values are for bars which have at least one bar diameter of clear concrete cover and are spaced at least two bar diameters, or have at least one bar diameter of clear concrete cover, are spaced at least one bar diameter and are enclosed by stirrups or ties. Splice lengths for bars not conforming to either of these conditions shall be increased 50%.
4. Reinforced concrete for the main tunnel work shall use splice lengths designated for "other bars" in this table for all splices. Main tunnel locations include starter/tail tunnel, adits, and main tunnel shafts (structures 1-1, 2-1, 3-1, 4-1, 5-1). Provide 3" clear cover at these locations.
NOTES:

1. INSTALL LAYER PLATES IN A STaggerED PATTERN. EXCAVATE AND INSTALL LAYER PLATES IN 3 FT. LOTS.

2. ALL ROCK DOZER LENGTHS SHOWN ARE DRAFTED LENGTHS AS SHOWN. ADDITIONAL LENGTHS SHALL BE PROVIDED FOR NUT AND BEARING PLATE CONNECTION AS RECOMMENDED BY MANUFACTURER.

3. CONTRACTOR SHALL INSTALL SPOT ROCK DoZERs IN ADDITION TO PATTERN ROCK DoZERs AS REQUIRED TO MAINTAIN EXCAVATION STABILITY.

4. ALL STRUCTURAL STEEL SHALL COMPLY TO ASTM A572 GRADE 50.

5. PROVIDE 1" DIA. HOLE MOLDS THROUGH FULL THICKNESS OF SHOTCRETE EVERY 5 FT. OF DEPTH AT 90° ANGULAR SPACING. STAGGER EACH HOLE MOLD 4'-0" FROM THE Previous HOLE. INSTALL ADDITIONAL HOLE MOLDS AT SEEPAGE AREAS.

6. EXCAVATION AND OVERBREAK BEYOND EXCAVATION LINE SHOWN SHALL BE BACKFILLED WITH CONCRETE OR SHOTCRETE.

7. THE CONTRACTOR SHALL INSTALL A STEEL HDG AT 3'-0" ABOVE GRADE TO REINFORCE FREE-STANDING LAYER PLATE.

8. THE ROOS AND OIL MAKEUP STEEL HDG IS NOT SHOWN ON DRAWINGS. INSTALL THE ROE HDG MUDPIPES AND GRADES AS REQUIRED FOR STABILITY IN ACCORDANCE WITH THE SPECIFICATIONS AND MANUFACTURER'S RECOMMENDATIONS.

9. ALL ROCK DOZERs SHALL BE INSTALLED PERPENDICULAR TO THE EXCAVATED ROCK SURFACE WITHIN 5 DEGREES OF THE INITIAL DIRECTION IN THE HORIZONTAL PLANE.

10. REFER TO GEOTECHNICAL BASELINE REPORT (S) FOR SUBSURFACE CONDITIONS AND ASSOCIATED DESIGN AND CONSTRUCTION REQUIREMENTS.

11. THE CONTRACTOR SHALL INSTALL LAYER PLATES AS DESCRIBED IN THE SPECIFICATIONS AND IN THE GQG FOR OPERATING SOLES FROM EL 531 TO EL 512 PRIOR TO THE START OF EXCAVATION. THE CONTRACTOR SHALL OPERATE ALL HOLEs CONTINUOUSLY AND AT ALL TIMES DURING CONSTRUCTION OF SHALLOW TUNNELS AND ASSOCIATED EXCAVATIONS UNTIL FINAL CONCRETE Lining IS PLACED AND CONCRETE SOLES A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI.

SECTION 8

CONTRACTOR TO EXCAVATE HOLEs AS NECESSARY TO CONSTRUCT TUNNEL AS SHOWN ON THE DRAWINGS. SEE DRAWING SHEET #111 FOR DETAILS. PROVIDE CONCRETE MOLDED DURING CONSTRUCTION.

EUCLID CREEK TUNNEL
ECT-1 ACCESS STRUCTURE 1-1
SUPPORT OF EXCAVATION

ADDENDUM NO. 2
SEPTEMBER 9, 2010

Hatch Mott MacDonald
Northeast Ohio Regional Sewer District
Protecting Your Health and Environment

PAGE 16

ST. 100
### Types of Egg Shaped Sewers

- **A** - 1 ring of brick all around.
- **B** - 1 ring of brick all around and 1 ring extra on arch.
- **C** - 2 rings of brick all around.
- **D** - 2 rings of brick all around and 1 ring extra on arch.
- **E** - 3 rings of brick all around.

### Tabular Dimensions for Egg Shaped Sewers No. 2 to No. 8

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### Standard Plan for Egg Shaped Sewers

- **Dimensions & Areas**
- **Source:** City of Cleveland Engineering Division
- **File No.:** 73
- **Revision:** 11-23-68
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work specified in this Section includes furnishing and installing all open shield pipe jacking equipment and jacking pipe to install the consolidation sewers as indicated on the Contract Drawings using open shield pipe jacking methods.

B. The CONTRACTOR shall determine, unless directly specified, whether it intends to complete the installations with a one-pass operation, where the jacking pipe also serves as the carrier pipe, or a two-pass operation, where the jacking pipe serves as a casing pipe for a carrier pipe that is installed following open shield pipe jacking operations. For one-pass installations, the jacking pipe material shall be as indicated on the Contract Drawings. For two-pass installations, the jacking pipe shall be reinforced concrete pipe or steel pipe. The carrier pipe shall be as indicated on the Contract Drawings.

C. Intermediate jacking stations will be required within the first 100 feet of the tunnel shield/boring machine and every 500 feet there after for all open shield pipe jacking drives longer than 500 feet in length.

D. For a two-pass operation, installation of the carrier pipe shall be completed in accordance with Carrier Pipe Installation in Trenchless Reaches as specified elsewhere in the Contract Documents. The annular space between the casing and carrier pipes shall be grouted in accordance with Tunnel and Shaft Grout as specified elsewhere in the Contract Documents.

E. Specified jacking and receiving shaft locations and shaft types are indicated on the Contract Drawings.

F. Open shield pipe jacking equipment shall be selected by the CONTRACTOR and subject to the minimum requirements specified herein. Open face machines shall provide partial excavation face support with breast plates, shelves, or closeable doors to control raveling into the face of the machine. The equipment proposed by the CONTRACTOR must be a new or fully refurbished machine.

G. Open shield pipe jacking submittals and supporting documentation including manufacturer’s letter of certification and site acceptance letter as defined in this Section.

