TECHNICAL SPECIFICATIONS

BID DOCUMENTS

VOLUME 1 OF 2

Rivertown Water Treatment Plant
Well Nos. 1, 2, and Backup Well (No. 3)
Part 1 – Production Well Drilling

JEA Project No. 8003981

JEA

Jacksonville, FL

July 2020

CDM Smith JACOBS

JEA

JACKSONVILLE, FLORIDA

Technical Specifications

FOR THE CONSTRUCTION

RIVERTOWN WATER TREATMENT PLANT WELL NOS. 1, 2, AND BACKUP WELL (No. 3)
PART 1 – PRODUCTION WELL DRILLING

JEA Project No. 8003981

BID DOCUMENTS

CDM Smith, Inc.
Jacobs Engineering Group, Inc.
Jacksonville, FL
July 2020

Project No. D3270100 Copy No._____

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END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01 01 00
GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 DEFINITIONS

A. Owner: JEA.

B. Contractor: NA.

C. Engineers:
1. CDM Smith, 4651 Salisbury Road, Suite 420, Jacksonville, FL 32256.
2. Jacobs Engineering Group, 200 W. Forsyth Street, Suite 1520, Jacksonville, FL 32202.

D. Project Site: JEA Rivertown Water Treatment Plant (WTP) Well Nos. 1, 2, and Backup Well (No. 3), St. Johns County, FL.

PART 2 SUMMARY OF WORK

2.01 PROJECT DESCRIPTION

A. The Contractor shall clear and mow the Well No. 1 site as needed. In addition, the contractor shall overexcavate unsuitable materials as identified in the Appendix 1 – Geotech Report to a depth of approximately 4 feet and replace with compacted granular backfill in a 30-foot radius surrounding Well No. 1 prior to well drilling.

B. The Contractor shall clear, overexcavate unsuitable materials, backfill, grade, and stabilize the Well No. 2 site in accordance with the Appendix 1 – Geotech Report and the Rivertown WTP Well Nos. 2 and 3 Site Preparation for Well Drilling Drawings. The Contractor shall not clear or disturb outside the Well No. 2 “Limits of Clearing” as shown on Dwg. C-1 in the Rivertown WTP Well Nos. 2 and 3 Site Preparation for Well Drilling Drawings. Furthermore, any prohibited clearing that occurs outside the “Limits of Clearing” shall be restored to original condition and vegetation at no additional cost the Owner.

C. The Contractor shall clear, grade, and stabilize the Backup Well (No. 3) sites as well as the Backup Well (No. 3) access drive and raw water main stub-out in accordance with the Rivertown WTP Well Nos. 2 and 3 Site Preparation for Well Drilling Drawings. Site Preparation for Backup Well (No. 3) site, access drive, and raw water main stub-out will be an alternate bid item and shall be constructed if authorized by JEA. The Backup Well (No. 3) access drive and raw water main stub-out work will include:

1. A permanent access entry driveway from Longleaf Pine to JEA's easement that will be approximately 50 lineal feet consisting of 8 inches of No. 57 stone, Tensar BX geogrid (or equal) and proof rolled subgrade with a varying width of driveway, as noted in the Rivertown WTP Well Nos. 2 and 3 Site Preparation for Well Drilling Drawings.
2. A permanent sheet pile wall system for the access entry driveway located within JEA's easement, as shown on Contract Dwg. C-3 and S-1.
3. A temporary access road (350 lineal feet) between the permanent entrance driveway and the Well No. 3 site consisting of compacted embankment fill as temporary driveway surfacing, as show on Contract Dwg C-3.
4. Installation of raw water main piping within the Well Site No. 3 access driveway and Longleaf Pine Parkway right-of-way. This shall include approximately 143 linear feet of 12-inch CLDI raw water piping by open cut construction, two (2) 12-inch DI plugs and four (4) 12-inch DI MJ 45-degree bends, as noted on Contract Dwg. C-4.
5. Tree removal, clearing, grubbing and clean filling of material within the JEA easement, as shown on Contract Dwg. C-3.
6. Erosion and sedimentation control fencing along access driveway.
7. Removal and replacement of curb and gutter between entrance driveway and Longleaf Pine Parkway, as shown on Contract Dwg. C-3.

D. The Contractor shall install temporary 6-foot chain link security fencing at the well sites in accordance with Section 33 21 12.01, Well Drilling Mobilization and Cleanup.

E. The Contractor shall be responsible for installing temporary silt fences and/or barriers as required to avoid silt or turbid water transport from the work areas in accordance with Section 01 57 13, Temporary Erosion and Sediment Control.

F. The Contractor shall be responsible for staking the well locations prior to construction. Coordinates for the well locations are provided on Figure 1 of Section 33 21 19, Water Wells. Well locations shall be staked by a land surveyor registered in the state of Florida. The Contractor shall verify that the staked location meets the 100-foot setbacks shown in Figures 2, 3, and 4 of Section 33 21 19, Water Wells.

G. The Contractor shall construct up to three upper Floridan aquifer wells in accordance with Section 33 21 19, Water Wells. Well Nos. 1 and 2 are included in the base bid and Backup Well (No. 3) will be an alternate bid item and shall be constructed if authorized by JEA. The wells shall be constructed with 30-inch surface casing installed to approximately 100 feet and 20-inch production casing installed to a depth of approximately 320 feet. The open hole will be drilled to approximately 600 feet below land surface or as directed by the Engineer.

H. The Contractor shall provide, install, and operate a test pump in accordance with Section 33 21 13.10, Well Pumping Test. Contractor shall perform a step-drawdown test on each well and a 72-hour constant rate pumping test after completion of all wells.

