

TECHNICAL SPECIFICATIONS

T-LINE – JTB TO TOWN CENTER PARKWAY - TRANSMISSION FORCE MAIN



**JEA
JACKSONVILLE, FLORIDA**

MARCH 2019

Prepared By:

Jacobs Engineering Group Inc.
200 West Forsyth Street, Suite 1520
Jacksonville, FL 32202
(904) 636-5432
COA #2822

JEA TECHNICAL SPECIFICATIONS FOR T-LINE – JTB TO TOWN CENTER PARKWAY TRANSMISSION FORCE MAIN

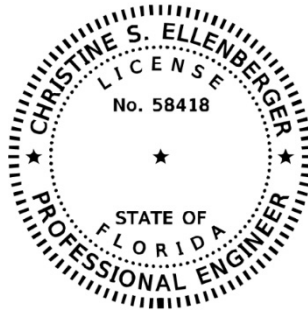
THE PROFESSIONAL ENGINEER LISTED BELOW SHALL BE RESPONSIBLE FOR THE FOLLOWING SECTIONS IN ACCORDANCE WITH THE RULE 61G15-23.004, F.A.C.

General/Civil/Process

Division 02

THIS DOCUMENT HAS BEEN DIGITALLY SIGNED AND SEALED BY:

Christine S. Ellenberger, P.E.
State of Florida, Professional Engineer, License No. 58418
Jacobs Engineering Group Inc.
200 West Forsyth Street, Suite 1520
Jacksonville, Florida 32202
Certificate of Authorization 2822



ON THE DATE ADJACENT TO THE SEAL

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC DOCUMENTS.

Jacobs Engineering Group Inc.
200 W. Forsyth St., Suite 1520
Jacksonville, Florida 32202
T 904.636.5432 F 904.636.5433
FL COA No. 2822

THIS PAGE INTENTIONALLY LEFT BLANK

TECHNICAL SPECIFICATIONS**Section Title****DIVISION 0 – BIDDING AND CONTRACT REQUIREMENTS**

JEA Standard Specifications

DIVISION 2 – SITEWORK

02342 Auger Boring

02344 Geotechnical Instrumentation and Monitoring

THIS PAGE INTENTIONALLY LEFT BLANK

PART 1 GENERAL

1.01 SUMMARY

- A. The work specified in this Section includes furnishing labor, equipment and material to install casing by auger boring, and to install carrier pipe within the casing, at the locations shown on the Drawings. Auger boring may be referred to in the Contract Documents as “Jacking and Boring” or “Jack and Bore.”
- B. The auger bore crossing under J. Turner Butler (JTB) Boulevard (SR 202) shall be constructed in accordance with this Section and the requirements of FDOT Standard Specification Section 556, “Jack and Bore,” subject to the following clarifications and modifications:
 - 1. Auger boring is the specified method for the JTB crossing construction. FDOT Specification Section 556 includes requirements specifically for microtunneling that shall not apply to auger boring for the project. Specific FDOT requirements that shall not apply are:
 - a. Section 556-5.1. Installation Process. Auger boring does not provide continuous fluid pressure to the face. Operate the boring equipment as required to control the ingress of soil into the casing, and to maintain ground stability.
 - b. Section 556-5.1. Installation Process, and Section 556-5.2 Excess material and fluids. The use of fluids for face stabilization and casing lubrication is not anticipated. Requirements for fluids shall not apply.
 - 2. Section 556-2. Materials and Section 556-2.1. Steel Pipe Casing and Welds. Casing, carrier pipe, and welds shall conform to the requirements of this Section and as shown on the Drawings.
 - 3. Section 556-4.2. Construction Process. Contractor shall not inject water inside the casing for spoil removal.
 - 4. Section 556-4.3.1. Testing Requirements. Casing pressure testing is not required.
 - 5. Section 556-7. Compensation. Compensation shall be in accordance with the Contract Documents.
 - 6. For the JTB crossing, in the event of a conflict between FDOT Standard Specification Section 556 and this Section, FDOT specifications shall prevail.
- C. Stabilized excavations, supported by an engineered shoring system, are required at each end of the auger bores in order to perform the work, referred to in this Section as the jacking and receiving pits. Retain a qualified engineer to design pit

shoring systems, as required to construct the pits in accordance with this Section and applicable regulations.

- D. Dewatering systems are required to lower the groundwater table at the jacking and receiving pits, and along the auger bore alignments. Design, install, operate, and maintain the dewatering system as required to perform the work covered by this Section, and to achieve the performance requirements of this Section. Retain a qualified engineer or geologist to design the dewatering system.
- E. Select auger boring equipment and construction methods to achieve the specified performance requirements for line and grade, dewatering, and for limiting settlement and disturbance to adjacent structures and utilities.

1.02 RELATED SECTION

- A. Section 02344, Geotechnical Instrumentation and Monitoring.

1.03 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A139 - Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe.
 - 2. ASTM C150 – Standard Specification for Portland Cement.
- B. American Welding Society (AWS): D1.1/D1.1M, Structural Welding Code for Steel.

1.04 DEFINITIONS

- A. Auger boring: The process of jacking a casing pipe into the ground using a system of hydraulic jacks, while simultaneously excavating the ground at the opposite end of the casing by means of a rotating cutting head fitted to a helical auger string, extending continuously through the casing. Excavated soil and rock fragments are conveyed from cutting head to the open end of the casing by rotation of the augers within the casing.
- B. Obstruction: Any buried object encountered by the casing that acts as a physical impediment to auger boring, such that it prevents the auger bore from being advanced forward.
- C. Casing: Protective steel pipe installed to support the auger bore excavation. Casing is advanced by jacking, and is designed to withstand all anticipated jacking loads, static loads, and imposed loads with appropriate factors of safety.
- D. Face: The excavation surface exposed by the cutting head.
- E. Jacking pit: Excavation from which the auger bore is advanced by jacking, supported by a shoring system, or graded to provide stable slopes, as evaluated and designed by the Contractor's engineer.

