

Addendum No. 2

Project: Depot Avenue 36-inch Water Transmission Main
Control No: 987
Issued: To all listed plan holders
Date: September 28, 2017

This addendum forms a part of the Agreement described above. The original Contract Documents and any prior addenda remain in full force and effect except as modified by the following, which shall take precedence over any contrary provisions in prior documents.

1. Section 00330Sup– Unit Price Schedule

- DELETE Section 00330sup in its entirety, and REPLACE with revised Section 00330sup, attached. In addition, the deleted page is of an obsolete version and the following changes have been made:
 - CHANGED QTY – Pay Item 3005, Water Main Bore
 - ADDED Pay Items 3010c-e, Gate Valves
 - CHANGED Pay Items 6005a-d from Base Course + Surface Course, to Base Course Only
 - ADDED Pay Item 7011 - Retaining Wall

2. Section 01110 Summary of Work

- DELETE Section 01110, page 3, and REPLACE with revised Section 01110, page 3, attached. In addition, the deleted page is of an obsolete version and Section 1.3, Paragraph K, Special Work Conditions has been added.

3. Section 01270 Measurement and Payment

- DELETE Section 01270, pages 6-11, and REPLACE with revised Section 01270, pages 6-11, attached. In addition, the following changes have been made on the revised version supplied with this addendum:
 - Pay Item 3015a-e – ADDED c-e, & See Welded-on Outlets supplemental information sheets.
 - Description added for Pay Item 6005a-d from item 1 (listed above).
 - Description added for Pay Item 7011 - Retaining Wall

4. Section 02445A Auger Boring Alternative Tunneling-Supplemental

- ADD Section 02445A in its entirety, as it was inadvertently omitted from the original bid package.

5. Clarification

- Geotechnical Information I & II included as a part of this Addendum
- Morgan & West Fifth NS RR pipe data sheets included as a part of this Addendum

6. Drawings: (pdfs of drawing sheets may be found at www.kub.org. Click the Procurement link, then Open Bids & Requests for Proposals, then scroll to find the above referenced project & its attachments)

- DELETE Drawing Sheet C7 and REPLACE with the attached Revised_C7 with revision date of 9/25/17.
- DELETE Drawing Sheet C8 and REPLACE with the attached Revised_C8 with revision date of 9/25/17.
- DELETE Drawing Sheet C9 and REPLACE with the attached Revised_C9 with revision date of 9/25/17.
- DELETE Drawing Sheet C16 and REPLACE with the attached Revised_C16 with revision date of 9/25/17.
- DELETE Drawing Sheet D2 and REPLACE with the attached Revised_D2 with revision date of 9/28/17.

7. The following are questions received prior to cut off along with their responses:

- 1) **Question:** Are MJ fittings with Mega-Lubs allowed on the 36” Water Main?
Answer: No, Field FlexRing/TR Flex restraints are required on the 36” water main
- 2) **Question:** Does Pay Item 3000g (450) 36” Lock Joint Restraints include fittings restraints or are these just pipe restraints?
Answer: Pay Item 3000g will be used for joints coming into and out of the fittings in addition to the 36” water main pipe joints.
- 3) **Question:** Will work have to begin near Williams St & 5th Avenue due to the City of Knoxville paving schedule?
Answer: No, the City of Knoxville has pushed back the paving schedule for this section of water main.
- 4) **Question:** Is a Geo-Technical report available?
Answer: Yes, the geo-technical report is available and will be provided in this Addendum
- 5) **Question:** Is a pay item for Lock Restraint Joints needed?
Answer: Lock Joint restraints are required on the 36" pipe (as noted in the plans) and on fittings.
- 6) **Question:** Are there any sewer lines to move?
Answer: To KUB’s knowledge, there are no sanitary sewers that need to be moved.
- 7) **Question:** Will traffic permit be required?

- Answer:** A traffic control permit will be required by the City of Knoxville and it is included in Pay Item 1010a – Traffic Control Plans.
- 8) **Question:** Will there be special equipment required for pipe sanitization?
Answer: No special equipment is required. The CCTV equipment should be sanitized if previously used for wastewater CCTV
- 9) **Question:** What method will be required to sanitize pipe after installation? How will contractor access the pipe for sanitization?
Answer: Disinfection and Testing of the water main(s) will be as stated in the Specification Sections 02516 and 02516a.
- 10) **Question:** Does road have to be restored to original condition at the conclusion of work each days work?
Answer: If the road is closed to traffic, temporary roadway restoration is not required, however, open trenches should be plated for safety reasons.
- 11) **Question:** Sheet G2/Note 23? Pavement requirements? Stone or Pug mix?
Answer: City of Knoxville requires full stone backfill. TDOT allows pug mix above the pipe envelope.
- 12) **Question:** Installation very close to existing sewer line, will there be an additional pay item for extended paving area due to shared ditches w/other utilities?
Answer: No, additional pay item will be provided for paving. Any additional paving incurred will be paid under bid pay item(s) 6005a-d.
- 13) **Question:** Question about Trolley Track/Concrete disposal?
Answer: Trolley Tracks and concrete in the vicinity of the trolley tracks will be handled as special waste under Pay Item 7000.
- 14) **Question:** Are the 36-inch ductile iron fittings required to be FlexRing/TR Flex or will wedge restraints (EBAA Iron Megalug or Sigma One Lok) be allowed?
Answer: The 36-inch ductile iron fittings are required to be Field FlexRing/TR Flex.
- 15) **Question:** Can you clarify the width of the concrete encasement required for crossing the existing box culvert?
Answer: The existing box culvert is 41-feet wide by 15-feet deep.
- 16) **Question:** Can the existing 14-inch cast iron water line be shut down without interrupting service to customers to install the new 16-inch and 12-inch ductile iron water line that is shown as same ditch relay or will a temporary water line need to be installed?
Answer: No, the existing 14-inch cast iron water main cannot be shut down without interrupting service to customers. A water clearance outage will be required. This work will need to be completed at night.

- 17) **Question:** There are no valves shown on Line B and Line C for connections to the existing water mains. This means once the lines are tested they would need to be completely drained to complete the tie-ins. Would you consider adding pay items for 16-inch, 12-inch, and 8-inch valves?
Answer: Yes, pay items for 16-inch (2 each), 12-inch (1 each), and 8-inch (1 each) valves. The pay items will be included in an addendum and shown on revised construction plans.
- 18) **Question:** Service No. 5 is shown being connected to the 36-inch water main instead of the 12-inch. Is this correct, or should the ¾-inch service be connected to the 12-inch water main?
Answer: Service No. 5 should connect to the new 12-inch D.I. water main. The plans will be corrected in an addendum.
- 19) **Question:** The easement details for Parcel C10 call out that if the project is not started within one year of signing the easement that KUB/Contractor will be responsible for moving/storing the semi-trailers. Easement shows it was signed on November 13, 2015. Please clarify if the contractor will be responsible for this.
Answer: As of August 8, 2017, there were five (5) semi-trailers on site within the project construction limits. The owner will have the semi-trailers relocated by September 30, 2017. This will clear the left side of the driveway. Semi-trailers on the right side will remain.
- 20) **Question:** The plans show 405 LF of 48-inch Jack and Bore, but pay item 3005 a 48" Auger Bore w/ 36" Carrier only has a quantity of 395 LF. Please clarify which is correct.
Answer: 405 LF of 48-inch Jack and Bore is correct. This amount includes 285 LF at the West Fifth Avenue location and 120 LF at the Morgan Street location. The bid quantity will be revised with an addendum.
- 21) **Question:** If subcontracting the pipe installation does the subcontractor need to be pre-qualified?
Answer: The subcontractor is not required to be pre-qualified, but must be approved by OWNER. The KUB contract is with the General Contractor, who is required to be pre-qualified.
- 22) **Question:** Is there a minimum % or scope of the project the General Contractor must perform? (i.e. GC must self-perform at least 50% of the work not including material cost.)
Answer: The Prime Contractor must self-perform 60% of the work.
- 23) **Question:** Will the Owner supply the geotechnical data called out on sheet C6?
Answer: The geotechnical data called out on sheet C6 will be made available in an addendum.
- 24) **Question:** Will the Owner add a pay item (CY) and detail for Flow Fill that is required in TDOT roads?

- Answer:** It has been determined that flowable fill will not be required for non-longitudinal cuts on TDOT roads. No pay item for flowable fill is required.
- 25) **Question:** Is the intent for the entire 36-inch water main to be restrained or should we follow the table provided in the plans concerning distance of restraint required from fittings?
- Answer:** The table provided in the plans concerning the distance of restraints required from the fittings should be followed as detailed. The inclusion of additional restraints will be at the Owner's discretion and will required the Owner's approval.
- 26) **Question:** The detail for Permanent Patching: Base Course Concrete Street with Asphalt Overlay Repair (Installed by Owner or Contractor) calls for an installed depth of 2" plus 1.5 times the depth of the existing concrete. Can you define the areas where this is the case and how deep the concrete is?
- Answer:** The exact locations of the area(s) where the pavement consists of a concrete base course cannot be identified prior to construction excavation. Due to the unknown(s) of this situation, a maximum 9-inch asphalt surface in those areas will apply.
- 27) **Question:** line item for 450 - 36-inch restraint joint locking gaskets. To our knowledge locking gaskets of this size are not manufactured?
- Answer:** 36" pipe and fittings shall only be ductile iron in accordance with ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53, latest revisions. Where 36" buried, restrained fitting joints are required to resist thrust due to internal pressure, only push-on, restrained joints (AMERICAN Flex-Ring, US Pipe TR-Flex, or approved equal) shall be utilized at the specified locations."
- 28) **Question:** Is temporary asphalt a pay item?
- Answer:** Bid Item(s) 6005(a,b,c,d) – Permanent Patching will be deleted and replaced with "Asphalt Pavement Repair, Base Course Only"
- 29) **Question:** Is the asphalt linear foot paid separately for each pipe in a "joint" trench?
- Answer:** Asphalt repair for pipe(s) installed in a joint trench will be paid per linear foot according to bid pay item 6005(e).
- 30) **Question:** Are concrete kickers required?
- Answer:** Concrete thrust blocks are a KUB requirement, however, because restrained pipe is being used, installation(s) of concrete thrust blocks will be evaluated and installed at the Owner's discretion.
- 31) **Question:** Can there be a pay item for the retaining wall?
- Answer:** Yes, a pay item for the retaining wall will be included in an addendum.
- 32) **Question:** Creek crossing, open cut, or bore?

Answer: In accordance with the approved ARAP, the creek crossing will be installed via jack and bore.

33) **Question:** May we have a copy of the geo-technical report on bore?

Answer: Geo-technical studies have been completed for the bores and will be attached in an addendum.

34) **Question:** Are MJ Fittings with Mega- Lugs allowed on the 36" Water Main?

Answer: 36" pipe and fittings shall only be ductile iron in accordance with ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53, latest revisions. Where 36" buried, restrained fitting joints are required to resist thrust due to internal pressure, only push-on, restrained joints (AMERICAN Flex-Ring, US Pipe TR-Flex, or approved equal) shall be utilized at the specified locations."

35) **Question:** On your larger 24-inch tapping valves, is their enough cover to stand these valves up vertically and will they need gearing? (can be provided with or without gearing in vertical applications) Or will contractors have to install these valves horizontally, and provide gearing?

Answer: The depth of the existing 24-inch water main at the Blackstock Avenue tie-in location is 7'-3" deep. The depth of the existing 24-inch water main at the East Summit Hill/Patton Street intersection tie-in location is 3.42' deep. Please note that the Contractor is required to pot-hole prior to excavation for tie-ins.

36) **Question:** Are the railroad flaggers and inspectors to be paid by KUB or the Contractor?

Answer: KUB will be responsible for paying the railroad flaggers and inspectors.