H. The CONTRACTOR shall refer to individual pipe material specifications for two pass jacking pipe requirements.

I. Open shield pipe jacking submittals and supporting documentation including manufacturer’s letter of certification and site acceptance letter as defined in this Section.
1.2 REFERENCES


1.3 DEFINITIONS

A. **Pipe Jacking:** A method for installing pipe or casing by jacking into position, typically behind a shield. The casing is shoved forward by means of hydraulic jacks from the drive or jacking shaft, as the machine is advanced, to form a continuous pipe string from the jacking shaft to the Reception Shaft.

B. **One Pass Installation:** Installation of jacking pipe where the jacking pipe serves as the carrier pipe to convey sanitary flows.

C. **Two Pass Installation:** Installation of jacking pipe that serves as a casing pipe in which the carrier pipe is installed upon completion of pipe jacking operations. The annular space between the carrier and casing pipes is grouted following installation of the carrier pipe.

D. **Open Shield Pipe Jacking:** For the purposes of this specification, open shield pipe jacking is defined as a technique for installing pipe by jacking it into place from a jacking shaft to a receiving shaft, using hydraulic jacks. Soil/rock excavation is performed within a shield in front of the lead pipe segment using hand-mining, mechanical methods, or mechanized equipment. The open shield allows access to the excavation face from inside the shield. The shield is steerable using hydraulic jacks to orient an articulation section of the shield.

E. **Open Shield Pipe Jacking Methodology:** A written description, together with supporting documentation that defines CONTRACTOR's plans and procedures for the pipe jacking operations.

F. **Zone of Active Excavation:** Area located within a radial distance around a surface point immediately above the face of excavation equal to the depth to the bottom of the excavation. For example, for a pipe jacking operation with an invert 30 feet deep, the zone of active excavation would project as a 60-foot diameter circle on the ground surface whose center is immediately above the excavation face and on the tunnel centerline.

G. **Critical Structure:** Any building, railroad, structure, bridge, pier, utility, or similar construction partially or entirely located within a zone of active excavation.

H. **Annular Space:** The void created outside of the jacked casing pipe associated with the cutting mechanism or shield overcut. The annular space is necessary to allow injection of bentonite to reduce jacking forces during pipe jacking operations. This void will tend to close with time unless it is filled with grout depending on soil conditions.
I. **Annular Grouting**: Grout used to fill the annular space between the jacking pipe and the ground (associated with the overcut) upon completion of each open shield pipe jacking drive.

J. **Lubricant**: Water combined with additives and injected into the annular space between the pipe and the soil to minimize friction and fill the annular space.

K. **Intermediate Jacking Station (IJS)**: Fabricated steel shield incorporating a series of hydraulic jacks temporarily installed between two pipe segments. The IJS’s are used to distribute the thrusting force along the pipe string by dividing the string into independent reaches.

L. **Obstruction**: An object or portion of object that stops the forward motion of pipe jacking operations, for more than 6 hours despite the CONTRACTOR’s reasonable and diligent means to overcome it, as determined by the OWNER, consisting of (a) man-made blocks, (b) boulders, (c) metal, (d) reinforced concrete, (e) clusters of timber piles and (f) nested cobbles (defined as three or more cobbles within the excavated face at any one location), located within the cross sectional area to be excavated at the excavation face at the front of the shield.

M. **Jacked Pipe**: This refers to the pipe to be installed behind the shield. This is synonymous with casing pipe in this Section.

N. **Jacking Record**: A computer generated (automated data collection) and manually recorded report containing information collected during each drive. The jacking record shall include: date, shift starting and ending time, name of operator, tunnel drive identification, installed tunnel length, pipe jacking start and end times, downtime events and reasons, rate of advance, jacking forces, cutterhead speed and torque, face pressure, steering jack positions, line and grade offsets, any movement of the guidance system, machine inclination and roll, intermediate jacking station use and jacking forces, pressure, volume, and location of any lubricant pumped, problems encountered with the tunneling machine or other components or equipment, and durations and reasons for delays.

1.4 **QUALITY ASSURANCE AND QUALITY CONTROL**

A. **Open Shield Pipe Jacking Machine Operation**:

1. Provide supervisory personnel and operators with suitable related experience in constructing open shield pipe jacking installations of similar size and length configuration with similar equipment and in similar ground conditions.

2. Provide evidence that key personnel operating and maintaining pipe jacking equipment, including the guidance system, have received training from the manufacturers.

3. Provide guidance equipment that is capable of continuously monitoring and recording the position and attitude of the open shield pipe jacking equipment.
B. Experience Requirements:

1. All open shield pipe jacking operations shall be performed by a CONTRACTOR with the following minimum experience: The CONTRACTOR shall have installation experience in at least three (3) projects involving open shield pipe jacking of similar pipe diameter, size, and scope proposed for this project for distances in excess of 300 feet through soil and groundwater conditions similar to those expected for this project, as contained in these documents. Experience must be with open shield pipe jacking meeting the requirements for this project. This prior experience must have taken place within the past five (5) years. Contact information for the CONTRACTOR’s references shall be provided. The OWNER will be the sole judge in determining if the prospective CONTRACTOR meets the aforementioned experience requirements.

2. The project superintendents and machine operators shall have at least five (5) years of open shield pipe jacking experience and shall have worked on at least five (5) open shield pipe jacking projects within the past five (5) years using similar type of equipment required for this project, in similar soil and groundwater conditions, as contained in these documents. Contact information for the superintendent’s references shall be provided. The OWNER will be the sole judge in determining if the superintendents and pipe jacking equipment operators meet the aforementioned work and project experience.

3. All open shield pipe jacking operators and superintendents shall read the Geotechnical Baseline Report (GBR) and Geotechnical Data Report (GDR) and familiarize themselves with the geotechnical conditions to develop their means and methods to suit the baseline conditions.

4. All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the type of materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local approved testing agency not more than six (6) months prior to commencing work; unless having been continuously employed in similar welding jobs since last certification. Machines and electrodes similar to those used in the work shall be used in qualification tests. The CONTRACTOR shall furnish all material and bear the expense of qualifying welders.

C. Surveying:

1. Each surveyor responsible for line and grade surveying shall have had previous experience with the pipe jacking laser guidance system or have attended instructional courses by the supplier of the system.