- F. Receiving pit: Excavation into which the auger bore is advanced, supported by a shoring system, or graded to provide stable slopes, as evaluated and designed by the Contractor's engineer.
- G. Cutting head: Device fitted with excavation tools and attached to the front of the casing and/or to the casing head that rotates to excavate the face.
- H. Jacking frame: A steel frame housing the hydraulic cylinders used to advance the casing string, designed to transmit jacking loads between the casing and the thrust block or reaction frame.
- I. Thrust block: An engineered structure that distributes the jacking force from the jacking frame to the ground or to the excavation support structure.
- J. Backstop: Jacking reaction structure, anchored into the ground in the jacking pit, or against a side of the jacking pit.
- K. Spoil: Excavated soil or rock, also referred to as "muck."
- L. Allowable jacking load: Maximum jacking load that can be applied to the casing pipe, allowing for an appropriate factor of safety. The allowable jacking load is determined by the Contractor's casing pipe designer, considering the capacity of the casing pipe to withstand loads imposed by the jacking process.
- M. Over-excavation: Excavation of a volume of ground greater than the volume filled by the casing.
- N. Water jetting: Use of a stream of water to erode soil, and/or to create a slurry of water and soil.
- O. Flowing ground: A mixture of sand, or sandy soil, and water will flow as a viscous fluid into the face of the bore and through the augers, or when exposed during pit excavation.
- P. Running ground: Granular soil with negligible cohesion that runs into a steep excavation until the slope of the running soil flattens to the angle of repose, or until support is placed against the soil.

1.05 QUALITY CONTROL

- A. The Contractor's staff shall include a Project Superintendent assigned to oversee auger boring at all times throughout construction. The Project Superintendent shall be familiar with FDOT Right-of-Way construction requirements. The Project Superintendent shall have at least three years of auger boring experience, including at least two projects with the range of ground conditions comparable to those described in the Contract Documents, using methods and equipment comparable to those proposed.
- B. Personnel operating the pipe jacking equipment shall have completed a minimum of five drives or 500 feet with equipment similar to the equipment proposed of the project.

- C. Casing pipe welding shall be performed by qualified welders in accordance with the requirements of ANSI/American Welding Society (AWS) D1.1/D1.1M.
- D. Retain a Professional Engineer to design the casing and to observe auger boring conditions and construction. The casing design engineer shall estimate the anticipated pipe jacking loads and design the thrust block. The engineer shall be registered in Florida, and shall have at least three years of related design experience, including design for at least two comparable projects.
- E. Retain a Professional Engineer to evaluate requirements for safely stabilizing and shoring the proposed pits, and to design the pit shoring, as required. The shoring design engineer shall estimate the anticipated earth loads and all other loads on the shoring system, and shall design the shoring system for the anticipated loads. The engineer shall be registered in Florida, and shall have at least three years of related design experience, including engineering for at least two comparable projects. Retain a Professional Engineer to design the carrier pipe installations, including pipe blocking, as required to prevent damage to the carrier pipe, and to secure it firmly at the design line and grade. The engineer shall be registered in Florida, and shall have at least three years of related design experience, including engineering for at least two comparable projects.
- F. Retain a Professional Engineer or Professional Geologist to design the dewatering systems. The dewatering system designer shall be registered in Florida, and shall have at least three years of related design experience, including design for at least two comparable projects.
- G. Survey and layout for auger boring and casing installation shall be performed by an experienced surveyor or survey technician with training and experience determined to be acceptable by the JEA Project Representative. Survey and layout control points shall be located and installed by a Professional Land Surveyor, registered in Florida, having experience with comparable auger boring projects, as determined to be acceptable by the JEA Project Representative.
- H. The carrier pipe manufacturer shall review the proposed work plan for pipe installation and blocking, prior to commencing auger boring.
- I. The carrier pipe manufacturer shall furnish the services of a competent factory representative to inspect the storage, handling, and installation of carrier pipe during initial pipe installation. The factory representative shall be provided at no additional cost to the Owner.
- J. Locate utilities within 30 feet of the auger bore alignment and within 30 feet of the required pit excavations, prior to mobilization to the site.
- K. For each pit, the Contractor's shoring design engineer shall perform a minimum of two (2) site visits during pit construction to observe ground conditions and verify that the excavation methods and support comply with the design and are appropriate for the conditions encountered.
- L. For each auger bore, the Contractor's casing design engineer shall perform a minimum of two (2) site visits during bore construction to observe ground

conditions and verify that the boring procedures and casing are appropriate for the conditions encountered. Provide the casing design engineer with all geotechnical instrumentation data obtained during construction of the auger bore.

1.06 DESIGN CRITERIA

- A. The following geotechnical report has been prepared for the Project, and is included as a reference to the Contract Documents:

“Geotechnical Exploration and Evaluation Report – T-Line – JTB to Town Center Parkway Transmission Force Main – Jacksonville, Florida”, dated January 24, 2019, prepared by CSI Geo, Inc.

This geotechnical report includes geotechnical data collected during the subsurface investigation for the Project, and presents factual information about the observed ground and groundwater conditions at the test boring locations, and interpretations of geotechnical parameters for design.

- B. The Contractor shall review the geotechnical report and develop their own interpretation of the subsurface conditions and ground behavior in response to the Contractor's means and methods of construction. However, the Contractor shall expect to encounter flowing ground during auger boring, and shall select the equipment and means and methods of construction to stabilize open excavations and the face of the bore when flowing ground is encountered, as required to achieve the requirements of this Section.
- C. The Contractor's engineer shall evaluate anticipated stability conditions at the launch and receiving pits, and shall provide signed and sealed recommendations for excavation configuration and stabilization measures, and shall provide a shoring design including signed and sealed drawings and design calculations.
- D. The Contractor's engineer shall estimate the maximum anticipated jacking load, and provide sealed calculations to verify the suitability of proposed backstops and thrust blocks.
- E. The Contractor's engineer or geologist shall design dewatering systems for each pit based on the information provided in the geotechnical report.
- F. The Contractor's engineer shall evaluate the anticipated jacking loads, and shall design the casing pipe based on these loads, considering the Contractor's proposed equipment, construction means and methods, and the requirements of this Section. Casing pipe shall be designed to withstand the maximum earth and groundwater loads, and jacking loads without cracking, breaking, deflection, or suffering other damage that affects the casing function. The Contractor's engineer shall determine the allowable jacking load and select safety factors to address potential effects of eccentric and/or concentrated loading on the pipe, and potential reductions in effective surface contact area.