END

Each Bidder/Proposer shall acknowledge receipt of this addendum by affixing his signature below, by noting this addendum on his Bid/Proposal Form, and by attaching this addendum to his Bid/Proposal. **Failure to acknowledge this addendum could be cause for bid/proposal rejection.**

ACKNOWLEDGMENT

The undersigned acknowledges receipt of this addendum and the Bid submitted is in accordance with information, instructions and stipulations set forth herein.

BIDDER / PROPOSER _____

AUTHORIZED SIGNATURE _____

DATE _____

UNIT PRICE SCHEDULE

Item No.	Description	Est. Quan.	Unit	Bid Unit Price	Extended Bid Unit Price
1000	Mobilization (Limited to Unit Price Bid or 8.25% of Project Bid Total, Whichever is Less)	1	LS	\$	\$
1005	Erosion and Pollution Control				
a.	Type A Silt Fence	100	LF	\$	\$
b.	Curb Inlet Protection	20	EA	\$	\$
1010	Traffic Control				
a.	Plans	1	LS	\$	\$
b.	Implementation	1	LS	\$	\$
1015	Pre-Construction Site Video Recording	1	LS	\$	\$
2600	Storm Sewer Replacement				
a.	12" RCP storm sewer main (As Directed by OWNER)	100	LF	\$	\$
3000	Water Line				
a.	36" DIP Water Line (with V-Bio Wrapping)	650	LF	\$	\$
b.	36" DIP Water Line Under Pavement or Within 3' of Edge of Pavement Per Section 02321 (with V-Bio Wrapping)	7,270	LF	\$	\$
c.	16" Water Line Under Pavement or Within 3' of Edge of Pavement Per Section 02321	75	LF	\$	\$
d.	12" Water Line Under Pavement or Within 3' of Edge of Pavement Per Section 02321	990	LF	\$	\$
e.	8" Water Line Under Pavement or Within 3' of Edge of Pavement Per Section 02321	340	LF	\$	\$
g.	Lock Joint Restraint (36")	450	EA	\$	\$
h.	Restrained Joint Gaskets (16")	10	EA	\$	\$

UNIT PRICE SCHEDULE

Item No.	Description	Est. Quan.	Unit	Bid Unit Price	Extended Bid Unit Price
i.	Restrained Joint Gaskets (12")	75	EA	\$	\$
j.	Restrained Joint Gaskets (8")	20	EA	\$	\$
3005 Water Main Bore					
a.	48" Auger Bore w/ 36" carrier	405	LF	\$	\$
3010 Water Valve Installation					
a.	36" Butterfly Valve	4	EA	\$	\$
b.	4" Gate Valve	3	EA	\$	\$
c.	16" Gate Valve	2	EA	\$	\$
d.	12" Gate Valve	1	EA	\$	\$
e.	8" Gate Valve	1	EA	\$	\$
3015 Air Valves & Blowoff Valves					
a.	8" Air Release Valve Assembly As Directed By KUB (Complete Installation Per. KUB Drawings)	6	EA	\$	\$
b.	10" Air Release Valve Assembly As Directed By KUB (Complete Installation Per. KUB Drawings)	5	EA	\$	\$
c.	12" Air Release Valve Assembly As Directed By KUB (Complete Installation Per. KUB Drawings)	1	EA	\$	\$
d.	6" Flushing Connection Assembly	3	EA	\$	\$
e.	Flow Meter Vault (36" Water Line)	1	EA	\$	\$
f.	Flow Meter Vault (12" Water Line)	1	EA	\$	\$

UNIT PRICE SCHEDULE

Item No.	Description	Est. Quan.	Unit	Bid Unit Price	Extended Bid Unit Price
3020	Tie-ins to Existing Facilities (complete all labor and installation for tie-ups including installation of tees, couplings, reducers, backfill, asphalt/concrete restoration, cleanup/restoration, pressure test, & tracer wire.)				
a.	36" DI to existing 24" DI (Sta. 0+00 Line A)	1	EA	\$	\$
b.	36" DI to existing 24" DI (Sta. 83+51 Line A)	1	EA	\$	\$
c.	16" DI to existing 16" DI (W. Fifth Ave. at Williams Street - Line A)	1	EA	\$	\$
d.	16" DI to existing 16" DI (Sta. 10+58 Line B)	1	EA	\$	\$
e.	12" DI to existing 12" DI (Sta. 0+00 Line B)	1	EA	\$	\$
f.	8" DI to existing 16" DI (Sta. 3+36 Line C)	1	EA	\$	\$
g.	8" DI to existing 8" DI (Sta. 0+00 Line C)	1	EA	\$	\$
3025	Service Connections complete all labor and installation for service connections per KUB Specifications 02518, Part 2, including, but not limited to all associated fittings, piping, backfill, asphalt/concrete restoration, cleanup, etc.				
a.	Reconnection (service tap) - 1" and smaller	7	EA	\$	\$
b.	Reconnection (service tap) - 1 1/2" - 2"	4	EA	\$	\$
c.	Reconnection (service tap) - 4"	1	EA	\$	\$
d.	Reconnection (service tap) - 6"	4	EA	\$	\$
e.	Meter well and lid, meter horn, and associated fittings - 1" and smaller	1	EA	\$	\$
f.	Meter well and lid, meter horn, and associated fittings - 1 1/2" - 2"	1	EA	\$	\$
g.	3/4" copper service pipe	100	LF	\$	\$

UNIT PRICE SCHEDULE

Item No.	Description	Est. Quan.	Unit	Bid Unit Price	Extended Bid Unit Price
h.	1" HDPE service pipe	50	LF	\$	\$
i.	1 1/2" service pipe	50	LF	\$	\$
j.	2" service pipe	50	LF	\$	\$
k.	4" service pipe	50	LF	\$	\$
l.	6" service pipe	50	LF	\$	\$
3030 Retire Existing Water Facilities					
a.	Abandon Existing Mains	1	LS	\$	\$
	Abandon Existing Water Valves, Air Valves, & Blowoff Assemblies	10	EA	\$	\$
4050 Creek Crossing					
a.	36" Creek Crossing (As Directed by OWNER)	50	LF	\$	\$
6005 Permanent Patching:					
a.	Asphalt Pavement Repair, Base Course Only (single 36") (As Directed by OWNER)	6,370	LF	\$	\$
b.	Asphalt Pavement Repair, Base Course Only (single 16") (As Directed by OWNER)	80	LF	\$	\$
c.	Asphalt Pavement Repair, Base Course Only (single 12") (As Directed by OWNER)	60	LF	\$	\$
d.	Asphalt Pavement Repair, Base Course Only (single 8") (As Directed by OWNER)	340	LF	\$	\$
e.	Asphalt Pavement Repair, Base Course + Surface Course (36"/12" in Common Trench) (As Directed by OWNER)	900	LF	\$	\$
f.	Asphalt Pavement Repair, (Single 36") Base Course (Base Course Only)	1,135	LF	\$	\$

UNIT PRICE SCHEDULE

Item No.	Description	Est. Quan.	Unit	Bid Unit Price	Extended Bid Unit Price
g.	Asphalt Pavement Repair, (Single 12") Base Course (Base Course Only)	1,060	LF	\$	\$
6010	Removal and Replacement:				
a.	Concrete Curb	100	LF	\$	\$
b.	Concrete Curb and Gutter	100	LF	\$	\$
c.	Concrete Sidewalk	200	SY	\$	\$
d.	Tactile Warning Strip	5	EA	\$	\$
6025	Seeding	2,000	SY	\$	\$
6040	Riprap	50	TN	\$	\$
6045	Cleanup Restoration & Closeout	1	LS	\$	\$
7000	Hauling of Special Waste to Chestnut Ridge Landfill	500	TN	\$	\$
7010	CCTV Inspection of 36" Water Main	8,365	LF	\$	\$
7011	Retaining Wall	1	LS	\$	\$

TOTAL OF ALL EXTENDED UNIT PRICE ITEMS LISTED ABOVE

\$ _____
(Total, numbers)

Dollars

Total, words (transfer to bid form, page 3)

END OF SECTION



- D. Storm Pipe CCTV: Contractor shall perform pre-construction and post-construction CCTV inspections of the storm piping along Morgan Street from E. Depot Avenue to E. Jackson Avenue (see part C above). Contractor to provide copies of the pre-construction and post-construction CCTV inspection reports for COK review. Any storm pipe defects caused by water line installations adjacent to existing storm sewers shall be repaired/replaced by the Contractor at no additional cost to the project.
- E. It is anticipated that some portion of the project will require spoils to be disposed as special waste, including rail cross-ties that will require disposal at Chestnut Ridge Landfill. See Spec 02321A
- F. Special Waste must be received by 2:00PM EST each day at the Chestnut Ridge Landfill, and Contractor will not be responsible for Tipping Fees.
- G. The 'Temporary Stockpiles' guidance will be applicable should any spoils or cross-ties need to be stockpiled.
- H. KUB will notify Contractor when ARAP has been executed, to perform the Creek Crossing work.
- I. Easement documents (including their special work conditions) are included in the project manual.
- J. KUB will notify Contractor when Norfolk Southern railroad permits have been executed.
- K. All 36" Ductile Iron Pipe and fittings shall be restrained equal to American Flex-Ring or U.S. Pipe TR Flex. A laying schedule shall be provided with the 36" Ductile Iron Pipe.

PART 2. PRODUCTS

- A. CONTRACTOR shall provide submittals for approval that are in accordance with Section 00700, included in the Project Manual.

PART 3. EXECUTION

NOT USED

END OF SECTION

Pay Item No(s). 3000h-j – Restrained Joint Gaskets are per each unit price pay items. The Unit price for this item shall be for restrained joint gaskets, expressed for each pipe size, that are required as joint thrust restraint adjacent to fittings as designated by the Thrust Restraint Tables in the Project Details. The cost for thrust restraint for fittings shall be included in the unit price for the pipe under a separate item.

Pay Item No(s). 3005a - Water Main Bore are linear foot unit price pay items. The quantities of pipe in place for which payment will be allowed shall be expressed in linear feet of water line in terms of the length of pipe installed in place as measured along the centerline of the alignment with no deductions for valves or fittings. Such payment shall be full compensation for the furnishing and installing of water pipe, fittings, pipe bedding, excavation, backfill per Section 02321, tracer wire, reaction blocking, surface restoration, excavating bore pits, backfill and compaction of bore pits, resurfacing of asphalt, resurfacing of lawns (seed or sod), and all other work necessary for and incidental to completion of the work. Fitting required to join new pipes are included in this line item.
CONTRACTOR will furnish all water line materials required for the water line installation. See Spec 02445A

Pay Item No. 3010a - Water Valve Installation are per each unit price pay items. Unit price bids for each shall be full compensation for these items and for all labor, materials including crushed stone bedding, valve boxes, pipe, thrust blocking, backfill, surface restoration as required, and necessary equipment required to complete the item in accordance with the Drawings and Specifications. See Section 02514 Water Lines – Valves and Section 02951 36-Inch Butterfly Valves. The CONTRACTOR will furnish all water line materials required for the water valve installation.