2. If monuments provided by the OWNER are damaged or moved notify the OWNER promptly.

3. During the execution of the Work submit to the OWNER all survey layout data. The OWNER reserves the option to check any or all of these measurements. Whether the OWNER exercises this option or not, the CONTRACTOR’s responsibility for accuracy will not be waived.
1.5 SUBMITTALS

A. Submittals shall be submitted within 45 working days following the Notice to Proceed.

B. Qualifications.

1. The CONTRACTOR shall submit for approval a detailed description of the superintendent's and open shield pipe jacking operator's experience as related to meeting the above minimum requirements as outlined in Paragraph 1.4.B. The OWNER’s approval of these individuals must be obtained prior to the start of any work related to pipe jacking. Should the CONTRACTOR's proposed superintendents and/or pipe jacking equipment operators fail, in the opinion of the OWNER, to meet these minimum experience requirements, the CONTRACTOR shall bear all costs, including those for delays, for taking whatever steps necessary to provide personnel with the required experience.

C. Open Shield Pipe Jacking Methodology Statement. A description of proposed pipe jacking methodology for review. CONTRACTOR shall organize the open shield pipe jacking submittal package with a table of contents and section dividers. The description should be sufficient to convey the following:

1. Proposed method of pipe jacking construction and type of face support. CONTRACTOR shall provide detail of planned approach and back-up measures to assure control of ground and limitation of surface settlement.

2. Manufacturer and type of all pipe jacking equipment proposed (including shield dimensions, cutting mechanism, steering mechanism, hydraulic jacks, shaft seals, method of muck removal, and other ancillary equipment); type of lighting and ventilation systems.

3. Number and duration of shifts planned to be worked each day.

4. Sequence of operations, including proposed mining cycle and scheduled shutdown periods.

5. Methods for shaft break-out and break-in including any proposed ground conditioning.

6. Layout of work sites; traffic control.

7. Method of spoil transportation from the face, surface storage and disposal location.

8. Contingency plan for disposal of contaminated soil and water.

9. Capacity of jacking equipment, jacking thrust reaction system, and jacking pipe. Jack calibration data (pressure versus force relationship). Include emergency measures to be taken if pipe string seizes and cannot be advanced.

10. Proposed method to cushion and distribute jacking forces at the pipe joints.
11. Identify critical utility crossings and special precautions proposed.

12. Jacking pipe shop drawings, including details on pipe/shield interface, pipe/IJS interface, joint packer material and dimensions, and joint type and dimensions.

13. **Machine Equipment** assembly and delivery schedule, means of transportation to site, method for machine assembly, dismantling and removal from site.

14. Methods to control line and grade accuracy to maintain pipe jacking tolerances. Procedures to mitigate laser distortion by heat and/or humidity in the jacking pipe.

15. Proposed emergency methods to be implemented should line and grade fall outside of tolerances.


17. Procedures, materials, and equipment for lubricating the exterior of the pipe during pipe jacking. Specific lubricant design mixture for the project including water, bentonite, and polymers as designed by an independent mud engineer specializing in mud rheology. Catalog specifications for all products proposed for use as pipe lubricant shall also be submitted.

18. Proposed ground movement monitoring program with procedures and equipment to be used to monitor and control heave and settlement at ground surface.


20. Proposed methods for removal of obstructions in front of the shield by the use of surface excavations or other, when obstruction cannot be removed from within the shield.

21. Proposed methods for grouting the annular space between the jacked casing pipe and soil, including grouting equipment, pumping and injection procedures, actual grout mix design types and mixtures.

22. Plans for delivery and storage of pipe to the work site.

D. **Shop Drawings:** The CONTRACTOR shall submit Shop Drawings to the OWNER, for record purposes, for any open shield pipe jacking support system and appurtenant systems designed by the CONTRACTOR, at least 45 working days before commencing the work to which they refer. Drawings shall be adequate for construction, and include installation details. Documents must be signed and sealed by a Professional Engineer registered in the State of Ohio with narratives. Shop Drawings and narratives shall be updated with as-built information and shall be provided for the following items:

1. Proposed open shield pipe jacking means and methods, method of providing face support, dimensions of jacking pit and pipe jacking thrust reaction structures, details of jacking system and any necessary specialized equipment.
In particular, the design, construction, and operational details of the pipe jacking thrust reaction system shall be provided.

2. Casing pipe and pipe joint detail.

3. Details of the packer or compression ring proposed to cushion and distribute jacking forces at pipe joints.

4. Electrical power supply and configuration, including location of transformers, lighting arrangement and supplies to major equipment

5. Cross section drawings illustrating utility and equipment layout.

6. Proposed shaft entry and exit seal details including details of ground improvement.

7. Details of the intermediate jacking stations (IJS’s) required for the drives. The submittal shall include details of pipe joints at the IJS’s, layout of the IJS’s, materials to be used for IJS housing, proposed means and methods of IJS operation and proposed procedures for permanent closure of the IJS’s upon completion of the drive.

8. Proposed gas monitoring and ventilation system for personnel entry.

9. Proposed means for installing independently mounted laser guidance system at base of drive shaft that is isolated from the thrust wall and shoring system.

E. Calculations: The CONTRACTOR shall submit calculations to the OWNER, for record purposes, for any open shield pipe jacking support system and appurtenant systems designed by the CONTRACTOR, at least 45 working days before commencing the work to which they refer. Documents must be signed and sealed by a Professional Engineer registered in the State of Ohio with narratives. Calculations shall be sufficiently detailed to provide the following:

1. Calculations that demonstrate that the pipe to be jacked is capable of supporting the superimposed live loads, including jacking loads and grouting pressures and other loading criteria shown on the Drawings or the GBR, which may be imposed on the pipe during construction. The CONTRACTOR shall determine the additional stresses imposed on the pipe during jacking operations and upgrade the quality and strength of the pipe and pipe joints to the extent necessary to withstand the additional stresses.

2. Calculations of the estimated jacking loads for each drive.

3. Calculations that clearly state the hydraulic pressure that is required to develop the maximum allowable axial load in the pipe and descriptions of controls to ensure that the hydraulic pressure determined by the CONTRACTOR will not be exceeded during the pipe jacking operations.

4. Calculations that indicate the maximum allowable face pressure that can be exerted at the face of the open shield pipe jacking machine without heave of the
ground. The calculations shall identify the operating range of face pressure and target pressure for face. Corrections related to line losses shall also be provided.

F. Open Shield Pipe Jacking Specifications Data: The CONTRACTOR shall submit the following machine technical specification data to the OWNER, for record purposes, at least 45 working days before machine procurement and transportation to the site:

1. Working or manufacturer's drawings showing the model designation, design, dimensions, and specifications.

2. The size and weight of the main components.

3. Performance data for the cutting mechanism and shield including manufacturer's statement on expected penetration rates.