1.07 PERFORMANCE CRITERIA

- A. Monitor settlement resulting from the work in accordance with Section 02344, Geotechnical Instrumentation and Monitoring. Limit settlement of utilities and the ground surface to ½-inch or less.
- B. If ground or structure settlement exceeds ½-inch, develop and implement a detailed plan to drill, intersect, and fill all voids under adjacent structures and utilities within 20 feet either side of the auger bore centerline with cementitious grout acceptable to the JEA Representative. Furnish and inject cementitious grout to fill any voids that develop, in accordance with the requirements of this Section, at no additional cost to the Owner.
- C. Repair all damage to adjacent structures, utilities, roadways, and walkways resulting from settlement or any other disturbance caused by auger boring. For each incidence of damage, develop and implement a written work plan for repairing the damage as required to restore the affected structure, utility, roadway, or walkway to the original, pre-construction condition, to the satisfaction of the JEA Project Representative. Repair all damage caused by ground settlement or other disturbance resulting due to auger boring, at no additional cost to the Owner.
- D. Install a dewatering system to lower the groundwater table elevation continuously throughout pit construction and auger boring, until all work is complete. The dewatering system shall draw the water table down to at least 2 feet below the bottom of the casing and the bottom of the auger boring pits, as indicated by measurement of the water level in the piezometers installed as shown on the Drawings.
- E. Installation Tolerances:
 - 1. The maximum deviation of the casing from the design alignment shown on the Drawings, at the recovery pits shall not exceed 18 inches.
 - 2. The maximum deviation of the casing from the design grade shown on the Drawings, at any point along the casing shall not exceed 6 inches.
 - 3. The installed carrier pipe flowline shall be within \pm two (2) inches of the design invert elevation, as shown on the Drawings.

1.08 SUBMITTALS

- A. Provide statements of qualifications for the auger boring crew or subcontractor, supervisory personnel for auger boring work, and supervisory personnel in charge of carrier pipe installation. Include resumes, project lists, and reference contact information, as required to demonstrate compliance with the Quality Assurance requirements, and as required by the JEA Project Representative.
- B. Provide a written auger boring work plan including narratives, descriptions, shop drawings, sketches, and cut sheets, to address the items listed below. Provide separate work plans for each bore, or clearly indicate differences in the work plan applicable to each bore.

1. Site layouts showing equipment layout, power and water supply, access and egress, and existing utilities.
2. Descriptions of the auger boring equipment, including manufacturer's specifications and cut sheets, and photographs and drawings of the equipment. Include the make, model, size, guidance and steering system, power system, bits, augers, track configuration and setup, and spoil handling system.
3. Description of the pipe jacking system, including cylinder sizes and jacking capacities, jacking frame and/or backstop configuration, thrust ring configuration and dimensions, and power unit(s). Indicate location, type, and calibration of pressure monitoring devices and readouts, including pressure vs. load relationship for jacking cylinder gauges. Describe configuration and dimensions of interfaces between pipes and auger boring equipment, including the thrust ring and bearing surfaces.
4. Auger boring methods and procedures, addressing:
 - a. Jacking procedures, including procedures for operating the jacks concurrent with boring, and procedures for monitoring jacking pressures to prevent exceeding the allowable jacking load for the casing pipe.
 - b. Auger operation procedures to excavate and remove spoil from the face.
5. Equipment configurations and operation procedures to control face stability, prevent over-excavation, and limit settlement during pipe jacking, as required to achieve the maximum settlement limits and prevent voids from developing above the bore. Describe the proposed methods for monitoring the soil volume removed, and for identifying potential over-excavation. Describe equipment and measures to address the potential to encounter flowing and/or running ground, for example: sand augers; sand cutting head; overcut band at front of lead casing; operation with the cutting head recessed inside the casing, etc.
6. Methods and materials to maintain face stability and prevent loss of ground and erosion of fines, when jacking is temporarily stopped, and in case of a prolonged stoppage of several days.
7. Methods and procedures for line and grade control, as required to achieve the design line and grade within the specified tolerances. Address the following:
 - a. Survey control and benchmarks for the pits and auger bore.
 - b. Layout to set up the track and initial casing position in the launch pit.
 - c. Measures and procedures for monitoring the lead casing position and grade continuously throughout jacking, and procedures for making adjustments to the lead casing orientation.
 - d. Measures for checking the casing alignment and position regularly during auger boring.

8. Spoil handling plan, including location of proposed on-site storage areas, and haulage routes.
 9. Groundwater and construction water control plan including drainage provisions, and details for the pumping, treatment, and disposal of ground and construction water. Address methods of drainage and water control in the bores and in the pits.
 10. Work schedule, identifying all major construction activities as independent tasks. Summarize construction sequence, number and duration of shifts planned and daily sequence of operations.
 11. Methods of sealing the pit break out and break in openings, including portal seals or ground improvement measures to prevent ground and groundwater inflows when portals are opened in the pit shoring system, and during jacking.
 12. Plans for storage and handling of casing and carrier pipe.
 13. Dewatering plan. Include drawings showing the proposed well or wellpoint types, configuration, and locations in plan, and bottom depths. Include description of the proposed pumps and other equipment, including pumping wells or educator wells, and describe the header and water treatment system. Provide signed and sealed calculations supporting the dewatering plan.
- C. Provide a casing design, prepared and signed and sealed by the Contractor's engineer, including calculations, descriptions, shop drawings, sketches, and cut sheets addressing the following:
1. Report of predicted jacking loads, and casing pipe and pipe joint design calculations, stating the allowable jacking load and basis for the design, prepared and sealed by the Contractor's engineer.
 2. Description of casing products and materials, including specifications and shop drawings showing the pipe wall thickness, steel grade, and the maximum allowable axial force. Provide cut sheets and shop drawings from the casing manufacturer.
 3. Plan and schedule for inspecting the casing after installation.
 4. Certifications for casing pipe segments demonstrating that the materials meet the requirements of the specifications.
- D. Prepare contingency plans, describing measures that the Contractor will be prepared to employ in the event of the following conditions:
1. An obstruction is encountered in the face. Describe plan for supporting face once augers have been removed, and providing ventilation required for entry of the casing.
 2. Flowing or running ground encountered at the face.