Pay Item No(s). 3010b - Water Valve Installation are per each unit price pay items. Unit price bids for each shall be full compensation for these items and for all labor, materials including crushed stone bedding, valve boxes, pipe, thrust blocking, backfill, surface restoration as required, and necessary equipment required to complete the item in accordance with the Drawings and Specifications. See Section 02514 Water Lines – Valves. **The CONTRACTOR will furnish all water line materials required for the water valve installation.**

Pay Item No(s). 3015a-e - Air Valves, Blowoff Valves, (As Directed by OWNER) are per each unit price pay items. Unit prices bids for each shall be full compensation for these items and for all labor, materials including crushed stone bedding, valve boxes, pipe, thrust blocking, backfill, surface restoration as required, and necessary equipment required to complete the item in accordance with the

Drawings and Specifications. See Section 02512 Water Lines - Air Valves, Blowoffs and Hydrants. **The CONTRACTOR will furnish all water line materials required for the air valves, blowoff valves and hydrant installations. Also, See Welded-on Outlets supplemental information sheets.**

Pay Item No. 3015d – 6” Flushing Connection Assembly are per each unit price pay items. Unit prices for each assembly shall be full compensation for these items and for all labor, materials including crushed stone bedding, 36”x6” welded tee, 6” gate valve and box, up to 30 linear feet of 6” pipe, fittings, blind flange, thrust blocking, backfill, surface restoration as required, and necessary equipment required to complete the item in accordance with the Drawings and Specifications. Additional 6” pipe, if required beyond the 30 linear feet, shall be covered under pay item 30251.

Pay Item No(s). 3015e & f – Flow Meter Vaults are per each unit price pay items. Unit price shall be expressed in terms of main line pipe size. Items include, clearing and grubbing, excavation, base, precast sections, concrete riser rings, gaskets, steps, cast-in or core drilled pipe openings, necessary pipe and pipe fittings, grout, frame, hinged manhole cover, and 1”tap connection to the main as depicted in project drawings or as designated by Owner. See Section 02530, Manholes and Section 02950 Flow Meter Vault and Assembly. **The CONTRACTOR will furnish all materials required for the vault and tap.**

Pay Item No. 3020a-g - Tie-ins to Existing Facilities is a per each unit price pay item when called out specifically on the bid form and is for all water tie-ins at each designated location. The unit price amount includes all taps, saddles, corporation stops, tees, fittings, sleeves, bends, and appurtenances needed for tie-ins, except for the valves that will be paid for at unit prices. Other connections shown on the drawings are considered incidental to the work and are not pay items. See Section 02515 Water Lines – Tie-Ins. **The CONTRACTOR will furnish all water line materials required for the water main tie-ins.**

Pay Item No(s). 3025 a-d - Service Connections (Reconnection at main and meter) are per each unit price pay items. Unit prices bid for each shall be full compensation for this item and for all labor, materials including crushed stone bedding, backfill as required and necessary equipment required to complete the item in accordance with the Drawings and Specifications. Unit price item will include the service tap connection to the main and the reconnection of the service pipe to the meter assembly. Contractor shall be responsible for coordinating and compensating the work of the Licensed Plumber on private property as needed to make the connection to the existing water service line. Contractor shall coordinate and ensure proper communication between Property Owner, Licensed Plumber, and Owner. Contractor shall be responsible for any damages that may result from the work on private property. Unit price for this pay item will include any asphalt pavement repair for service pipes less in 4-inches diameter. Asphalt pavement

repair will be paid separately for 4-inch diameter water service connections and larger. **The CONTRACTOR will furnish all water line materials required for the water service connections to the main and meter.**

Pay Item No(s). 3025e & f – Meter well and lid, meter horn, and associated fittings are per each unit price pay items. Unit prices bid for each shall be full compensation for this item and for all labor, materials including crushed stone bedding, backfill as required and necessary equipment required to complete the item in accordance with the Drawings and Specifications. Meter Assemblies will be relocated to the edge of the proposed easement and replaced as identified by the Owner. Water Meter Assembly Replacement(s) shall be installed in accordance to Specifications Section 02518. Complete **asphalt repair** meter assembly replacement shall be approved by project manager and paid according to unit pricing on bid form. Contractor shall be responsible for coordinating and compensating the work of the Licensed Plumber on private property. Contractor shall coordinate and ensure proper communication between Property Owner, Licensed Plumber, and Owner. Contractor shall be responsible for any damages that may result from the work on private property. **The CONTRACTOR will furnish all water line materials required.**

Pay Item No(s). 3025 g-1 – Service Pipe are linear foot unit price pay items. Unit prices bid for each shall be full compensation for this item and for all labor, materials including crushed stone bedding, backfill as required and necessary equipment required to complete the item in accordance with the Drawings and Specifications. Long Side Service Relays are required to be relayed via trenchless technology with three attempts. If after three attempts contractor is unsuccessful pavement must be saw cut. Additionally, complete asphalt repair for service pipe installation is included as part of this bid item, for water services smaller than 4-inch diameter. Asphalt repair will be paid separately for 4-inch diameter water service connections and larger. Contractor shall be responsible for coordinating and compensating the work of the Licensed Plumber on private property. Contractor shall coordinate and ensure proper communication between Property Owner, Licensed Plumber, and Owner. Contractor shall be responsible for any damages that may result from the work on private property.

Pay Item No. 3030a - Retire Existing Water Facilities – Abandon Existing Mains is a lump sum price pay item. Each item abandoned per Sections 02512 and 02513. Water Mains will be abandoned generally by three techniques. Existing taps with corporations will be abandoned at the corporation stop. Mechanical tees will be plugged at the tee, and leadite joints will be completely removed and replaced with solid sleeves. Payment is for all labor, materials, asphalt repair and equipment required completing the item, which shall include all items that are incidental to proper abandoning existing facilities.

Pay Item No. 3030b - Retire Existing Water Facilities - Abandon Existing Water Valves, Air Valves, Blowoff Assemblies & Fire Hydrants is a per each unit price pay item. Each item abandoned per Sections 02512 and 02513. Water Mains will be abandoned generally by three techniques. Existing taps with corporations will be abandoned at the corporation stop. Mechanical tees will be plugged at the tee, and leadite joints will be completely removed and replaced with solid sleeves. Payment is for all labor, materials, asphalt repair and equipment required completing the item, which shall include all items that are incidental to proper abandoning existing facilities.

Pay Item No. 4050a – Creek Crossing in accordance with ARAP including surface/bank restoration & stabilization, and environmental protection of waterway is a pay item based on lump sum for designated location from the edges of the creek banks. Any additional footages will be paid in accordance with Pay Item 3000 of this Measurement and Payment Section.

Pay item 6005a-d, f & g - Pavement Repair (Installed by Contractor): Permanent Patching, Base Course (As Directed by Owner) is a linear foot unit price pay item. Unit price item includes excavation of temporary pavement repair, excavation of stone base as needed, material (Base Grade B or B-M and Surface Course Grade D), compaction, cleanup, striping (if needed), milling (as directed), and straight line truing of existing surface as needed. See KUB Standards Section 02321 General Excavation, Bedding and Backfill for Utilities; Section 02740 Pavement Repair; and Section 1740 Surface Restoration Special Provisions. Pay item 6005a shall be paid exclusive of Pay Item Nos. 6005b and 6005c and shall not be priced in combination with pay items 6005b or 6005c for any area(s) of work (payment for any given unit of measure shall be made for either Item Nos. 6005a, 6005b, or 6005c). Payment for this unit price item will be made based on the length of trenches, to the limits of excavation, including manhole excavations, as specified in the bid documents OR as approved in writing by OWNER.

Pay item 6005e - Pavement Repair (Installed by Contractor): Permanent Patching, Base Course + Surface Course (As Directed by Owner) is a linear foot unit price pay item. Unit price item includes excavation of temporary pavement repair, excavation of stone base as needed, material (Base Grade B or B-M and Surface Course Grade D), compaction, cleanup, striping (if needed), milling (as directed), and straight line truing of existing surface as needed. See KUB Standards Section 02321 General Excavation, Bedding and Backfill for Utilities; Section 02740 Pavement Repair; and Section 1740 Surface Restoration Special Provisions. Pay item 6005a shall be paid exclusive of Pay Item Nos. 6005b and 6005c and shall not be priced in combination with pay items 6005b or 6005c for any area(s) of work (payment for any given unit of measure shall be made for either Item Nos. 6005a, 6005b, or 6005c). Payment for this unit price item will be made based on the length of trenches, to the limits of excavation,

including manhole excavations, as specified in the bid documents OR as approved in writing by OWNER.

Pay Item No(s). 6010a & b - Removal and Replacement are linear foot unit price pay items. Unit price items include excavation, removal and disposal of material, replacement material to duplicate material type and specification, depth, width, and length of removed materials, cleanup, and 30 days of maintenance. Compensation will be per linear foot of repair for Owner approved areas surrounding the work. See Section 02321, Excavation, Bedding, and Backfill for Utilities, Section 02770, Concrete for Utilities and Concrete Pavement Construction, and Section 02740, Pavement Repair.

Pay Item No(s). 6010c - Removal and Replacement are square yard unit price pay items. Unit price items include excavation, removal and disposal of material, replacement material to duplicate material type and specification, depth, width, and length of removed materials, cleanup, and 30 days of maintenance. Compensation will be by square yard of repair for Owner approved areas surrounding the work. See Section 02321, Excavation, Bedding, and Backfill for Utilities, Section 02770, Concrete for Utilities and Concrete Pavement Construction, and Section 02740, Pavement Repair.

Pay Item No. 6010d - Tactile Warning Strip is a per each unit price pay item. Unit price item includes replacement of existing tactile warning strip, where required, when removal and replacement of existing sidewalks are necessary for water main installation. Tactile Warning Strip shall be installed in strict accordance with City of Knoxville requirements and specifications.

Pay Item No. 6025 - Seeding is a square yard unit price pay item. Unit price item includes topsoil, reseeding per property owner's preference and as directed by the Resident Project Representative to match existing condition, maintenance for 60 days or until re-established; maintenance includes water, fertilizer, and mowing. Re-establish at no additional compensation. See Section 02920, Seeding.

Pay Item No. 6040 - Riprap is a per ton unit price pay item. Unit price item includes geotextile, base, and riprap material, placement and cleanup. See Section 02372, Geotextiles and Section 02371, Riprap.

Pay Item No. 6045 – Cleanup Restoration & Closeout is a lump sum pay item. Lump sum price bid for site restoration, lawn repair, landscape repair, etc., shall be full compensation for this item and for all labor, materials, water and equipment required to complete the restoration to its original or better condition. Payments for this lump sum item will be made based on percentage of work complete for the entire project. **It is highly recommended that the**

CONTRACTOR photograph existing conditions at the Site prior to commencing with the Work.

Pay Item 7000 – Hauling of Special Waste to Chestnut Ridge Landfill is a per ton unit price pay item. Unit Price item includes removal of special waste and transport/disposal at the Chestnut Ridge Landfill. KUB will be responsible for the special waste permit. Special waste is defined as follows:

- A. Soil removed from trenching operations that contain levels of contaminants such that the material is not suitable to place back into the trench;
- B. Railroad Ties

Pay Item 7010 – CCTV Inspection of 36” Water Main is a linear foot unit price pay item. Unit Price item includes remote TV inspection of the new 36” water transmission main to be performed prior to testing. The price shall include furnishing all labor, materials and equipment required to complete TV inspections including: inspection of the water mains by remote closed circuit TV methods, preparation of the video (with voice descriptions) and written logs of the inspections, set-up and take-down of equipment and repair of any damage caused by the Contractors activities. See Section 02513A, Water Lines – Supplemental, Part 3.1, O.

Pay Item No. 7011 – Retaining Wall is a lump sum pay item. Lump sum price includes removal of existing fence/temporary fencing (as required), excavation, subgrade preparation (as required), bedding, backfill, concrete footing, concrete wall, reinforcing steel, footing drain, weep holes, handrail, surface restoration, fencing replacement, and all other items as necessary for a complete and functional retaining wall in accordance with the Structural Drawings.

END OF SECTION



SECTION 02445A
AUGER BORING AND ALTERNATIVE TUNNELING
SUPPLEMENTAL

PART 1 GENERAL

1.01 DESCRIPTION

- A. The Work to be performed herein shall consist of the installation of a casing pipe for the purpose of installing a carrier pipe as shown on the drawings or as called for in these specifications. It shall include the excavation of a boring pit, auger boring between the points specified on the drawings, or as directed by the OWNER, installation of the carrier pipe, and disposing of the excavated materials in the manner herein provided.