4. A letter of certification from machine manufacturer that the telemetry, and other remote systems can function properly at the drive distances and under the baselined conditions on the project. The letter shall also specifically reference that the pipe jacking equipment has been full refurbished for the project in accordance with manufacturer recommendations. Backup to the letter shall include the list of parts that were refurbished and/or replaced. If the machine manufacturer no longer provides support of subject equipment, an independent, licensed Professional Engineer who has documented extensive experience in the pipe jacking industry may provide the letter of certification. Documentation of the independent engineer's experience shall be provided.

5. Details of the guidance system, operation and alert system to correct the alignment if it is moving off line or grade.

6. Method of operation, face control capability, mucking system, stone crushing system, configuration of cutting head(s) including type and layout of individual cutting tools (i.e., drag bits and/or rolling tools), proposed over-cut, spoil removal system and propulsion system.

7. Details of the lubrication system equipment, including but not limited to pumping capacity and hose sizes.

8. Inventory of spare parts for open shield pipe jacking cutting mechanism and shield and back up equipment, which shall be maintained on site to ensure continued use of the equipment.


10. Shop drawings and narrative describing proposed muck transportation system and its method of operation.

11. Proposed requirements for conditioners at the face to improve stability and workability of the excavated soil and provisions for delivery of conditioners to the face.
12. Capabilities for accommodating cobbles and boulders as established in the GBR. Details of the largest particle dimension that is able to enter into the shield.

13. Electrical system for operation (primary and standby).

14. If the proposed open shield pipe jacking equipment is reconditioned the CONTRACTOR shall submit the following additional information at least 45 days before machine procurement and transportation to the site:
   a. The history of the open shield pipe jacking machine including the year of manufacture, the projects on which it has been employed and the length of drives it has already mined. The types of ground in which the machine was used and progress and detailed performance data therein.
   b. Date and detailed description of any machine overhauls.
   c. Detailed description of machine modifications to be performed prior to the start of pipe jacking operations.

G. Quality Control: Submit for review a brief description of quality control methods including:
   1. Method and frequency of survey control.
   2. Example of pipe jacking daily log.

H. Geotechnical Investigation: When geotechnical investigations are conducted by the CONTRACTOR, submit results to the OWNER for record purposes.

I. Monitoring Plans:
   1. Surface Settlement Monitoring Plan. CONTRACTOR shall refer to Instrumentation and Monitoring requirements as specified elsewhere in the Contract Documents for review prior to construction. The plan shall identify the location of settlement monitoring points, reference benchmarks, survey frequency and procedures, and reporting formats. The readings of all monitoring shall be submitted to the OWNER.
   2. Daily Reports: The CONTRACTOR shall submit Daily Reports within 24 hours of the completion of the previous workday's operations including drive records. Daily Reports shall be prepared by the CONTRACTOR and include information defined in Paragraph 3.4.A of this Section.
   3. Daily Jacking Records: The daily jacking record as defined in Paragraph 3.4.B of this Section, shall be maintained by the CONTRACTOR, and must be made available to the OWNER on request. Copies of manual recorded data shall be submitted to the OWNER by noon on the next working day following the shift for which the data and records were taken. Automated/computerized data files of required machine parameters shall be provided to the OWNER within 24 hours of the completion of the previous workday's operations.
   4. The CONTRACTOR shall submit weekly as-built survey records showing open shield pipe jacking alignment relative to theoretical alignment.
5. The CONTRACTOR shall submit a Safety Plan for personnel conducting pipe jacking operations.

6. A site acceptance certification from the manufacturer that the open shield pipe jacking equipment has gone through a no-load performance test on the project site and that all electrical, mechanical, and hydraulic systems are functioning properly and that all components of the mechanized cutters and shield have been properly connected. CONTRACTOR shall provide the torque reading measurement for the cutting wheel during this no-load performance test. A manufacturer’s representative shall be on-site for the performance test. If the machine manufacturer no longer provides support of subject equipment, an independent, licensed Professional Engineer who has documented extensive experience in the pipe jacking industry may conduct the site inspection and provide the site acceptance certification. Documentation of the independent engineer’s experience shall be provided.

7. The CONTRACTOR shall provide survey documentation indicating that the grade and orientation of the guide rails in the jacking shaft have been properly set to the required design line and grade. CONTRACTOR shall survey guide rails and push ring of the hydraulic jacking system with the hydraulic rams retracted and extending to ensure the hydraulic jacking system is properly aligned and functioning.

8. The CONTRACTOR shall submit samples of automated and manual jacking records at least seven (7) days prior to the launch of the machine. Samples shall include electronic data and any necessary programs to interpret data, and the manual logs or records to be used. Submitted samples must demonstrate compliance with data recording requirements provided in Paragraph 3.4.B of this Section.

1.6 PROJECT SITE CONDITIONS

A. Safety:

1. The CONTRACTOR shall comply with referenced codes and safety requirements as specified elsewhere in these Contract Documents.

2. Safety shall be the sole responsibility of the CONTRACTOR. The CONTRACTOR shall conduct work so as to minimize safety hazards and exposure of persons to hazardous and potentially hazardous conditions within all job site areas.

3. The CONTRACTOR shall work 24 hours per day continuously whenever there is a condition that may result in the open shield pipe jacking equipment becoming immobilized when required jacking forces approach either the capacity of the jacking system or the designed jacking capacity of the pipe or a condition is encountered that endangers the excavation or surrounding structures, until the hazardous condition is eliminated and the safety of the work is restored. The OWNER shall be notified immediately if such a condition occurs.
4. CONTRACTOR shall control groundwater. Anticipated groundwater inflow rates are provided in the GBR.

B. Air Quality:

1. The CONTRACTOR shall conduct excavation operations employing methods and equipment that will positively control dust, fumes, vapors, gases, mists, and other airborne impurities in accordance with OSHA regulations.

2. The CONTRACTOR shall provide approved instruments and test the underground atmosphere in accordance with OSHA regulations as frequently as necessary to ensure that the required air quality and quantity is maintained. The CONTRACTOR shall maintain a log book of all air quality test results including date, time, microtunnel station, name of person taking tests and all information relevant to each test and test results.

C. Geotechnical Conditions:

1. Geotechnical information is contained in the Geotechnical Baseline Report (GBR) and Geotechnical Data Report (GDR).

D. Field Measurements:

1. The CONTRACTOR shall be responsible for monitoring ground settlement and heave associated with the work in accordance with Instrumentation and Monitoring requirements as specified elsewhere in the Contract Documents. CONTRACTOR shall modify their construction methods to control ground settlement or heave to the allowable tolerances indicated in Paragraph 3.1 herein and prevent damage to existing structures or detrimental movement to the work.