3. Settlement in excess of the specified criteria, and/or volume of excavated spoil exceeding the volume of the casing installed, or other indications of voids. Describe the plan to mobilize drilling and grouting equipment. Describe measures to monitor and control grout injection rates, and to prevent damage due to grouting pressures.
- E. Provide a carrier pipe installation work plan including narratives, descriptions, shop drawings, sketches, and cut sheets. Address the items listed below:
1. Schematic profile along bore axis showing proposed layout for carrier pipe installation.
 2. Description of survey and layout procedures, including as-built profile of the casing prior to installing the carrier pipe.
 3. Carrier pipe installation and blocking plan:
 - a. Narrative describing procedures for installation of the carrier pipe, spacers, and blocking.
 - b. Sections perpendicular to the bore axis showing proposed casing spacers and additional blocking.
 - c. Product descriptions of the casing spacers and blocking materials. Include cut sheets, specifications, and shop drawings provided by the manufacturer. Provide the manufacturer's recommended installation procedures including recommended casing spacer intervals.
 - d. Carrier pipe blocking design, including calculations and sketches, prepared and signed and sealed by the Contractor's engineer.
 - e. Written statement verifying that the carrier pipe manufacturer has reviewed the proposed work plan for pipe installation and blocking.
 - f. Plan for assembly of the casing spacer and carrier pipe and insertion into the casing. Include anticipated maximum forces to be applied to the carrier pipe and casing spacer assembly during insertion into the casing.
- F. Provide a written report of utility locates in accordance with ASCE 38-02 Quality Level A, within five (5) days after completing the observations, for utilities within 30 feet of the auger bore alignment and within 30 feet of the required excavations.
- G. Prepare as-built drawings and records in accordance with JEA Standard Specification Section 501.
- H. Submit shift reports for each shift within 24 hours of the end of each shift, including the following:
1. Hours worked per shift.
 2. General description of work performed each shift.

3. Summary of equipment and crew.
4. Weather conditions.
5. Jacking reports including, as applicable:
 - a. Time of reading.
 - b. Cutting head position including: station and elevation.
 - c. Thrust and torque readings (per casing joint).
 - d. Individual thrust jack pressures, and total thrust on the casing.
 - e. Start/end time for each jacking cycle.
6. Volume of spoil removed.
7. Seepage and pumping rates, description of ground encountered, and observations of lost ground or ground movement.
8. Description of unexpected conditions or events, and operation shut-down periods or other interruptions in the work, including reasons for shut-down.

1.09 PRE-CONSTRUCTION MEETING

- A. Hold a pre-construction meeting at least one week prior to the start of auger boring work. The Contractor is responsible for scheduling and holding the meeting after the submittals have been reviewed. The meeting shall include the Contractor, the auger boring subcontractor, the Contractor's engineer, and the JEA Project Representative.
- B. Review at least the following information at the pre-construction meeting:
 1. Pipe jacking and boring work plan.
 2. Quality control plan.
 3. Grade and alignment control procedures.
 4. Spoil and water management plan.
 5. Safety plan.
 6. Plan for daily coordination of geotechnical instrumentation monitoring with boring and jacking positions, and procedures for settlement control.

PART 2 PRODUCTS

2.01 EQUIPMENT

- A. Select, furnish, and operate auger boring equipment appropriate to complete the work shown on the Drawings and to comply with the requirements of this Section, suitable for the range of subsurface conditions indicated in the Contract Documents.
- B. The auger boring equipment shall incorporate a water line system with a grade indicator in the shaft to monitor the grade at the cutting head at all times. The Contractor may propose alternative means to continuously monitor the elevation of the lead casing, for review by the JEA Project Representative.
- C. The auger boring equipment shall incorporate a steering can consisting of a steerable lead casing segment with steering cylinders and control rods. The Contractor may propose an alternative steerable boring head configuration, for review by the JEA Project Representative.
- D. The cutting head and augers shall cover 100% of the casing face, and augers in the lead section of casing shall fill the casing. The cutting head and augers shall be configured to control the ingress of excavated ground at the face to prevent over-excavation.
- E. The cutting head and/or casing banding shall not result in an overcut greater than 1 inch beyond the outside diameter of the casing.
- F. Provide sump pumps and discharge lines for each pit, with appropriate pumping capacity as required to maintain equipment in a dry condition during rainfall events.
- G. The jacking system shall incorporate means to monitor the jacking pressures.
- H. The jacking system shall develop a uniform distribution of jacking forces on the end of the casing pipe.

2.02 STEEL CASING PIPE

- A. Furnish steel casing pipe conforming to ASTM A139 per JEA Water and Sewer Standards Specification Section 429, Paragraph II.1.3, and Steel Casing Detail as shown on the Drawings.
- B. Casing joints shall be prepared in accordance with JEA Water and Sewer Standards Specification Section 429, Paragraph II.3.6.
- C. The Drawings show the casing diameter and minimum thickness requirements. The Contractor may propose an alternative, larger diameter casing, subject to review by the JEA Project Representative.
- D. Casing pipe shall be designed by the Contractor's engineer for the requirements and conditions described in the Contract Documents, and the Design Criteria included in this Section.

- E. Straightness: The maximum straightness deviation in any 10-foot length shall be 1/8 inch.