1.02 DESIGN CRITERIA

- A. Design boring and receiving pits, excavation support systems to withstand lateral earth pressures, ground loads, unrelieved hydrostatic pressures, bottom heave, equipment loads, applicable traffic and construction loads, and other surcharge loads to allow safe construction of boring and receiving pits without appreciable movement or settlement of ground, and to prevent damage to or movement of adjacent structures, streets, utilities and trees.
- B. Design excavation support systems and casing installation equipment to be compatible with geologic conditions described in the Geotechnical Report.

1.03 SUBMITTALS

- A. Action Submittals
 1. Casing pipe material including the standard to which it is manufactured, outside diameter, wall thickness, and joint configuration.
 2. Details of casing spacers, including manufacturer's recommended spacing.
 3. Details of end seals.
 4. Boring and jacking plan.
 5. Means and method of dewatering.

1.04 QUALIFICATIONS

- A. Bore and jack operations shall be performed by a CONTRACTOR or Subcontractor with at least 5 years of experience involving work of a similar nature



PART 2 PRODUCTS

2.01 CASING PIPE

- A. The casing pipe shall be steel meeting the latest approved American Railway Engineering Association "Specifications for Pipelines for Carrying Flammable and Nonflammable Substances."
- B. Unless otherwise required by the agency having jurisdiction, the steel casing pipe shall have a minimum yield strength of 35,000 psi and shall have the minimum wall thickness shown in the following table:

TABLE OF MINIMUM WALL THICKNESS FOR STEEL CASING PIPE FOR E72 LOADING

<u>CARRIER PIPE</u>	<u>CASING PIPE</u>	<u>NOMINAL THICKNESS</u>
2	6	0.344 inch
4	8	0.344 inch
6	12	0.344 inch
8	16	0.375 inch
10	20	0.407 inch
12	24	0.469 inch
14	27	0.505 inch
16	30	0.505 inch
18	30	0.505 inch
20	36	0.595 inch
24	36	0.595 inch
36	48	0.688 inch

- C. The thickness listed above pertains to when the casing pipe is installed without benefit of a protective coating.
- D. Where a steel casing is being installed under an existing railroad, the casing pipe wall thickness as required by the railroad permit/agreement may be greater than what is shown in the Table above.

2.02 CARRIER PIPE

- A. The carrier pipe shall be the same material as the pipeline unless otherwise directed by the OWNER.
- B. All carrier pipes shall be restrained joint in the casing.



2.03 GROUTHOLES

- A. Furnish casing pipe with 2-inch diameter preformed grout holes at centerline and crown for pressure grouting. Spacing of grout holes shall not exceed 5 feet.

2.04 GROUT FOR FILLING VOIDS OUTSIDE CASING

- A. Neat cement grout with a minimum compressive strength of 500 psi.

2.05 FILL MATERIAL FOR ANNULAR SPACE BETWEEN CASING PIPE AND CARRIER PIPE

- A. Fill material is not required in the annular space. CONTRACTOR shall provide plastic chocks to minimize annular space between casing and fabricated casing spacer device.

2.06 CASING SPACERS

A. Fabrication:

1. Polyethylene spacers shall be used on pipe up to 12-inch diameter. For larger pipes, spacers shall be carbon steel or stainless steel and include a PVC or neoprene liner.
2. Spacer Band Material: Carbon steel coated with fusion bonded epoxy or Type 304 stainless steel.
3. Spacer Width: As recommended by spacer manufacturer for the specific application.
4. Spacer Runners:
 - a. Suitable for supporting the weight of carrier pipe.
 - b. Manufactured of material having a low coefficient of friction and designed to support the carrier pipe without damage or excessive wear.
5. Size: Sufficient to provide a minimum clearance of 2 inches between outside of carrier pipe bells or couplings and inside of casing.

B. Manufacturers:

1. Pipeline Seal and Insulator, Inc. (PSI), Houston, TX.
2. Advance Products and Systems, Inc., Lafayette, LA.
3. Cascade Waterworks Mfg. Co., Yorkville, IL.

2.07 CASING END SEALS

- A. Synthetic rubber, conical shape, pull-on or wrap-around style with Type 304 stainless steel bands.

B. Manufacturers:

1. Pipeline Seal and Insulator, Inc. (PSI), Houston, TX.
2. Advance Products and Systems, Inc., Lafayette, LA.
3. Cascade Waterworks Mfg. Co., Yorkville, IL.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Confirm location of all known existing utilities prior to start of jacking/receiving pit excavation and pipe installation.
- B. The OWNER will provide the necessary control points required by the CONTRACTOR for this construction. The CONTRACTOR shall provide the detailed layout required to keep the tunnel or bore on grade.

3.02 SHAFT/PIT INSTALLATION

- A. Notify OWNER not less than 15 working days before beginning shaft excavation.
- B. Methods of construction for jacking/receiving pits shall be such as to ensure the safety of the Work, CONTRACTOR's employees, the public, existing utilities, and adjacent property and improvements, whether public or private.
- C. Before beginning construction of jacking/receiving pit, adequately protect existing structures, utilities, trees, shrubs, and other existing facilities.
- D. Provide complete groundwater control for excavations at all time.
- E. Perform jacking/receiving pit excavations using appropriate excavation or large hole drilling methods, as required.
- F. Place fencing, gates, lights, and signs, as necessary around shafts and staging areas to provide for public safety.
- G. Inspect shaft/pit excavations daily to check safety of excavation and structural integrity of support system.

3.03 EQUIPMENT SELECTION

- A. Select necessary equipment and methods to install casing and carrier pipe as shown on Drawings. Selected equipment shall be capable of accurate alignment and grade control, and shall protect against subsidence or other disturbance of ground, existing utilities, existing road surface, railroad facilities and existing structures.



3.04 LUBRICATION OF CASING EXTERIOR

- A. Bentonite slurry may be used to lubricate exterior of casing during installation.

3.05 BORING

- A. The boring shall be accomplished by means of auguring to the size, line, and grade shown on the Drawings or as directed by OWNER. The hole diameter shall be essentially the same as the outside diameter of the casing pipe.

3.06 INSTALLATION OF CASING PIPE

- A. Verify casing pipe minimum wall thickness is adequate for anticipated jacking loads.
- B. Hole diameter shall not exceed outside diameter of casing pipe by more than 1 inch.
- C. Where unstable soil conditions are found to exist, conduct boring operations in a manner that will not be detrimental to facility being crossed.
- D. Tolerance shall be as follows:
 - 1. Line Tolerance: 2 inches, maximum.
 - 2. Grade Tolerance: 2 inches, maximum.
- E. Provide means of checking line and grade at all times to confirm allowable tolerance has been achieved.
- F. Provide means of steering casing to ensure allowable tolerance can be achieved.
- G. Jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide watertight joints by operators qualified in accordance with the American Welding Society Standard Procedures.
 - 1. Welds shall be continuous, complete joint penetration (CJP) butt joint welds as required for rigid and watertight connections.
- H. Do not remove unacceptable casing without prior approval from OWNER. If the removal of casing pipe is permitted, make proper provisions to prevent caving in of the earth surrounding the casing.



- I. If necessary to abandon a bored hole, remedial measures shall be taken by CONTRACTOR, subject to review by OWNER of facility being crossed.

3.07 CORRECTION OF GRADE

- A. If required grade tolerance has not been achieved, correct grade using casing spacers of varying height.

3.08 MONITORING OF SURFACE MOVEMENT

- A. Perform a preconstruction survey of road surface or railroad tracks. Record horizontal coordinates and elevations. Mark location of where measurements were taken. Monitor movement of road surface or railroad tracks on a daily basis and provide results to OWNER. Stop operations if movement exceeds 1/4 inch and immediately notify the OWNER.

3.09 GROUTING BORED AND JACKED CASINGS

- A. Exterior Voids:
 1. After casing has been jacked into position, pressure grout through grout holes provided to fill voids outside of casing.
 2. Start grouting at centerline hole at one end and pump grout until grout appears in grout hole at the crown, then start grouting through opposite spring line hole until grout appears at hole in crown.
 3. Grout through hole at crown until grout appears in next set of holes along casing.
 4. Plug holes at starting point and move to next set of holes and repeat grouting sequence until full length of casing has been grouted.

3.10 INSTALLATION OF CARRIER PIPE (See Figure 1-02445-a)

- A. Entire length of casing shall be installed complete and inspected and approved by OWNER before any carrier pipe is placed therein. Repair defects in casing pipe or leakage at joints.
- B. Install a minimum of three casing spacers to each length of carrier pipe in such a manner that electrical continuity will not occur between casing pipe and carrier pipe. Spans between spacers shall be as shown on Drawings or as directed by the OWNER.
- C. Check each joint makeup and pipe segment prior to pushing carrier pipe segments into casing.

- D. When the carrier pipe is a ductile iron or PVC pressure pipe install restrained joint pipe or mechanical joint with restrainers, unless otherwise directed by OWNER.
- E. Casing end seals shall be provided at the end of the casing pipe after installation of the carrier pipe.

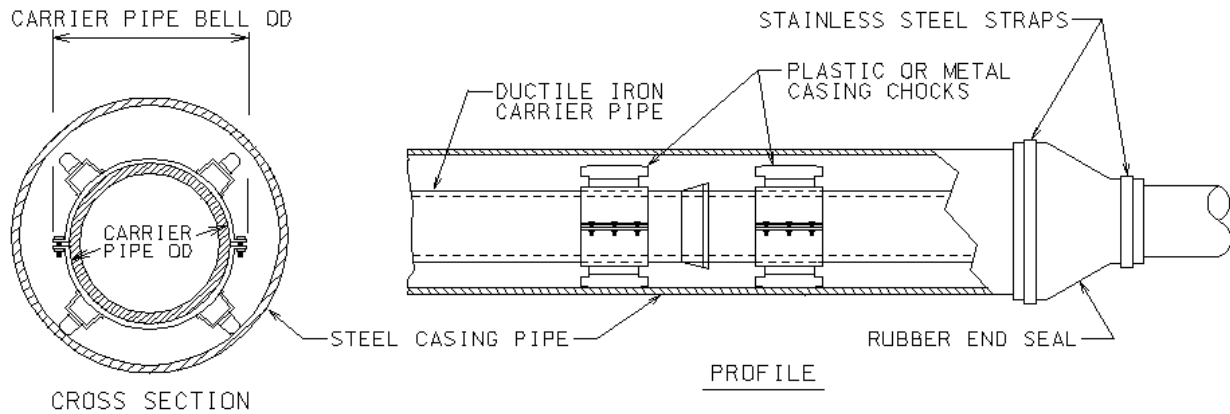


Figure 1-02445-a (Standard Carrier/Casing Pipe Details for Water and Sanitary Sewer Lines)

Notes:

- I. Casing spacers to be spaced as directed by OWNER or shown on the drawings.
- II. Plastic or stainless casing spacers shall be a minimum of 4" long or as directed by OWNER.
- III. OWNER will direct whether the casing spacers will be standard, center, or bottom restrained.

3.11 CASING PIPE AND CARRIER PIPE ANNULAR SPACE

- A. The annular space shall be left empty.

3.12 REMOVAL OF JACKING/RECEIVING PIT SUPPORT SYSTEM

- A. Remove support elements, except those required by OWNER to remain in place, from excavation in upper five (5) feet below ground surface. In addition, remove support elements as needed to install the pipeline.
- B. Removal of support system shall be performed in a manner that will not disturb or harm adjacent construction or facilities.
- C. Fill voids created by removal of support system with clean sand as approved by OWNER.