E. Access to Site and Equipment:

1. The CONTRACTOR shall allow access to the OWNER and shall provide necessary assistance and cooperation to aid the OWNER in documenting observations, measurements, and sample collection prior to, during and following all pipe jacking operations. Access shall include but not limited to:
   a. The OWNER shall have full access to the open shield pipe jacking shield, jacking system and excavation face during all site activities to visually observe jacking forces, cutter wear, and steering corrections.
   b. The OWNER shall have full access to the jacking and reception shafts and installed pipe string to visually inspect installed pipes, shaft seals, and line and grade.
   c. The OWNER shall have full access to the bentonite lubrication plant to visually inspect storage and mixing tank levels, lubrication pressures and pumping rates, amount and type of additives, and collection of samples to determine lubrication properties.
PART 2 - PRODUCTS

2.1 JACKING PIPE

A. One-Pass Installation Strategy

1. Jacking pipe shall be as indicated on the Contract Drawings for each pipe jacking reach. CONTRACTOR shall refer to individual jacking pipe requirements as specified elsewhere in the Contract Documents.

B. Two-Pass Installation Strategy

1. Allowable casing jacking pipe materials include steel jacking pipe utilizing an integral, machined press-fit connection and joint sealant or reinforced concrete jacking pipe. CONTRACTOR shall refer to individual jacking pipe requirements as specified elsewhere in the Contract Documents.

2. Carrier pipe shall be as indicated on the Contract Drawings. CONTRACTOR shall refer to Carrier Pipe Installation in Trenchless Reaches for specific requirements, as specified elsewhere in the Contract Documents.

2.2 PIPE JACKING LUBRICANT

A. Pipe jacking lubricant shall be a mixture of water, bentonite, and polymer additives. Mix ratio of these materials shall be based on the CONTRACTOR’s anticipated means and methods and a project specific mix design as completed by an independent mud/slurry engineer specializing in lubricant rheology.

B. Proposed lubricant mixture shall be capable of filling external annular voids as the casing is jacked forward and be used on a continuous basis during pipe jacking. The use of water alone for lubrication is strictly prohibited.

C. Bentonite and polymers used for pipe lubrication shall be non-toxic and shall not adversely affect groundwater quality.

D. Water used for making pipe lubricant shall be clean, potable, fresh and free from oil, acid, alkali, organic matter or other deleterious substances. Use of water from nearby water bodies is prohibited.

2.3 PIPE JACKING THRUST REACTION STRUCTURE

A. To resist jacking forces, CONTRACTOR shall design a concrete thrust block to distribute jacking/thrust forces and stresses. CONTRACTOR shall stiffen the shaft initial support such that maximum jacking frame capacity does not impair structural capacity and watertightness of the sheet piles or liner plate/rings. If additional thrust resistance is required, and/or if thrusts deform or damage the shaft support, CONTRACTOR shall modify the ground behind the shaft wall and jacking thrust block, and/or design the internal thrust frame and reaction structure to be independent of the initial shaft support system.
B. Shaft excavation support systems shall be protected from loading and deformation due to pipe jacking thrust forces. Pressures applied to shaft support systems during jacking operations shall be limited to 3,000 pounds per square foot (psf) for all soil installations and 4,500 psf for all rock installations.

C. Shaft supports shall not be deformed by pipe jacking operations and pipe jacking thrust resistance shall not be derived from the shaft excavation support system. The CONTRACTOR's pipe jacking thrust reaction structure, such as an integral base slab and jacking thrust wall, shall be used to resist and distribute pipe jacking thrust forces transferred from the jacking frame.

D. Pipe jacking thrust reaction structures and pipe jacking operations shall be designed and performed to protect any new pipes that have been previously installed.

E. Pipe jacking thrust reaction structures shall be designed and sealed by a Professional Engineer registered in the State of Ohio.

2.4 JACKING AND RECEIVING SHAFTS

A. CONTRACTOR shall refer to Temporary Excavation Support System and Tunnel Shaft requirements as specified elsewhere in the Contract Documents for jacking and receiving shaft construction.

2.5 CELLULAR BACKFILL GROUT

A. The annular space between the carrier pipe and casing pipe shall be backfilled with cellular grout in accordance with Tunnel and Shaft Grout as specified elsewhere in the Contract Documents.

2.6 OPEN SHIELD PIPE JACKING EQUIPMENT

A. The CONTRACTOR shall be fully responsible for the selection, design, and supply of open shield pipe jacking equipment and ancillary equipment. Full directional guidance of the shield is a prerequisite of this method of construction.

B. OWNER will consider CONTRACTOR proposals to use a larger diameter open shield pipe jacking machine. OWNER will have sole discretion on acceptance or rejection of CONTRACTOR's proposal to use larger diameter casing or machine. The open shield pipe jacking machine/shield proposed shall be documented in the CONTRACTOR's submittal package including detailed machine specifications.

C. The CONTRACTOR shall employ pipe jacking equipment that will be capable of handling the various anticipated ground conditions as described in the GBR. Equipment must be capable of minimizing loss of soil ahead of and around the machine and shall provide support of the excavated face at all times during prolonged stoppages in pipe jacking operations.
D. The CONTRACTOR shall take into consideration all geotechnical information available to the CONTRACTOR and any special scheduling constraints for this Project and select a new or recently reconditioned open shield pipe jacking equipment machine capable of achieving the required rate of advance allowing for all non-productive time. The open shield pipe jacking machine equipment shall meet the following requirements:

1. The proposed cutting mechanism and shield system selected shall be capable of installing the pipe while being compatible with the anticipated soil, groundwater, cobbles, boulders, and other geotechnical conditions detailed in the GBR. The machine equipment shall be capable, at all times, of supporting the full excavated area without the use of ground stabilization, during prolonged stoppages such as at the end of each shift and have the capability of controlling and measuring the earth pressure at the face. The pipe jacking system shall be capable of adjustments required to maintain face stability for the particular soil condition and shall monitor and continuously balance the soil pressure.

2. The maximum radial overcut shall not exceed 0.75 inch.

3. The open shield pipe jacking equipment shall be capable of controlling shield rotation by means of a bi-directional drive on the cutter head or by use of mechanical fins or grippers, where a mechanized machine is proposed. The machine/shield shall be mechanically articulated to enable remotely-controlled steering of the shield in all directions. The machine shall control groundwater during excavation.

4. The machine/shield shall be designed to sustain all ground and hydrostatic loads that may be imposed upon it as well as loads imposed by the thrust jacks, steering mechanisms and other appurtenances.