2.03 CARRIER PIPE

- A. Furnish carrier pipe complying with JEA Water and Sewer Standards Specification Section 429, and as shown on the Drawings.
- B. Carrier Pipe Joints: All PVC carrier pipe joints to be installed within the steel casing pipe shall be restrained in both directions. All PVC pipe joints shall be restrained with an EBAA Iron Series 2824 Bell Restraint Harness. In addition, to prevent over-insertion during the carrier pipe installation into the steel casing, all PVC pipe joints shall also have an EBAA Iron Series 2024PV Joint Restraint installed on the PVC pipe plain end up against the PVC pipe bell, with the lip of the Joint Restraint facing away from the PVC pipe bell. A stainless steel backer ring and an EBAA Iron EBAA-Seal gasket shall be installed between the Joint Restraint and the PVC pipe bell. All restraints and appurtenances shall be installed in accordance with the manufacturer's recommendations.

2.04 CASING SPACERS

- A. Casing spacers shall conform to the requirements of JEA Water and Sewer Standards Specification Section 429, Paragraph II.5.2, and shall be as shown on the Drawings.
- B. Casing spacers shall be configured to prevent metal-to-metal contact between the carrier pipe and the spacer and/or the casing wall.

2.05 BACKFILL GROUT

- A. Grout used to fill voids under structures shall be a water/cement grout. Contractor may propose admixtures, subject to review by the JEA Project Representative.
- B. Cement used in backfill grout: normal Portland, Type I, II, or I/II conforming to ASTM C150.

PART 3 EXECUTION

3.01 GENERAL

- A. Perform the work in accordance with the approved work plans.
- B. Perform geotechnical instrumentation monitoring in accordance with Section 02344 and as shown on the Drawings.
- C. The Contractor shall ensure the safety of the work, construction personnel, the public, and adjacent third parties.
- D. Protect adjacent existing structures, utilities, roadways, walkways, and vegetation from damage due to construction operations.

- E. Repair all damage to adjacent existing structures, utilities, roadways, walkways, and vegetation from damage due to construction operations, in accordance with the requirements of this Section.
- F. Conduct site operations so that trucks and other equipment do not track dirt or debris onto the streets. Immediately clean any dirt or debris from the roadway.
- G. Obtain and provide all services required to perform the work, including electrical power and water.
- H. Locate all utilities and other buried facilities within 30 feet of the auger bore alignment and within 30 feet of the limits of each pit excavation. Contact Sunshine 811 prior to starting work at the site, allowing for time to expose and verify locations of each utility within 30 feet of each pit and the auger bore alignment. Hand dig or vacuum excavate to expose all utilities within 30 feet of each pit and the auger bore alignment to verify locations, prior to starting construction at the site.
- I. Perform all excavation within the easements and rights-of-way shown on the Drawings.
- J. Provide and maintain barricades, fences, and other means to prevent entry to the pits and casing during non-working hours.
- K. Control entry to pits, and limit entry to personnel essential for performance of the work.
- L. Prevent entry into the casing, except in the case of Contractor's personnel with appropriate training for safe working inside the casing. The Contractor's personnel shall only enter the casing if appropriate safety measures are in place, as determined by the Contractor, and in accordance with the applicable regulations.
- M. Wherever there is a condition which may endanger the stability of the excavation or any adjacent structures and utilities, operate with a full crew continually for 24 hours per day, including weekends and holidays, until the conditions no longer jeopardize the stability of the excavations.
- N. Complete the following work prior to setting up the auger boring equipment:
 - 1. Submittals have been made and JEA has reviewed and accepted the submittals.
 - 2. Locate utilities within 30 feet of the auger bore alignment and within 30 feet of the required pit excavations.
 - 3. Install all geotechnical instrumentation and obtain baseline readings.
 - 4. Complete construction of the jacking and receiving pits.
 - 5. Dewater the pits and confirm that groundwater levels have been lowered to a minimum of 2 feet below the base of the pits and casing invert.

- O. Prior to starting auger boring, install soil anchors or other measures, as required to prevent the auger boring equipment from overturning during operation.

3.02 DEWATERING SYSTEMS

- A. Design, install, maintain, and operate dewatering systems for each pit, and along the length of the auger bore alignment. Dewatering systems shall have sufficient capacity to remove groundwater on a continuous basis throughout pit construction and auger boring, in order to maintain the excavations in a dry state until all work is complete.
- B. Dewatering systems shall be designed to prevent removal of soil particles.
- C. Dewatering systems shall discharge into a settlement pond or frac tank.
- D. Decommission dewatering wells and/or wellpoints by filling with cementitious grout, approved by the JEA Project Representative.
- E. Furnish and operate a backup electrical power supply for the dewatering systems that can be activated to provide power to the systems within one (1) hour following a loss of power from the primary power source.

3.03 JACKING AND RECEIVING PITS

- A. Design and construct jacking and receiving pits at the locations shown on the Drawings. The Contractor shall determine actual jacking and receiving pit dimensions. Any changes to the pit locations as shown on the Drawings shall be reviewed and approved by the FDOT or City of Jacksonville, as required, and the JEA Project Representative.
- B. Provide surface drainage during the period of construction to protect the work and avoid affecting adjoining property. Prevent surface runoff from entering the launch and receiving pits.
- C. Operate and maintain sump pumps in each pit, to maintain the auger boring equipment in a dry condition during rainfall events.
- D. The Contractor's engineer shall provide signed and sealed designs of pit shoring systems in accordance with the requirements of this Section.
- E. Prevent voids from developing and prevent settlement around the jacking and receiving pits. If voids or settlement are detected, immediately implement measures to prevent further ground loss and settlement. Meet with the JEA Project Representative and provide a plan to prevent further ground loss and settlement, and to completely backfill any voids with cementitious grout or flowable fill.
- F. Perform all pit excavation and support in accordance with applicable regulations, and in accordance with the design and recommendations provided by the Contractor's shoring design engineer.

- G. Place sheeting and shoring so that the maximum unsupported height of exposed soil in the pit excavations does not exceed four (4) ft.
- H. Design and install backstops, jacking frames, and thrust blocks as required to transfer jacking loads to the ground without excessive deflection of shoring or disturbance to adjacent structures or utilities.
- I. Once carrier pipe connections are completed within the pits, remove pit sheeting and shoring, backstops, and thrust blocks, and backfill the pits in accordance with the specified backfilling and compaction requirements for the Project.