3.13 BACKFILLING OF JACKING/RECEIVING PIT

- A. Seal jacking/receiving pit opening and backfill at shafts when no longer required.
- B. Backfill shall be as specified in Section 02321, Excavation, Bedding, and Backfill for Utilities.

3.14 GUARANTEE OF WORK

- A. Guarantee a usable completed casing between the points specified and to the line and grade specified. The allowable tolerance at the downstream end point of the bore shall be such that the invert of the carrier pipe may be positioned within a vertical area limited on the top by an elevation no higher than the elevation shown on the drawings and on the bottom by an elevation no lower than the existing inlet pipe invert. For sewers, the sides shall be a minimum of 8 inches inside the interior face of the manhole at the end of the bore.
- B. The allowable tolerance at the upstream end point of the bore shall be such that the invert of the carrier pipe may be positioned at the elevation shown on the drawings.

3.15 TUNNELING ALTERNATIVE

- A. In the event boring and jacking is impossible because of pipe size rock, or other factors as determined by the OWNER, and the highway department or railroad will not permit open cutting, make crossings by tunneling using liner plates. Conduct tunneling operations as approved by the OWNER and the agency having jurisdiction of the facilities. If voids are caused by the tunneling operations, fill by pressure grouting or by other approved methods that will provide proper support.
- B. After the tunnel liner plates are formed to shape, the plates shall be galvanized on both sides by the hot dip process. A coating of prime western zinc, or equal, shall be applied at the rate of not less than 2 ounces per square foot of double exposed surface. If the average spelter coating as determined from the required samples is less than the amount specified above, or if any one specimen shows a deficiency of 0.2 ounce, the lot shall be rejected. Spelter coating shall be first class commercial quality, free from injurious defects such as blisters, flux, and uncoated spots.
- C. The inside and outside of the plates shall be given a bituminous coating meeting the AASHO M-190 Specifications for bituminous protected corrugated metal pipe.

- D. Construct the tunnel and completely line on the inside with structural steel liner plates meeting all requirements specified herein. The dimensions, of the tunnel, shall be as shown on the drawings or as specified by the OWNER.
- E. The tunneling operation is to commence from a pit no larger than required, and sheeted and shored, if necessary. The CONTRACTOR shall furnish line and grade stakes.
- F. All excavation, for the entire length of the tunnel, shall be done by tunneling, and the work may be done from either end, but not both. Trim the periphery of the tunnel smooth to fit the outside of the steel liner plate as nearly as is practical, and fill all space outside of the steel liner plate with a sand-cement grout mixture.
- G. Install the steel liner plates immediately after the excavated material has been removed. Do not remove material more than 24 inches ahead of the installed liner plates.
- H. Provide all necessary bracing, bulkheads, and/or shields to ensure complete safety to traffic at all times during the progress or the work. Perform the work in such a manner as to not interfere with normal traffic over the work.
- I. The steel lining shall consist of plates 16 or 18 inches wide, and each circumferential ring shall be composed of the number and length of plates necessary to complete the required diameter.
- J. The inside diameter of the completed ring shall be as shown on the drawings or as specified by the OWNER, and no part of the plate or reinforcing ribs will be allowed to extend inside this net diameter.
- K. The strength of the tunnel lining will be determined by its section modulus. In no case shall it be less than 0.0590 inch cubed per inch of plate width based on the average for one ring of plates. Thickness of the metal for these steel plates shall be not less than 10 gauge, allowing for standard mill tolerances. The tunnel strength shall be equal to AASHO railroad E80 loading at the appropriate depth of cover.
- L. All plates shall be punched for bolting on both longitudinal and circumferential seams and shall be fabricated so as to permit complete erection from the inside of the tunnel. The longitudinal seam shall be of the lap type with an offset equal to the gauge of metal for the full width of the plate, including flanges, and shall have staggered bolt construction fabricated to allow the cross section of the plate to be continuous through the seam. All plates shall be of uniform fabrication, and those intended for one size tunnel shall be interchangeable.

- M. The material used for the construction of these plates shall be new and unused and suitable for the purpose intended. Workmanship shall be first class in every respect.
- N. Pour a 6- inch carrier pad to grade using a grout mixture prior to carrier pipe.
- O. Install the carrier pipe to the line and grade shown on the drawings or as specified by the OWNER. After the carrier pipe is installed adequately, place support and securing jacks at a longitudinal distance not to exceed 8 feet as shown on the Standard Drawing herein. Block the carrier pipe and backfill the space between the carrier pipe and the tunnel liner with sand by a method approved by the OWNER. The CONTRACTOR shall be responsible for securing an adequate water supply for the installation of the sand.
- P. The tunnel shall be grouted every 10 feet or every five consecutive calendar days (including weekends and holidays), whichever comes first, or at more frequent intervals as determined by the OWNER. This grout shall include filling all voids outside of the liner plates with a sand-cement grout mixture to prevent settlement.

END OF SECTION



Bhate Geosciences Corporation

Geotechnical, Materials Environmental Engineers
5217 5th Avenue South
Birmingham, Alabama 35212
Phone: (205) 591-7062
Fax: (205) 591-7184
Web: <http://www.bhate-geo.com>

January 26, 2017

Knoxville Utilities Board
4505 Middlebrook Pike
Knoxville, Tennessee 37921

Attention: Mr. Biswa Pokharel, P.E.

Subject: Subsurface Exploration and Boring Logs
Proposed Water and Gas Main
Knoxville, Tennessee
BHATE Project Number: 710101

Dear Mr. Pokharel:

As authorized, Bhate Geosciences Corporation (BHATE) has completed the subsurface borings at the specified locations of the subject project site. We conducted a total of two (2) soil test borings in the area of two railroad crossings within the proposed pipe alignment. The boring locations were identified in the field by Biswa Pokharel, Professional Engineer with the Knoxville Utilities Board. Based on your instructions, our services were provided in accordance with Knoxville Utilities Board Paving Program - Work Authorization #6.

We greatly appreciate the opportunity to work with you on this project. If you have any questions or we may be of further service, please do not hesitate to contact us.

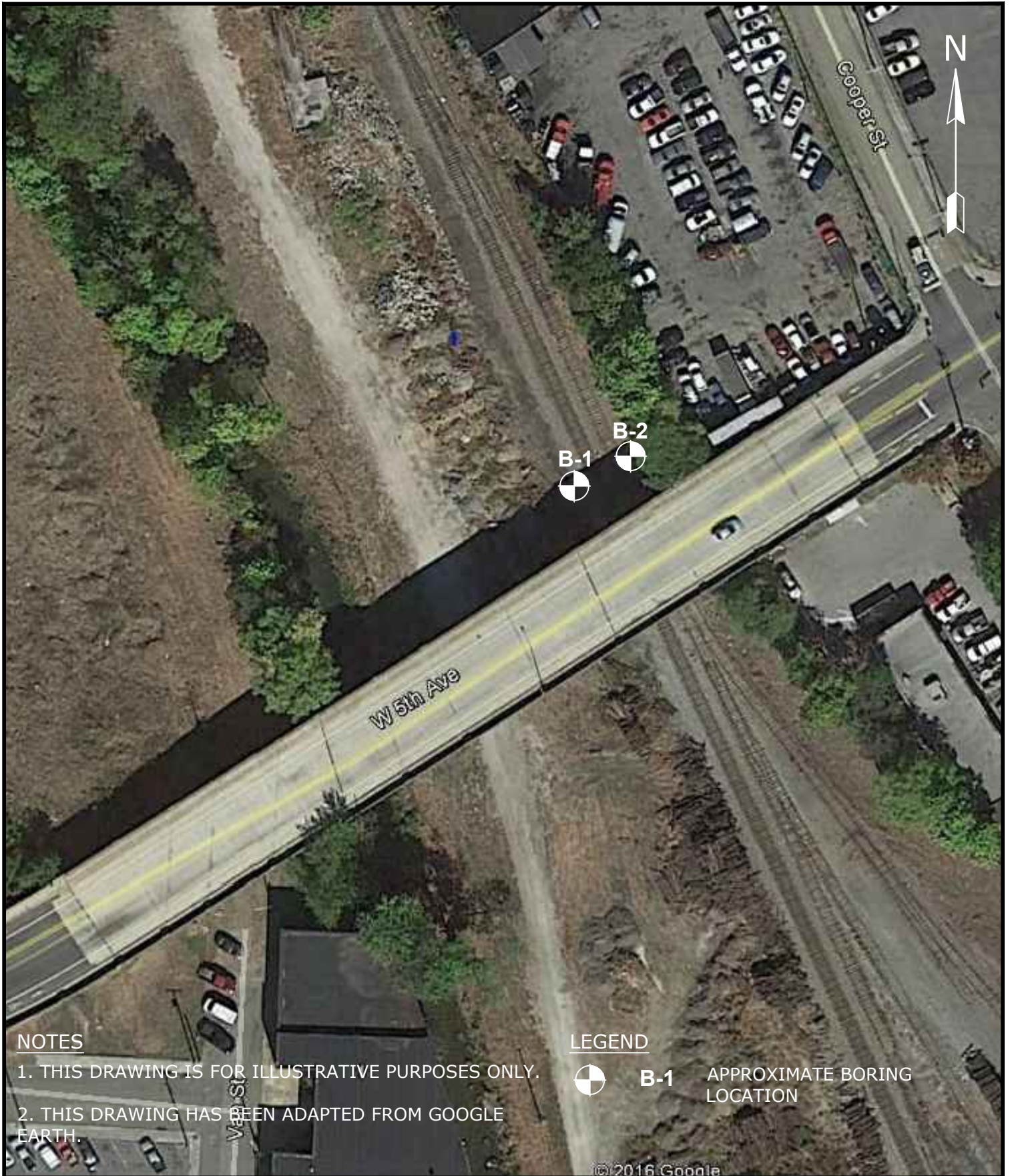
Respectfully submitted,
BHATE GEOSCIENCES CORPORATION

A handwritten signature in black ink that reads 'Luke Cassidy'.

Luke Cassidy, E.I.
Staff Professional

A handwritten signature in black ink that reads 'Uday R. Bhate'.