5. Where proposed, the mechanized The machine shall have protected motors and operating controls against the anticipated water inflows. Parts and components shall be resistant to the anticipated water inflows.

6. The machine/shield shall be designed to provide a safe working environment and the greatest efficiency in the performance of the boring operation, related maintenance including changing of the cutters, muck removal and handling, etc.

7. The machine shall be equipped with a fire warning system.

8. Hydraulic fluids used in the machine/shield shall be fire resistant, in accordance with NFPA 241, and shall be certified by the manufacturer as being fire resistant.

9. The machine/shield shall be equipped for monitoring hazardous gases, with alarms and automatic shut-off per Tunnel and Shaft Safety as specified elsewhere in the Contract Documents.

10. Where a mechanized The open shield pipe jacking machine is proposed, it shall be equipped with a roll indicator and laser target system to permit continuous control, monitoring and setting of line and grade.
11. A means for injecting pipe lubricant at or ahead of the lead edge of the first pipe segment shall be incorporated in the shield for all drives greater than 75 feet. The CONTRACTOR shall determine if lubricant is required for drives less than 75 feet in length, consistent with their means and methods to control jacking forces. A watertight seal shall be provided between the shield and first pipe to avoid leakage into the shield and pipe string.

12. Where a mechanized open shield pipe jacking machine is proposed, the cutterhead shall be designed and equipped with the capability and means to cut, excavate, and crush the geotechnical materials and baseline conditions as established in the GBR.

13. Laser/theodolite system shall be capable of accurately locating MTBM the shield for the longest drive. The submittal shall show how the laser is to be isolated from the thrust wall and shoring system. The laser(s) shall be calibrated for the longest drives on the project. The CONTRACTOR shall retain a laser alignment and control specialist to set-up the overall alignment control system. The system shall utilize a rotating beam laser set-up that will immediately identify deviation from line at the surface. Confirm that these systems can achieve the required pipeline line and grade within the specified tolerances. Include a description of the equipment and procedure to be used in checking the positioning of the alignment control system and the shaft temperatures. In addition, the CONTRACTOR shall submit a contingency plan if line and grade cannot be maintained. The laser at the jacking shaft shall be securely fastened and be independent from the jacking frame, jacking pad, or thrust wall.

14. The minimum information available to the operator at the control console shall include the position of the laser target relative to the reference position, line and grade offsets, shield roll and inclination, rate of advance, installed length, tunnel length, jacking loads and thrust force, intermediate jacking loads, cutter head torque and rotation rate, steering cylinder pressures and locations, and earth pressure balance at the face. All data shall be electronically recorded continuously by the control system. NOT USED.

15. The control equipment shall integrate the system of excavation, removal of spoil and its simultaneous replacement by a pipe. As each pipe section is jacked forward, the control system shall synchronize the operational functions of the system. The system shall coordinate excavation and machine advance rate to avoid over-excavation.

E. Spoil Transport and Removal:

1. Excavated material shall be handled in the underground opening and transported to the jacking shaft, where it shall be hoisted and loaded for offsite disposal. Stockpiling of spoil shall not be permitted.

F. The CONTRACTOR shall maintain an inventory recommended by the open shield pipe jacking and backup systems manufacturers to ensure continued availability of all essential systems. The following inventory of spare parts shall be maintained for the open shield pipe jacking machine and be available on site at all times during excavation:
1. Power and control cables.

2. Drive motors.

3. Hydraulic cylinders, hoses, controls, seals.

4. Bearings and seals for all motors and pumps.

G. Pipe Jacking Equipment/Intermediate Jacking Station:

1. A jacking frame with suitable hydraulic jacks capable of successively pushing a string of connected pipes following tunnel excavation equipment through the ground toward the Reception Shaft shall be provided for developing a uniform distribution of jacking forces around the perimeter of the pipe. The jacking frame shall react against a pipe jacking thrust reaction structure as specified in this Section, the thrust reaction face of which shall be vertically and horizontally perpendicular to the pipeline alignment. CONTRACTOR shall ensure, through a detailed survey that the jacking pipe guide rails are set to the required design alignment. CONTRACTOR shall survey guide rails and push ring of the hydraulic jacking system with the hydraulic rams retracted and extending to ensure the hydraulic jacking system is properly aligned and functioning.

2. The jacking frame and pipe jacking thrust reaction structure shall be designed and constructed by the CONTRACTOR and shall have design capacity equal to the maximum anticipated jacking loads to push the shield, continuous pipe string, and ancillary equipment (including IJS’s) through the ground to the receiving shaft with a factor of safety of at least 2.5. The jacks shall have pressure limiting devices such that the capacity of the pipe is not exceeded. The CONTRACTOR shall submit these pressures and describe the controls to ensure they are not exceeded.

3. An intermediate jacking station shall be installed within the pipe string within the first 100 feet of the open shield pipe jacking drive and every 500 feet there after for all drives longer than 500 feet in length. The intermediate jacking station shall have a minimum capacity of 600 tons. Additional intermediate jacking station shall be installed when the required jacking forces reach approximately 70 percent of the allowable jacking forces of the casing pipe, hydraulic jacking equipment in the main shaft, or the intermediate jacking station, whichever is lowest.

4. Provide and maintain a pipe lubrication system at all times to lower the friction developed on the surface of the pipe during jacking operations. Pipe lubrication shall be a project specific mixture of bentonite, polymer, and water.

H. Use a power generator, which is suitably insulated for noise ("hospital" type) in residential or commercial areas.

I. Enclose lighting fixtures in watertight enclosures with suitable guards. Provide separate circuits for lighting, and other equipment.

J. Electrical systems shall conform to requirements of National Electrical Code - NFPA70.
2.7 SHAFT EYE

A. Launch/Reception Eye or Entry/Exit Eye: A mechanical seal shall be designed by the CONTRACTOR and be comprised of one or more rubber flanges attached to a steel housing that is mounted to the wall of the shaft. The machine distends the flange seal as it passes through, creating a seal to reduce water or lubrication inflows into the shaft during pipe jacking operations.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. The CONTRACTOR shall be responsible for means and methods of open shield pipe jacking operations and shall ensure the safety of personnel and adjacent property.

B. Use methods for pipe jacking operations that will minimize ground settlement, and keep settlement of structures, roadways, utilities, and ground surface less than 1/2 inch and heave less than 1/4 inch. Select an excavation face stabilization method that will control flow of water and prevent loss of soil into the face of the shield and provide stability of the face under anticipated conditions and satisfy the requirements of this Section.