3.04 AUGER BORING

- A. Verify the alignment and grade of the launch cradle, tracks, or other casing supports prior to starting jacking, and verify the directions of the first and second casing pipe joints.
- B. The Contractor shall ensure that all personnel tasked with operating equipment are trained in the safe and appropriate operation of the equipment, in accordance with the equipment manufacturer's recommendations and guidelines, and the Contractor's safety plan.
- C. Install entry and exit seals at pits, and employ measures as required to prevent ground and groundwater inflows as portals are opened in the pit support system, and during pipe jacking. Provide seals at the entry and exit for the anticipated ground and ground water conditions indicated in the Contract Documents.
- D. Inspect casing prior to lowering it into the launch pit to ensure that no cracked, broken, or otherwise defective materials are being used. Casing delivered with visible damage shall not be used. Damaged or defective pipe shall be marked as rejected and promptly removed from the site.
- E. Prevent damage to the casing pipe and carrier pipe during handling. Lift pipe in accordance with the manufacturer's recommendations.
- F. Damaged casing pipe and carrier pipe shall be removed from the site.
- G. Clean ends of each casing pipe before joining pipes.
- H. Weld casing joints to provide the full capacity of the pipe against jacking and installed loading conditions. Field welds for steel casing pipes shall conform to the American Welding Society (AWS) standard specifications. The pipe ends shall be tapered where welding is required. Field welds shall be complete penetration, single-bevel groove type joints. Welds shall be airtight and continuous over the entire circumference and length of the steel casing pipe. Welding operators shall meet the qualifications requirements of the AWS procedures.
- I. Mark each casing pipe joint with a painted number, visible from the top of the launch pit, indicating the order of installation.

- J. Operate and control the auger boring cutting head and casing position as required to maintain face stability and to prevent over-excavation and settlement, during pipe jacking, and when jacking is temporarily stopped.
- K. Water jetting shall not be used to excavate the bore.
- L. In the event of a work stoppage, bulkhead the face against ground movement, as required to stabilize the face. Install weep holes to prevent excessive water pressure build up, and filter materials as required to prevent erosion of soil into the casing.
- M. Jack the casing string periodically during periods of work stoppage, as required to prevent pipe set and to prevent start-up jacking loads from exceeding the allowable loads.
- N. If an obstruction is encountered during boring, immediately stabilize and support the face to prevent ingress of soil and groundwater, and notify and meet with the JEA Project Representative. Within 12 hours of encountering an obstruction, provide the JEA Project Representative with Contractor's plan to remove or otherwise remediate the obstruction, so that the auger bore can progress past the obstruction.

3.05 LINE AND GRADE CONTROL

- A. Utilize a system to monitor the auger bore line and grade, and adjust the bore inclination during jacking of each casing pipe segment.
- B. Survey and record the position of the lead casing a minimum of two (2) times during auger boring.
- C. Perform an as-built survey of the installed casing pipe before installing the carrier pipe. Survey line and grade at the invert and crown, at 20-ft intervals.
- D. Utilize a laser line to control, check, and adjust the position of the carrier pipe within the casing, during carrier pipe installation. Adjust the carrier pipe position as necessary to achieve the design tolerances.

3.06 CARRIER PIPE INSTALLATION

- A. Remove all construction debris, spoil, oil, grease, and other materials from the installed casing pipe prior to commencing carrier pipe installation.
- B. All PVC carrier pipe joints to be installed within the steel casing pipe shall be restrained in both directions as indicated in Paragraph 2.03.B in this Section. All restraints and appurtenances shall be installed in accordance with the manufacturer's recommendations.
- C. Install spacers at locations and spacing per JEA Water and Sewer Standards Specification Section 429, Paragraph III.3.6., and as shown on the Steel Casing Detail in the Drawings, to fully support the carrier pipe and associated loads. Casing spacers shall be installed at a maximum interval of every 9 feet.

Clearances of the spacer system from the casing wall shall be as recommended by the casing spacer manufacturer. Protect casing spacers from damage due to installation.

- D. Install pipe on the design line and grade, by sliding the spacer and carrier pipe assembly into the casing. Adjust casing spacer positions and/or provide blocking prior to insertion, as needed to maintain pipe position within the specified tolerances. Secure spacers with blocking, as needed to prevent displacement during backfill placement.
- E. Provide lubricant between casing spacers and casing.
- F. Prevent rotation of carrier pipe during installation.
- G. Prevent forces on pipe or spacers from exceeding the allowable forces, as provided by the manufacturers of the pipe and casing spacer assemblies.
- H. Test carrier pipe in accordance with JEA Water and Sewer Standards Specification Section 429.
- I. Seal the annular space between the casing pipe and carrier pipe, at each end of the casing, as shown on the Drawings.

3.07 CLEANUP, TESTING AND INSPECTION

- A. Remove all construction debris, spoil, oil, grease, and other materials from the installed carrier pipe.
- B. Prepare as-built drawings in accordance with JEA Water and Sewer Standards Specification Section 501.

3.08 ACCEPTANCE CRITERIA

- A. Acceptance of the carrier pipe shall be based on meeting following requirements:
 - 1. The carrier pipe has been cleaned and is free from debris.
 - 2. The line and grade of the carrier pipe is within the tolerances specified in the Contract Documents.
 - 3. Carrier pipe has been tested in accordance with the carrier pipe requirements.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

Geotechnical Instrumentation and Monitoring

PART 1 GENERAL

1.01 SUMMARY

- A. The work specified in this Section includes furnishing, installing, and maintaining geotechnical instruments as shown on the Drawings and specified herein, and monitoring the instruments to detect and track ground and structure movements in the vicinity of bored crossings and pipe installations.
- B. Monitor the geotechnical instrumentation for ground and structure movements in response to construction, to achieve the specified Project performance criteria and to prevent damage to existing structures and utilities.
- C. Approximate locations for geotechnical instrumentation are shown on the Drawings. The final locations shall be agreed with the JEA Project Representative, considering actual conditions observed at the sites.
- D. Remove all instrumentation and associated elements upon completion of the work, and restore the ground surface to pre-existing conditions, unless otherwise directed or agreed to by the JEA Project Representative.