Uday R. Bhate, P.E.
Senior Principal




NOTES

1. THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY.
2. THIS DRAWING HAS BEEN ADAPTED FROM GOOGLE EARTH.

LEGEND

-  **B-1** APPROXIMATE BORING LOCATION

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NOT TO SCALE		BORING LOCATION PLAN		 <p>BHATE QUALITY • SERVICE • EXCELLENCE</p> <p>5217 5TH AVENUE SOUTH BIRMINGHAM, ALABAMA 35212 205.591.7062 FAX: 205.591.7184</p>
DATE 1/18/17	DRAWN BY ELC	36" MAIN KNOXVILLE UTILITY BOARD		
PROJECT NO. 710101	FILE NAME BLP_710101.dwg	KNOXVILLE, TENNESSEE		

LOG OF BORING

CONTRACTED WITH: KUB

PROJECT NAME: KUB Paving Program

PROJECT LOCATION: Knoxville, Tennessee

BORING NUMBER: B-1

PROJECT NUMBER: 710101

SHEET 1 OF 1

DATE: 1/17/17

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE DATA									
				NUMBER	TYPE	BLOWS/6"	N-VALUE	MOISTURE (%)	LL (%)	PL (%)	PI (%)	PPqu (tsf)	WATER LEVEL
0	886		Black, sandy BASE material, with soft, brown clay and little gravel (FILL)	1		2-3-3-3	6						Backfilled with Portland Cement
885	2				4-3-2-4	6				2.0			
			Soft, reddish-brown CLAY (RESIDUUM)	3		6-12-37-7	44						
5			Dark red, silty, decomposed MUDSTONE, with soft, reddish-brown clay ...little clay	4		5-15-32-34	66					▽	
			approximate pipe and casing location ...some clay	5		14-12-5-4	9						
10			...little clay	6		4-3-27-50/5	100+				1.75		
			...no clay	7		50/2-x-x-x							
15				8		50/1-x-x-x							
	870		9		50/1-x-x-x								
20	865		Auger refusal at 18 feet										
25	860												
30	855												

Split Spoon

Grab Sample

GNE = Ground Water Not Encountered

▽ = Water Table Encountered

● = Time of Boring

▽ = Delayed Water Table Level

= Hole Cave In Depth

5217 5th Avenue South
Birmingham, Alabama 35212
205-591-7062
205-599-0229

LOG OF BORING

CONTRACTED WITH: KUB

PROJECT NAME: KUB Paving Program

PROJECT LOCATION: Knoxville, Tennessee

BORING NUMBER: B-2

PROJECT NUMBER: 710101

SHEET 1 OF 1

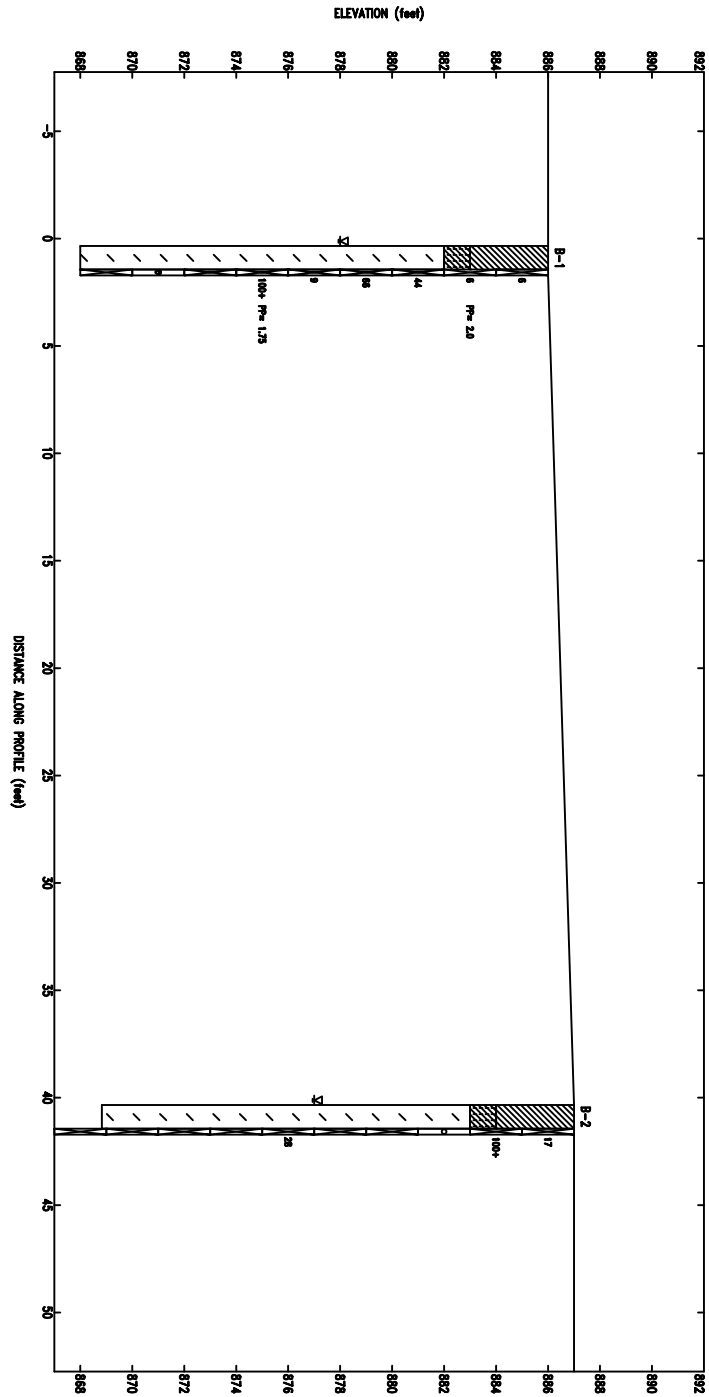
DATE: 1/17/17

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE DATA											
				NUMBER	TYPE	BLOWS/6"	N-VALUE	MOISTURE (%)	LL (%)	PL (%)	PI (%)	PPqu (tsf)	WATER LEVEL	REMARKS	
0	887		Black, sandy BASE material, with soft, brown clay and little gravel	1	⊗	2-3-5-9	17								Backfilled with Portland Cement
	885		(FILL)	2	⊗	10-10 -50/4-x	100+								
			Medium, dark red, silty CLAY, with dark red, silty, decomposed mudstone (RESIDUUM)	3	○	50/2-x-x-x									
5		⊗	Dark red, silty, decomposed MUDSTONE, with soft, reddish-brown clay	4	⊗	50/3-x-x-x									
		⊗	approximate pipe and casing location	5	⊗	50/4-x-x-x									
		⊗	...with little clay	6	⊗	27-22-12 -16	28					▽			
10		⊗	...some clay	7	⊗	50/4-x-x-x									
	875	⊗	...little clay	8	⊗	50/3-x-x-x									
15		⊗		9	⊗	21-50/2-x -x									
	870	⊗		10	⊗	50/2-x-x-x									
20			Boring terminated at 18.17 feet												
	865														
25															
	860														
30															
	855														

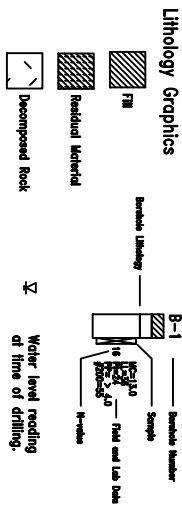
⊗ Split Spoon
○ No Recovery

GNE = Ground Water Not Encountered
▽ = Water Table Encountered
● = Time of Boring
▼ = Delayed Water Table Level
⊗ = Hole Cave In Depth

5217 5th Avenue South
Birmingham, Alabama 35212
205-591-7062
205-599-0229



Explanation:



NOT TO SCALE		BORING PROFILE		<p>BHATE QUALITY • SERVICE • EXCELLENCE</p> <p>5217 5TH AVENUE SOUTH BIRMINGHAM, ALABAMA 35212 205.591.7062 FAX: 205.591.7184</p>
DATE 1/23/17	DRAWN BY ELC	36" MAIN KNOXVILLE UTILITY BOARD		
PROJECT NO. 710101	FILE NAME PROFILE_710101.dwg	KNOXVILLE, TENNESSEE		



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October 19, 2015

Knoxville Utilities Board
4505 Middlebrook Pike
Knoxville, Tennessee 37921

Attn: Mr. Greg Patterson, P.E.

Subject: Subsurface Exploration and Boring Logs
Proposed Depot Avenue
36" Water Transmission Main
Knoxville, Tennessee
BHATE Project Number: 710101

Dear Mr. Patterson:

As authorized, Bhate Geosciences Corporation (BHATE) has completed the subsurface borings at specified locations of the subject project. We conducted a total of four soil test borings in the area of two railroad crossings within the proposed pipe alignment. We are pleased to provide the attached logs of the borings drilled at the subject site. The borings were marked in the field by Fulghum MacIndoe, and Associates. Based on your instructions, our services will be provided under our current work authorization contract with Knoxville Utilities Board.

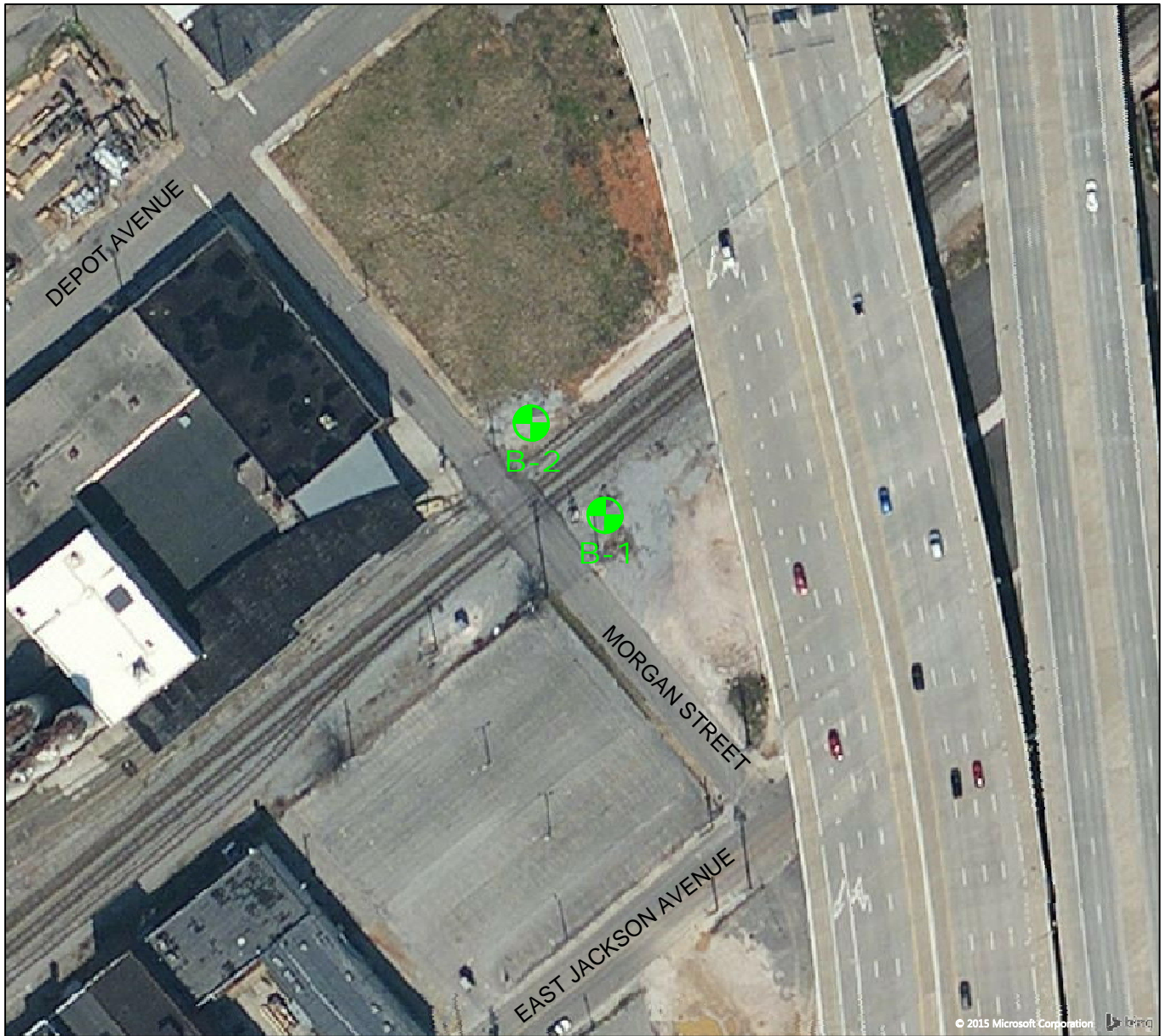
We greatly appreciate the opportunity to work with you on this project. If you have any questions or we may be of further service, please do not hesitate to contact us.

Respectfully submitted,
BHATE GEOSCIENCES CORPORATION

A handwritten signature in black ink, appearing to read 'B. Pokharel'.