C. Conduct pipe jacking operations in accordance with Tunnel and Shaft Safety requirements as specified elsewhere in the Contract Documents, applicable safety rules and regulations, OSHA standards and CONTRACTOR’s safety plan. Use methods that include due regard for safety of workmen, adjacent structures, utilities, and the public.

D. Maintain clean, safe working conditions wherever there is person-access, including proper lighting and ventilation.

E. For pipe jacking under embankments, highways, parking lots, or streets, perform the installation so as to avoid interference with the operation of the embankments, highways, parking lots, or streets, except as approved by the owner of the facility.

F. The CONTRACTOR shall not begin open shield pipe jacking operations until all applicable submittals have been reviewed and approved by the OWNER.

G. The CONTRACTOR shall jack each pipe section forward as the excavation progresses so as to provide complete and adequate ground support at all times.

H. The CONTRACTOR shall continuously inject pressurized lubricant around the leading edge of the pipe being jacked and through the ports in the pipe sections being jacked to lower friction along the pipe surface during jacking for all drives greater than 75 feet in length. The CONTRACTOR shall determine if lubrication is required for drive lengths less than 75 feet, consistent with their means and methods to control jacking forces. Volumes of lubricant pumped shall be recorded and shall be at least equal to the volume of annulus produced by the shield overcut.
I. Excavated materials shall be disposed of in accordance with Muck Disposal requirements as specified elsewhere in the Contract Documents.

J. The CONTRACTOR shall notify the OWNER immediately if any section of pipe is damaged during jacking operations, or at any time, or by any other means prior to continuing jacking. Prior to completion of pipeline installation the damaged pipe shall be jacked through to the receiving shaft and replaced with undamaged pipe or otherwise repaired to the satisfaction of the OWNER at no additional cost to the OWNER.

K. The CONTRACTOR shall have on site all necessary safety equipment required for personnel to enter the pipe.

L. The CONTRACTOR shall measure, record and report the “no-load torque” required to rotate the cutterhead in both directions to the OWNER during start-up testing prior to shield launch where a mechanized machine is proposed.

M. The CONTRACTOR shall provide, install, maintain, and operate drainage facilities at the shaft bottom and in the shield to collect and dispose of any construction water that enters the shield and collects in the jacking pipe string and shaft.

N. The CONTRACTOR shall supply fresh air to all work areas in sufficient quantity to comply with all applicable laws, safety codes, regulations, and Tunnel and Shaft Safety requirements as specified elsewhere in the Contract Documents. The CONTRACTOR shall install ventilation plants capable of supplying the required flow rate of fresh air. Ventilation pipes shall be of sufficient size, adequately supported, strong and tightly jointed and capable of flow in both directions.

O. Within 24 hours after completion of jacking, cavities behind the jacked pipes shall be filled with grout injected under pressure. All lifting and grouting holes shall be sealed with purpose made plugs.

P. The CONTRACTOR shall provide a watertight seal between the outer surface of the shield and jacked pipe to prevent bentonite and groundwater from entering into the pipe string.

Q. The CONTRACTOR shall improve the ground outside of the jacking and receiving shaft, as required, to facilitate launch and retrieval of open shield pipe jacking equipment. Ground improvement shall be to the extent that the ground will remain stable without inflow of soil or water into the shaft while the equipment is being launched or received. Ground improvement shall be confirmed by a progressive demonstration as identified below:

1. Step 1: CONTRACTOR shall demonstrate stability of ground by cutting a two (2) inch diameter hole in the shaft wall near the center of the open shield pipe jacking drive. If soil enters or groundwater flow exceeds 5 gallons per minute (GPM), the CONTRACTOR shall seal the demonstration hole and further improve the ground before repeating this demonstration step.

2. Step 2: Upon successful completion of Step 1, the CONTRACTOR shall demonstrate the suitability of the ground by cutting a 12 inch diameter hole in the
center of the shaft wall. If soil enters or groundwater flow exceeds 10 GPM, the CONTRACTOR shall seal the demonstration hole and further improve the ground before repeating this demonstration step.

3. Step 3: Upon successful completion of Step 2 and if the CONTRACTOR believes the ground is stable, the CONTRACTOR may proceed with removing the remaining shaft wall at the tunnel eye to facilitate equipment launch/retrieval.

R. The CONTRACTOR shall provide a watertight seal between the outer surface of the shield and jacked pipe and at all shaft penetrations.

S. The CONTRACTOR shall provide all ground modification or improvement measures necessary to allow the machine shield to maintain specified alignment tolerances at no additional cost to the OWNER.

T. The CONTRACTOR shall demonstrate to the OWNER the surveyed location of the heading at 100-foot increments during excavation.

U. Acceptance criteria for casing pipe alignment tolerances to be maintained during excavation shall be as follows:

1. Line ................................................................................................... ±1 inches

2. Elevation .......................................................................................... ±1 inches

3. Horizontal Corrections Not to Exceed ...................................... 1 inch/25 feet

4. Vertical Corrections Not to Exceed ........................................... 1 inch/25 feet

V. Casing installation outside these tolerances shall have implications on carrier pipe installation where a two pass installation strategy is specified.

W. CONTRACTOR shall provide, operate and maintain for the duration of the pipe jacking construction operations a temporary ventilation system and air quality monitoring system which conforms to the requirements of Tunnel and Shaft Safety as specified elsewhere in the Contract Documents. Remove system(s) from the site when work is complete.

3.2 LEAKAGE CONTROL

A. Leakage inflow through the casing joints is not permitted. Any inflow shall be sealed off by the CONTRACTOR. Method of sealing should leakage occur shall be approved by the OWNER.

3.3 OBSTRUCTIONS

A. The CONTRACTOR shall develop generalized schemes for removal of obstructions in front of the shield by the use of the shield and surface excavations. Surface excavation will not be allowed within the zone of influence of major utilities or beneath
treed areas, and the CONTRACTOR must propose alternative methods acceptable to
the OWNER and the owner of the structure/utility in question.

B. Obstructions within the limits established in the GBR shall be removed at no additional
cost to the OWNER. For other obstructions, the CONTRACTOR shall endeavor to
remove obstructions using reasonable and diligent means, as determined by the
OWNER, for up to 6 hours at no additional cost to the OWNER.

C. The CONTRACTOR shall remove obstructions subject to the following procedures and
criteria:

1. The CONTRACTOR shall notify the OWNER immediately upon encountering an
obstruction that stops the forward progress of the Work.

2. Upon written authorization by the OWNER, the CONTRACTOR shall proceed
with removal of the obstruction in accordance with the CONTRACTOR's
previously reviewed submittal(s).