1.02 RELATED SECTIONS

- A. Section 02342, Auger Boring.

1.03 DEFINITIONS

- A. Settlement Monitoring Point (SMP): Reference point installed on a structure or within the ground, and surveyed regularly to monitor vertical movement of the structure or ground at the location of the point.
- B. Piezometer: Standpipe piezometer, consisting of a hollow casing, well screen, and aggregate filter pack as shown on the Drawings. Readings are obtained by means of a water level tape.
- C. Baseline Reading: Value of instrumentation readings taken prior to construction to provide a baseline against which subsequent readings are compared.
- D. Review Level: Value of instrumentation readings at which the Contractor and JEA Project Representative jointly assess necessity of altering methods, rate, or sequence of construction.
- E. Geotechnical instruments or instrumentation: Any device or installation used for monitoring groundwater pressures or movement of ground, or structures situated on or within the ground. SMPs and piezometers are geotechnical instruments.

1.04 QUALITY CONTROL

- A. Piezometer installation shall be performed by a geotechnical engineering or well drilling firm, routinely engaged in drilling and installing piezometers for the purpose of groundwater level monitoring for geotechnical engineering, as determined to be acceptable by the JEA Project Representative.
- B. Settlement monitoring shall be performed by an experienced surveyor or survey technician with training and experience determined to be acceptable by the JEA Project Representative. Monitoring point locations, survey control points, and baseline readings shall be obtained by a Professional Land Surveyor, registered in Florida, and having experience with comparable monitoring projects, as determined to be acceptable by the JEA Project Representative.

1.05 TOLERANCES

- A. Install SMPs and piezometers within one foot of the horizontal location shown on the Drawings, unless otherwise directed or approved by the JEA Project Representative.
- B. The Contractor's surveyor shall determine the initial coordinates of all installed instruments before monitoring commences.
- C. Provide and install benchmarks and fixed survey control points at locations such that they are not susceptible to displacement, disturbance, or damage during monitoring. Install steel bars for benchmarks to extend to depths below the expected zone of settlement influence, as necessary to prevent displacement during construction.

1.06 SUBMITTALS

- A. Provide documentation of qualifications to demonstrate that the proposed personnel tasked with geotechnical instrumentation and monitoring meet the requirements of this Section. Provide resumes, project lists, references, and other pertinent information as required by the JEA Project Representative.
- B. Work plan for installation and monitoring of SMPs and piezometers. Include the following information in the plan:
 - 1. Plan sketches for each site showing planned instrument locations and anticipated utility locations. Include list of instruments to install at each site.
 - 2. Description of methods, equipment, and products to be used for installation and protection of the instruments, including dimensions. Include cut sheets summarizing product specifications.
 - 3. Materials and mix proportions for aggregate and grout.
 - 4. Description of the survey instruments that will be used including: manufacturer's product information for each survey instrument, and current documentation of instrument calibration.
 - 5. Procedures for reducing the survey data and verifying survey results.

6. Example copies of forms, spreadsheets, and plots to be used for recording, reporting, and tracking instrumentation monitoring data.
- C. Within five days following installation of the instruments, submit as-built drawings and records showing the surveyed instrument locations, instrument identification number, instrument type, installation date and time. Include log of borehole drilling if applicable.
- D. Reports and Records: Provide reports of monitoring data in accordance with the requirements of this Section. Submit instrumentation monitoring data and plots by email, in Microsoft Excel format, within 12 hours of obtaining the monitoring instrument readings. Maintain a complete record of monitoring data on-site in a form compatible with Microsoft Excel.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Grout: cement grout shall be a mixture of 5.5 gallons of water per 94 lb. sack of cement. Cement shall be Type I and/or Type II meeting the requirements of ASTM C 150. Add sodium bentonite to the grout mix as proposed by the Contractor and acceptable to the Owner, if appropriate for the grout application.
- B. Flush mounted protective covers:
 1. Watertight steel cover meeting the requirements shown on the Drawings.
 2. In paved areas, or where instrument collar is below grade, use a traffic rated valve box meeting JEA Standards.
- C. SMPs:
 1. Concrete: As required to completely fill all voids around the excavation or borehole. Minimum 28-day strength shall be 3,000 psi.
 2. Nails and rebar: As acceptable to the JEA Project Representative.
- D. Piezometers:
 1. Standpipe: NSF rated, Schedule 40, flush threaded, PVC. Minimum nominal diameter 2 inches.
 2. Well screen: Schedule 40 PVC, 10 slot screen with sump and cap at base of well.
 3. Sand filter pack: #20-40 Silica sand, clean and free of debris and fines.
 4. Bentonite: Sodium bentonite, as chips.
 5. Tip depth: Minimum depth below pits and casing as shown on the Drawings.

2.02 EQUIPMENT

- A. Surveying instruments used for vertical or horizontal monitoring shall have a minimum accuracy of ± 0.005 foot.
- B. Calibrate surveying instruments and well monitoring tape in accordance with the procedures recommended by the manufacturer or supplier, prior to starting the work.

PART 3 EXECUTION

3.01 GENERAL

- A. Notify the JEA Project Representative at least five days prior to installing instruments.
- B. Obtain all permits required for installing instruments before starting installation.
- C. Existing Conditions: Locate conduits and underground utilities in areas where drilling or excavation is required to install the instruments. Notify utility companies in accordance with regulations and specified requirements.
- D. Approximate instrument locations are shown on the Drawings. Adjust the locations of the instruments, as approved in the field by the JEA Project Representative, to avoid interference with existing conduits, utilities, and structures. Repair damage to existing utilities and structures resulting from instrument installations at no additional cost to the owner of the existing utility or structure and JEA.
- E. Clearly mark, label, and protect instruments to avoid being covered, obstructed or damaged by construction operations or the public.
- F. Surveying: Survey the location of the instruments to provide horizontal coordinates and elevations within two days of completing the installation.
 - 1. Establish the initial coordinates of each instrument installation to 0.1 foot.
 - 2. Establish the initial elevation of SMPs to 0.005 foot. Establish the elevation of piezometer reference points to 0.005 foot.
 - 3. Record the subsequent elevations of SMPs to 0.005 foot.
- G. Provide the Owner and JEA Project Representative with access to the instruments at all times.
- H. Piezometer readings:
 - 1. Identify a reference point for water level readings at the highest point on each standpipe piezometer casing. Clearly mark the location of each reference point on the casing.