Biswa R Pokharel, P.E.
Project Manager





BORING LOCATION MAP

PROJECT NO. 710101	APPROX. SCALE NTS	DATE 10/12/15	DRAWN BY: BP
			FILE NAME:

KUB
Depot Avenue
36" Water Transmission Main
Knoxville, Tennessee

LOG OF BORING

CONTRACTED WITH: Knoxville Utilities Board

PROJECT NAME: KUB Depot Avenue 36" Water Transmission Main

PROJECT LOCATION: Knoxville, Tennessee

BORING NO.: B-1

JOB NO.: 710101

SHEET 1 OF 1

DATE: 10/7/15

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE DATA								REMARKS		
				NUMBER	TYPE	BLOWS/6"	N-VALUE	MOISTURE (%)	LL (%)	PL (%)	PI (%)		PPqu (tsf)	WATER LEVEL
0	896		Medium-dense to loose, dark brown to black SAND, fine to coarse gravel size rock fragments, trace organics (FILL)	1	⊗	6-5-6	11							Due to gravel surface, sampling at the ground surface was not conducted Strata change at 3.5 feet from fill to residual soil
3.5	895		Medium-stiff to stiff, tan, silty CLAY	2	⊗	2-1-3	4							
5				3	⊗	2-3-5	8							
	890			4	⊗	3-4-6	10							
				5	⊗	3-2-3	5							
10			Approximate pipe and casing location	6	⊗	2-2-3	5							
	885			7	⊗	2-3-4	7							
				8	⊗	2-3-4	7							
15			...moist	9	⊗	2-2-2	4							
	880		...trace rock fragments	10	⊗	2-3-4	7							
			Auger refusal at 18 feet	11	⊗	1-1-50/3	50+							
20													GNE	
	875													
25														
	870													
30														
	865													

Split Spoon

GNE = Ground Water Not Encountered

= Water Table Encountered

● Time of Boring

= Delayed Water Table Level

= Hole Cave In Depth

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 Knoxville, TN 37919
 865-584-3243 (Phone)
 865-584-4297 (Fax)

LOG OF BORING

CONTRACTED WITH: Knoxville Utilities Board

PROJECT NAME: KUB Depot Avenue 36" Water Transmission Main

PROJECT LOCATION: Knoxville, Tennessee

BORING NO.: B-2

JOB NO.: 710101

SHEET 1 OF 1

DATE: 10/7/15

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE DATA									
				NUMBER	TYPE	BLOWS/6"	N-VALUE	MOISTURE (%)	LL (%)	PL (%)	PI (%)	PPqu (tsf)	WATER LEVEL
0	897		<p>Medium stiff, reddish-tan to tan, silty CLAY, with little fine to coarse gravel size chert fragments</p> <p style="text-align: right;">(FILL)</p> <p style="color: green; text-align: center;">Approximate pipe and casing location</p> <p>Medium-stiff, tan, silty CLAY</p> <p>Tan to brown ROCK fragments, moist, with sandy clay</p> <p>Auger refusal at 18.5 feet</p>									<p>Due to gravel surface, sampling at the ground surface was not conducted</p> <p>Strata change at 7.5 feet from fill to residual soil</p> <p>*N-Value exaggerated due to the presence of rock fragments</p> <p>Strata change at 13.5 feet from residual soil to decomposed rock</p>	
	895			1	X	2-2-2	4						
				2	X	1-2-2	4						
5				3	X	1-2-3	5						
	890			4	X	1-1-24	25*						
				5	X	2-2-4	6						
10				6	X	2-3-4	7						
	885			7	X	2-2-2	4						
				8	X	1-8-4	12						
15				9	X	50/4-x-x	50+						
				10	X	10-5-26	31						
	880			11	X	1-16-13	29						
		12	X	50/4-x-x	50+					▼			



Split Spoon

GNE = Ground Water Not Encountered

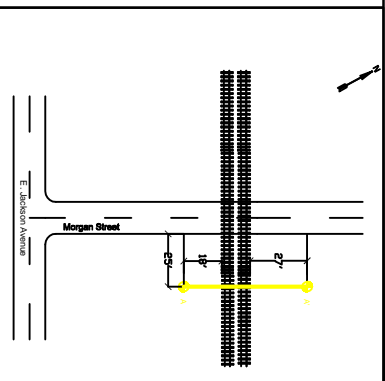
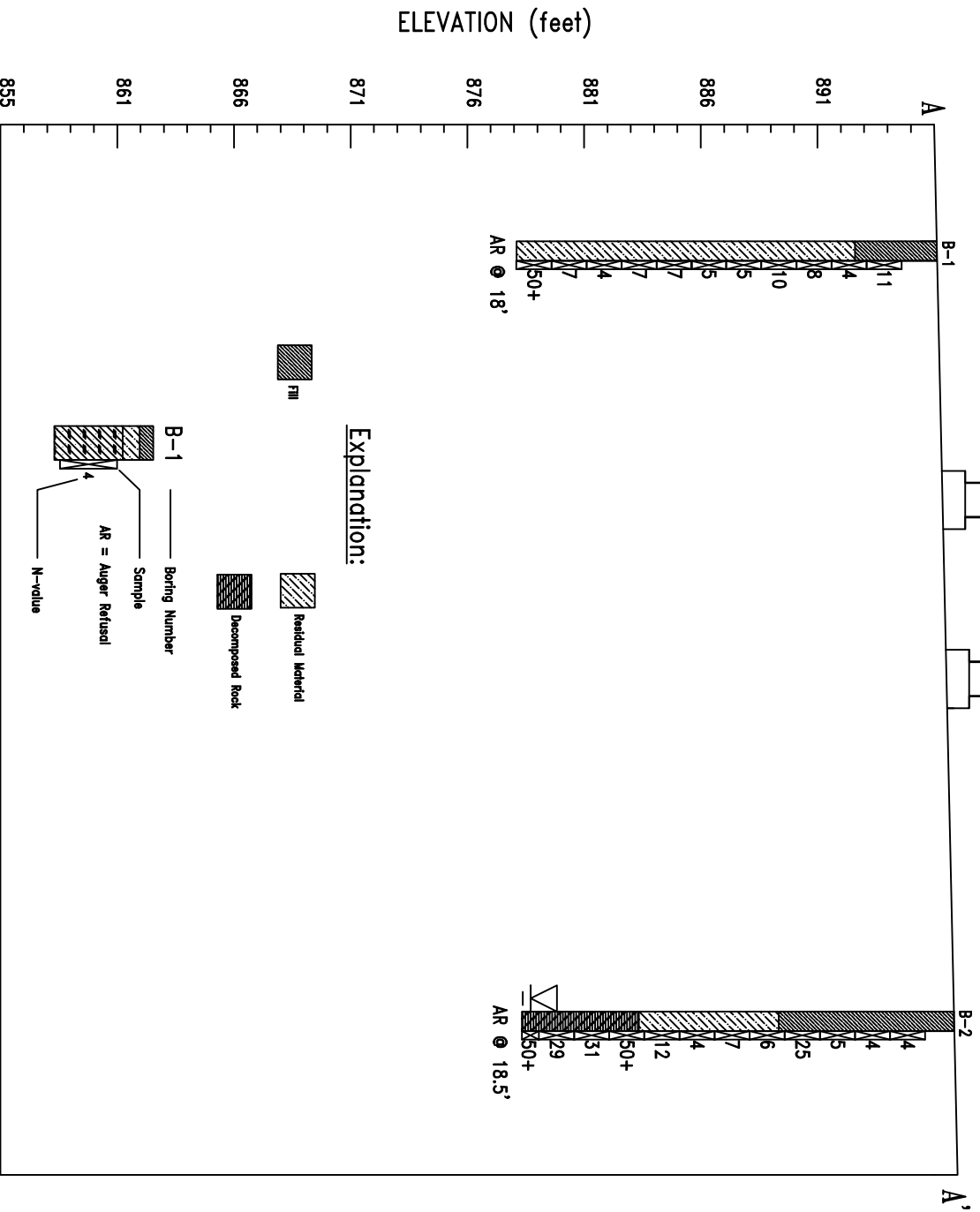
▼ = Water Table Encountered

● = Time of Boring

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KUB Water Services Depot Avenue 36" Water Transmission Main	
A-A'	
Drawn By: Biswa Pokharel	
JOB NUMBER 710101	Date 10-16-15
NTS. This drawing is for illustration purpose only	



BORING LOCATION MAP

PROJECT NO.	APPROX. SCALE	DATE	DRAWN BY: BP
710101	NTS	10/12/15	FILE NAME:

KUB
 Depot Avenue
 36" Water Transmission Main
 Knoxville, Tennessee

LOG OF BORING

CONTRACTED WITH: Knoxville Utilities Board

PROJECT NAME: KUB Depot Avenue 36" Water Transmission Main

PROJECT LOCATION: Knoxville, Tennessee

BORING NO.: B-3

JOB NO.: 710101

SHEET 1 OF 1

DATE: 10/8/15

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE DATA											
				NUMBER	TYPE	BLOWS/6"	N-VALUE	MOISTURE (%)	LL (%)	PL (%)	PI (%)	PPqu (tsf)	WATER LEVEL	REMARKS	
0	886		FILL consisting of organics, debris, clay and rock fragments	1	X	2-3-2	5								Strata change at 2 feet from fill to residual soil
	885		(FILL)	2	X	3-3-6	9								
			Medium-stiff to stiff, brownish-tan, silty CLAY	3	X	2-1-2	3								
5				4	X	1-2-2	4								
	880			5	X	2-2-4	6								
			Approximate pipe and casing location	6	X	1-2-3	5								
10				7	X	2-3-5	8								
	875			8	X	2-2-5	7								
			...with decomposed rock fragments	9	X	5-9-10	19								
				10	X	3-6-9	15								
15				11	X	9-14-18	32					▽			
	870			12	X	7-12-17	29								
				13	X	19-28-30	50+								
20				14	X	21-31-35	50+								
	865		Auger refusal at 21.5 feet												
25															
	860														
30															
	855														

Split Spoon

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LOG OF BORING

CONTRACTED WITH: Knoxville Utilities Board

PROJECT NAME: KUB Depot Avenue 36" Water Transmission Main

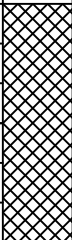
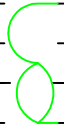
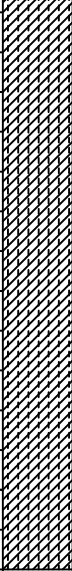
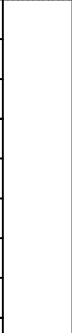
BORING NO.: B-4

SHEET 1 OF 1

PROJECT LOCATION: Knoxville, Tennessee

JOB NO.: 710101

DATE: 10/8/15

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE DATA										
				NUMBER	TYPE	BLOWS/6"	N-VALUE	MOISTURE (%)	LL (%)	PL (%)	PI (%)	PPqu (tsf)	WATER LEVEL	REMARKS
0	883		FILL consisting debris, organics, soft, clay and rock fragments	1	⊗	4-5-4	9							Strata change at 6 feet from fill to residual soil
				2	⊗	4-4-4	8							
	880			3	⊗	1-1-2	3							
5				4	⊗	1-1-1	2						▽	
		(FILL)		5	⊗	0-0-2	2							
		Approximate pipe and casing location 		6	⊗	0-0-2	2							
875		Soft, brownish-tan, silty CLAY, moist		7	⊗	2-2-3	5							
10		Stiff to hard, brownish-tan, silty CLAY, with little decomposed rock		8	⊗	4-7-14	21							
	870			9	⊗	3-7-19	26							
				10	⊗	28-36 -50/4	50+							
15				11	⊗	15-38-48	50+							
				12	⊗	28-41 -50/4	50+							
	865			13	⊗	26-35 -50/4	50+							
20				14	⊗	15-30-45	50+							
				15	⊗	43-50/3-x	50+							
	860			16	⊗	25-42-45	50+							
25				17	⊗	15-16-25	41							
				Boring terminated at 25 feet										
	855													
30														
	850													