3. The CONTRACTOR shall provide the OWNER with details of the nature and size
of the obstruction.

4. OWNER shall be given the opportunity to witness removal of the obstruction from
the ground. Any removal process that does not allow direct inspection of the
nature and position of the obstruction will not be considered for payment.
Payment will only be considered if the obstruction is outside of the limits
established in the GBR.

3.4 REPORTING REQUIREMENTS

A. CONTRACTOR’s daily reports shall include the following information:

1. Shift's activities, including starting and ending stations for each shift.

2. Starting and ending clock readings for each shift.

3. Manpower count by location and classification.

4. Location of excavation face/shield by station and progress of drive during shift.

5. Hours worked per shift on pipe jacking operations.

6. Completed field forms for checking line and grade of the pipe jacking operation,
showing achieved tolerance relative to design alignment reference line and
grade.

7. Groundwater control operations and/or piezometric levels.

8. Observation of any lost ground or other ground movement.

9. Any unusual conditions or events.
10. Reasons for operational shutdown in the event a drive is halted.

11. Information regarding pipe lubricant including, volume placed and locations of injection, lubricant mix design and pumping pressures.

12. Comments regarding any and all atypical machine performance that may have occurred.


14. Obstructions or other reasons for stoppages, duration of each stoppage, cause of stoppage, and remedial action taken.

15. Pumping discharge records.

16. Air quality and ventilation records.

17. The volume of muck removed from site.

B. The CONTRACTOR shall submit daily jacking records (consisting of manual and electronically recorded data) to the OWNER for review by noon on the day following the shift for which the data or records were taken during pipe jacking operations. These records shall include date, start and end time, name of operator, tunnel drive identification, installed pipe number and corresponding tunnel length, rate of advance, jacking forces, cutterhead RPM and torque (if mechanized machine is proposed), steering jack positions and pressures, line and grade offsets and adjustments to the laser, any movement of the guidance system, intermediate jacking station use and jacking forces, pressure, volume, and location of lubricant pumped, problems encountered with the tunneling machine or other components or equipment, and durations and reasons for delays. CONTRACTOR shall also record groundwater control operations and/or piezometric levels, observation of any lost ground or other ground movement, description of ground conditions encountered, and excavated volume of material. Manual jacking records shall be recorded at a minimum of every 5 feet, ½ hour interval or as conditions change, whichever is more frequent. Electronic or computer recorded data shall be referenced to date, time and distance and shall be recorded at intervals of one minute or less.

C. The CONTRACTOR shall maintain and submit a separate log indicating the volume of spoil removed from the jacking shaft site, at the completion of each shift. Actual volumes shall be compared to expected theoretical volumes. Discrepancies between actual and theoretical volumes shall be immediately reported to the OWNER.

3.5 EXCAVATION AND PIPE JACKING

A. Excavation

1. Keep excavation within the easements and rights-of-way indicated on the Drawings and to the lines and grades designated on the Drawings.
2. Perform pipe jacking operations in a manner that will minimize the movement of
the ground in front of and surrounding the machine/shield. Prevent damage to
structures and utilities above and in the vicinity of the pipe jacking operations.
a. During shutdown periods, support the face of excavation by positive
means; no support shall rely solely on hydraulic pressure.
b. Inspect machine, shield and all equipment between drives for wear and
damage. Repair/refurbish as necessary between drives.
c. Carefully control volume of spoil removed. Advance rate and excavation
rate to be compatible to avoid over-excavation or ground loss.
d. When cutting head is withdrawn or is open for any purpose, keep
excavated face supported and stabilized.

3. Excavated diameter should be a minimum size to permit pipe installation by
jacking with allowance for bentonite, polymer, and water lubrication injection into
the annular space. In no case shall overcut exceed 1.5-inches total, diametrically
(0.75-inch radial overcut).

4. Whenever there is a condition encountered in which stopping the pipe jacking
operation could endanger the excavation or adjacent structures, operate without
intermission including 24-hour working, weekends and holidays, until the
condition no longer exists.

5. The CONTRACTOR shall be responsible for damage due to settlement from any
construction activities.

B. Pipe Jacking

1. Continuously maintain face support during excavation and shutdown periods.

2. Lubricant shall be injected at lead pipe. Additional injection of lubricant shall
occur at other locations within the pipe string to control jacking forces in
conjunction with CONTRACTOR’s means and methods.

3. If the pipe “freezes” in place or otherwise seizes or becomes immobilized and the
CONTRACTOR elects to construct a recovery access shaft, obtain approval from
the OWNER, then coordinate traffic control measures and utility adjustments as
necessary prior to commencing work. No rescue shafts will be allowed within 25
feet of major utilities. In case of a stalled machine at this location, the
CONTRACTOR shall excavate from the opposite shaft or a recovery shaft
outside the gas pipeline limits to clear the machine and complete the pipe
installation.

3.6 CONTROL OF LINE AND GRADE

A. Construction Control

1. The OWNER will establish the baselines and benchmarks indicated on the
Drawings. CONTRACTOR shall check baselines and benchmarks at the
beginning of the Work and report any errors or discrepancies to the OWNER.
2. Use the baselines and benchmarks established by the OWNER to establish and maintain construction control points, reference lines and grades for locating tunnel, sewer pipe, and structures.

3. Establish construction control points sufficiently far from the work so as not to be affected by ground movement caused by pipe-jacking operations.

B. Benchmark Movement. The CONTRACTOR shall ensure that if settlement of the ground surface occurs during construction which affects the accuracy of the temporary benchmarks, the CONTRACTOR shall detect and report such movement and re-establish temporary bench marks.

C. CONTRACTOR to refer to Instrumentation and Monitoring requirements as specified elsewhere in the Contract Documents for additional details on construction monitoring.

3.7 ANNULAR GROUTING

A. After the completion of the jacking operations between shafts, the CONTRACTOR shall displace any lubricant slurry and fill the external annular space with grout applied under sufficient pressure to displace the lubricant slurry and fill all voids. CONTRACTOR shall refer to grouting requirements as specified elsewhere in the Contract Documents.

B. Annular Grouting shall be accomplished as soon as possible after jacking pipe has been completely installed but no more than 24 hours after end of pipe jacking to prevent any surface settlement due to movement of the soil material into the void space around the jacking pipe.

C. After completion of the Annular Grouting operation, the grout holes shall be plugged and the interior of the pipeline finished to a smooth, even surface and watertight condition.

3.8 DISPOSAL OF EXCESS MATERIAL

A. Spoil and garbage shall be disposed of in accordance with all applicable local, state and federal regulations and these Specifications. Re-use of material for backfill purposes is prohibited.

END OF SECTION