2. The Contractor's licensed surveyor shall obtain a baseline reading of elevation and position of the reference point for each piezometer. Clearly mark the reference point elevation on the casing.
3. Measure the water level position in each piezometer relative to the reference point, using a calibrated water level tape, and record the position in a Microsoft Excel table.

3.02 INSTALLATION SCHEDULE

- A. Install SMPs within 14 days to 30 days prior to the start of construction.
- B. Install piezometers at least 45 days prior to the start of construction.

3.03 INSTALLATION

- A. Use vacuum methods to perform excavation for installation of instruments adjacent to existing utilities as marked by the utility locator or shown on the Drawings, where necessary to protect the utility against damage.
- B. Clearly label or mark all instruments to enable field identification.
- C. Prepare an installation record as each instrument is installed including:
 1. Establish the initial coordinates of each instrument installation to 0.1 foot.
 2. Project name and contract name and number.
 3. Instrument type and number.
 4. Personnel responsible for installation.
 5. Equipment used, including diameter and depth of any drill casing used.
 6. Date and time of start and completion.
 7. Prepare a written log of soil and subsurface conditions, for each hole bored or dug for instrument installation. The log shall state the soil classification and engineering soil description for every 5 feet of depth, or where the soil conditions are observed to change. Soil classifications shall be generally in accordance with ASTM D2487 and soil descriptions shall be in accordance with ASTM D2488, or otherwise as acceptable to JEA.
 8. Type and description of backfill used.
 9. Surveyed as-built location in plan and elevation.
 10. As-built lengths and volumes of backfill.
 11. Weather conditions at the time of installation on record sheet.

12. Notes including problems encountered, delays, unusual features of the installation, and any events that may have an influence on instrument behavior.
- D. Install and monitor Settlement Monitoring Points (SMPs) as required to maintain a stable excavation throughout installation.
- E. The JEA Project Representative may modify the required monitoring frequencies depending upon location of the bore, construction progress, rates of movement, and other factors affecting the ground or structures that are subject to monitoring.
- F. Baseline readings for the SMPs shall consist of an average of three readings obtained 7 days prior to the start of construction, or otherwise as acceptable to the JEA Project Representative.
- G. Settlement monitoring points:
 1. Survey elevation once every 24 hours during pit excavation and construction.
 2. Survey elevation once every 24 hours during auger boring work, until completion of the work.
 3. Survey elevation two (2) times, during a period of 1 month to 3 months following backfilling of the pit, as directed by the JEA Project Representative.
- H. Obtain water level readings in standpipe piezometers according to the following schedule:
 1. Once every 7 days for the first two weeks following installation.
 2. Once every 7 days for the two weeks prior to starting excavation or dewatering within 200 feet of the piezometer.
 3. Once every 24 hours during construction of any excavation or bore located within 100 feet of the piezometer.
 4. Once per week during the period when an open or active excavation or bore is within 100 feet of the piezometer.
 5. Once every 7 days for 2 weeks after backfilling an excavation or bore within 100 feet of the piezometer.
 6. Once within 1 month to 2 months following construction, as directed by the JEA Project Representative.

3.04 REVIEW LEVEL

- A. The review level for SMPs shall be 0.5 inches (0.04 feet) settlement relative to the baseline.
- B. If the Review Level is reached:
 1. Immediately notify the JEA Project Representative.

2. Within two (2) hours, meet with the JEA Project Representative to discuss response action(s), and develop a plan of action to prevent further settlement.
3. Implement the plan of action to prevent further settlement and to remediate any adverse conditions or damage, due to settlement.
4. The cost of measures required to limit further settlement, and to repair settlement induced damage due to auger boring and pit excavation shall be incidental to the work.

3.05 REPORTING

- A. Provide readings from instruments to the JEA Project Representative within 24 hours of taking the measurement. Provide data and updated plots to track changes in elevation to the JEA Project Representative in Microsoft Excel format. The plots shall be prepared to clearly show the change in elevation or position with respect to time, and to show the change in elevation or position with respect to the depth of the pits or location of the face of the bore.
- B. Prepare and submit a weekly report documenting the monitoring performed and results of the monitoring. Include, at minimum, the following information:
 1. Description and location of adjacent construction activity.
 2. Excavation depth, or stations of the boring, drilling, or reaming operations, and other pertinent work that may affect the readings.
 3. Data plots for each instrument. For SMPs, provide plots of vertical displacement with time. For piezometers, plot water level versus time.
 4. Indicate any exceedances of the review levels specified herein.
- C. Contractor shall not disclose any instrumentation data to third parties, nor publish data, without prior written approval from the Owner.

3.06 PROTECTION, MAINTENANCE, AND REPAIR

- A. Protect instruments and associated elements from damage due to construction operations, weather, traffic, and vandalism.
- B. If an instrument is damaged or inoperative, notify the JEA Project Representative within 24 hours from the time that the damage was observed.
- C. Repair or replace the damaged or inoperative instrument within 72 hours at no additional cost to the Owner. Notify the JEA Project Representative at least 24 hours prior to repairing or replacing a damaged or inoperative instrument.
- D. The JEA Project Representative may impose a work stoppage in the vicinity of the damaged or inoperative instrument until it is operational at no cost to the Owner and with no schedule adjustment.

3.07 RESTORATION

- A. Remove or decommission all instrumentation and associated elements installed upon completion of the work, unless otherwise directed by the JEA Project Representative.
- B. Remove portions of instruments above or at grade including protective covers and concrete pads. Fill any subsurface installations with neat cement grout. Patch surface to match material at the surface or another material approved by the JEA Project Representative.

END OF SECTION