 Split Spoon

GNE = Ground Water Not Encountered

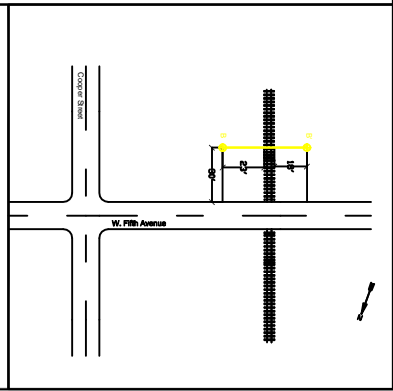
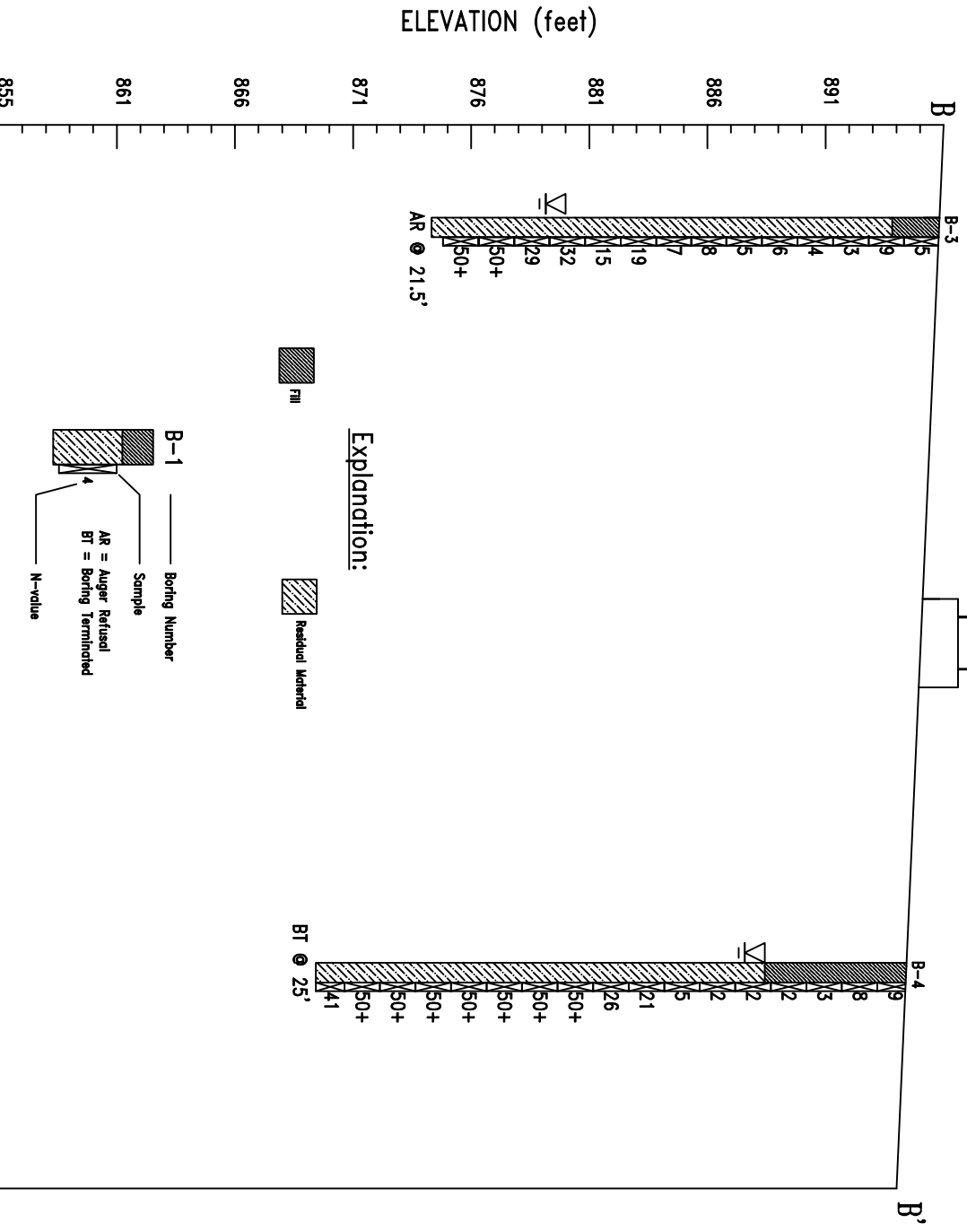
▽ = Water Table Encountered

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KUB Water Services	
Depot Avenue 36" Water Transmission Main	
B-B'	
Drawn By: Biswa Pokharel	
JOB NUMBER	Date
710101	10-16-15
NTS, This drawing is for illustration purpose only.	

PIPE DATA SHEET

	CARRIER PIPE	CASING PIPE
CONTENTS TO BE HANDLED	Water	-
NORMAL OPERATING PRESSURE (for uncased Natural Gas include the MAOP)	120 psi	-
NOMINAL SIZE OF PIPE	36"	48"
OUTSIDE DIAMETER	38.30"	48"
INSIDE DIAMETER	37.18"	46.25"
WALL THICKNESS	0.56"	0.875"
WEIGHT PER FOOT	203.2 lbs/ft	440.80 lbs/ft
MATERIAL	DIP	Steel
PROCESS OF MANUFACTURE	Centrifugally	Control-Rolled
SPECIFICATION	C-151/A121.51	ASTM A-252.2
GRADE OR CLASS (Specified Minimum Yield Strength)	CL 350	35,000 psi
TEST PRESSURE	200 psi	-
TYPE OF JOINT	Mechanical	Welded
TYPE OF COATING	Asphaltic	-
DETAILS OF CATHODIC PROTECTION	-	-
DETAILS OF SEALS OR PROTECTION AT END OF CASING	-	Synthetic Rubber, conical
CHARACTER OF SUBSURFACE MATERIAL	-	-
APPROXIMATE GROUND WATER LEVEL	-	-
SOURCE OF INFORMATION ON SUBSURFACE CONDITIONS	-	-

Proposed Method of Installation:

- Bore and jack (per Section 5.1.3 of NSCE-8)
 Jacking (per Section 5.1.4 of NSCE-8)
 Tunneling (with Tunnel Liner Plate) (per Section 5.1.5 of NSCE-8)
 Directional Bore/Horizontal Direction Drilling – Method A (per Section 5.1.6 of NSCE-8)
 Directional Bore/Horizontal Direction Drilling – Method B (per Section 5.1.6 of NSCE-8)
 Open Cut (per Section 5.1.2 of NSCE-8). *All installations directly under any track must be designed as a bored installation. Open cut installations will be considered on a case-by-case basis by Norfolk Southern's Division Superintendent at the time of installation.*
 Other (Specify): _____

PIPE DATA SHEET

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DETAILS OF CATHODIC PROTECTION	-	-
DETAILS OF SEALS OR PROTECTION AT END OF CASING	-	Synthetic Rubber, conical
CHARACTER OF SUBSURFACE MATERIAL	-	-
APPROXIMATE GROUND WATER LEVEL	-	-
SOURCE OF INFORMATION ON SUBSURFACE CONDITIONS	-	-

Proposed Method of Installation:

- Bore and jack (per Section 5.1.3 of NSCE-8)
 Jacking (per Section 5.1.4 of NSCE-8)
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 Directional Bore/Horizontal Direction Drilling – Method B (per Section 5.1.6 of NSCE-8)
 Open Cut (per Section 5.1.2 of NSCE-8). *All installations directly under any track must be designed as a bored installation. Open cut installations will be considered on a case-by-case basis by Norfolk Southern's Division Superintendent at the time of installation.*
 Other (Specify): _____

Welded-on Outlets

Scope:

Welded-on outlets shall be limited to branch outlets having a nominal diameter not greater than 70% of the nominal diameter of the main line pipe or 30-inch whichever is smaller (see Table No. 1). Welded-on outlets may be provided as a radial (tee) outlet, tangential outlet, or lateral outlet fabricated at a specific angle to the main line pipe (in 1° increments between 45° and 90° from the axis of the main line pipe), as indicated on the drawings. Welded-on outlets shall be fabricated by the pipe manufacture at the same facility where the pipe is produced. The pipe manufacturer shall have a minimum of 5 years experience in the fabrication and testing of outlets of similar size and configuration.

**Table No. 1: Main Line Nominal Diameter
Versus
Maximum Nominal Branch Outlet Diameter**

<u>Main Line</u> <u>Nominal Dia.</u>	<u>Branch Outlet</u> <u>Nominal Dia.</u>	<u>Main Line</u> <u>Nominal Dia.</u>	<u>Branch Outlet</u> <u>Nominal Dia.</u>
10"	6"	30"	20"
12"	8"	36"	24"
14"	8"	42"	30"
16"	10"	48"	30"
18"	12"	54"	30"
20"	14"	60"	30"
24"	16"	64"	30"

Outlet Joint Types:

The joints on welded-on branch outlets shall meet, where applicable, the requirements of ANSI/AWWA C111/A21.11 and/or ANSI/AWWA C115/A21.15.

Design:

Weldment for welded-on outlets shall be based on the method described in Section VIII of the ASME Unfired Pressure Vessel Code. Reinforcing welds shall be placed using Ni-Rod FC 55[®] cored wire or Ni-Rod 55[®] electrodes manufactured by INCO Alloys (or an electrode with equivalent performance properties). Carbon Steel electrodes are not acceptable.

Parent pipe and branch outlet candidate pipe shall be centrifugally cast ductile iron pipe designed in accordance with ANSI/ AWWA C150/A21.50 and manufactured in accordance with ANSI/ AWWA C151/A21.51. Minimum classes shall be: for sizes 4-inch through 54-inch, Special Thickness Class 53; for sizes 60-inch through 64-inch, Pressure Class 350.

All welded-on outlets shall be rated for a working pressure of 250 psi and must have a minimum safety factor of 2.0 based on proof of design hydrostatic test results. The manufacturer shall, at the request of the owner or owner's engineer, provide representative proof test data confirming hydrostatic test results and safety factors.

Welded-on Outlets

Prior to the application of any coating or lining in the outlet area all weldments for branch outlets to be supplied on this project shall be subjected to an air pressure test of at least 15 psi. Air leakage is not acceptable. Any leakage shall be detected by applying an appropriate soapy water solution to the entire exterior surface of the weldment and adjoining pipe edges or by immersing the entire area in a vessel of water and visually inspecting the weld surface for the presence of air bubbles. Any weldment that shows signs of visible leakage shall be repaired and retested in accordance with the manufacturers' written procedures.

Quality Assurance:

The manufacturer shall have a fully documented welding quality assurance system and maintain resident quality assurance records based on ANSI/AWS D11.2, the *Guide for Welding Iron Castings*. The manufacturer shall maintain appropriate welding procedure specification (WPS), procedure qualification (PQR), and welder performance qualification test (WPQR) records as well as appropriate air test logs documenting air leakage tests. The manufacturer shall have ISO 9001 or 9002 registration.

Prior to the start of manufacturing any proposed manufacturer not meeting ISO 9001 or 9002 registration requirements shall submit to the owner or owner's engineer the name of an Independent Inspection Agency and the agency's qualifications. Submitted qualifications shall include but are not limited to the following:

- List of project references for projects of similar type and size
- Resumes for inspection and testing personnel
- Capacities for chemical and mechanical testing of material specimens
- Frequencies for all instrument and testing equipment certifications

The independent inspection agency shall be responsible for all of the following:

- Verify compliance to written welding procedures specification (WPS) and procedure qualification (PQR).
- Verify qualification of all welders (WPQR) per ANSI/AWS D11.2 criteria
- Document use of Ni-Rod FC 55[®] cored wire or Ni-Rod 55[®] electrodes manufactured by INCO Alloys (or an electrode with equivalent performance properties)
- Witness and document all air testing of outlet welds