I. The Contractor shall perform video logging of the completed wells from the surface to the total depth in accordance with Section 33 21 13.12, Water Well Video Inspection.

J. The Contractor shall perform geophysical logging of the wells under static and dynamic conditions in accordance with Section 33 21 13.03, Geophysical Logging of Wells.

K. Should water quality be unsuitable to the Owner, Contractor shall backplug the wells in accordance with Section 33 21 19, Water Wells, or as directed by Engineer.

L. The Contractor shall develop the wells in accordance with Section 33 21 19, Water Wells.

M. The Contractor shall disinfect the wells in accordance with Section 33 21 13.13, Water Well Disinfection.

N. The Contractor shall provide a fluids management and discharge plan during drilling and testing to be approved by Engineer prior to starting any work. The plan shall address at a minimum the following:

1. Lost circulation zones.
2. Reverse-air discharge.

3. Artesian flow management, if needed.
4. Discharge during pumping tests.
5. Management of turbidity.

O. For each supply well, the Contractor shall be responsible for setting the temporary casing flange in accordance with Section 33 21 19, Water Wells.

P. The Contractor is responsible for providing a contingency plan for installing casing through lost circulation zones that may be encountered. The Contractor shall submit to Engineer a plan for approval prior to any Work.

Q. The Contractor shall cleanup and demobilize from the drilling sites in accordance with Section 33 21 12.01, Well Drilling Mobilization and Cleanup.

R. Additional references for this project are included as appendices to this specification (Permitting Matrix, Geotechnical Report, Soft Dig Report and Wetlands and Wildlife Assessment Report).

2.02 SEQUENCE OF WORK

A. The Contractor shall construct Well No. 1 first followed by Well No. 2. Backup Well (No. 3) will be an alternate bid item and shall be constructed if authorized by JEA. Contractor shall execute work according to the tasks specified below during construction and testing of each production well. Coordinate the well construction and testing schedule and operations with Engineer and Owner:

1. Contractor shall obtain a Well Construction Permit from the St Johns River Water Management District (SJRWMD). All fees and documentation required to obtain the permit will be paid by the Contractor. No construction activities shall commence until the permit has been issued by the SJRWMD. The Contractor shall apply and comply with all aspects of the permit.
2. Contractor shall clear and mow the Well No. 1 site as needed prior to starting construction.
3. Contractor shall perform the following site preparation work for Well No. 2 site and Backup Well (No. 3) site if authorized by JEA:
   a. Clear and grub in accordance with the Rivertown WTP Well Nos. 2 and 3 Site Preparation for Well Drilling Drawings.
   b. Remove and dispose of all clearing and grubbing debris in accordance with the Rivertown WTP Well Nos. 2 and 3 Site Preparation for Well Drilling Drawings.

c. Deliver, place, and compact fill material in accordance with the Rivertown WTP Well Nos. 2 and 3 Site Preparation for Well Drilling Drawings.
d. Construct access roads in accordance with the Rivertown WTP Well Nos. 2 and 3 Site Preparation for Well Drilling Drawings.

4. Contractor shall erect temporary 6-foot chain link security fencing and gate at each well site in accordance with Section 33 21 12.01, Well Drilling Mobilization and Cleanup. The security fencing shall be installed to prevent public access to the sites and ensure public health and safety.
5. Install silt fencing at each well site in accordance with Section 01 57 13, Temporary Erosion and Sediment Control. Mobilize drill rig and equipment to the site in accordance with Section 33 21 21.01, Well Drilling Mobilization and Cleanup.
6. Set up fluid containment system for mud rotary and reverse air drilling.
7. Drill a nominal 8- to 12-inch pilot hole from ground surface to a depth of approximately 100 feet bls using mud rotary drilling techniques and in accordance with Section 33 21 19, Water Wells.
8. Collect formation samples during drilling from the circulation fluid, at 10-foot intervals, in accordance with Section 33 21 19, Water Wells.
9. Ream a nominal 36-inch diameter borehole and install and grout a 30-inch steel surface casing to a depth of approximately 100 feet bls in accordance with Section 33 21 19, Water Wells.
10. Drill a nominal 8- to 12-inch pilot hole from 100 feet bls to a depth of approximately 320 feet bls using mud rotary drilling techniques and in accordance with Section 33 21 19, Water Wells.
11. Collect formation samples during drilling from the circulation fluid, at 10-foot intervals, in accordance with Section 33 21 19, Water Wells.
12. Ream the pilot hole to a nominal 29-inch borehole, in accordance with Section 33 21 19, Water Wells.
13. Install and pressure grout a 20-inch final steel casing to a depth of approximately 320 feet bls, in accordance with Section 33 21 19, Water Wells.
14. Drill a nominal 8- to 12-inch pilot hole from 320 feet bls to a depth of approximately 600 feet bls using reverse-air drilling techniques and in accordance with Section 33 21 19, Water Wells.
15. Collect formation samples during drilling from the circulation fluid, at 10-foot intervals, in accordance with Section 33 21 19, Water Wells.
16. Collect reverse-air water samples at the change of each drill rod in accordance with Section 33 21 19, Water Wells, or as directed by Engineer.
17. Collect up to six (6) drill stem water samples as the in accordance with Section 33 21 19, Water Wells, or as directed by Engineer.

18. Ream the borehole to a nominal 19-inch borehole, in accordance with Section 33 21 19, Water Wells
19. Develop well in accordance with Section 33 21 19, Water Wells.
20. Conduct a step drawdown pumping test in accordance with Section 33 21 13.1, Well Pumping Test.
21. Conduct a video survey of the well in accordance with Section 33 21 13.12, Well Video Inspection.
22. Conduct static and dynamic geophysical logging in accordance with Section 33 21 13.03, Geophysical Logging of Wells.
23. Disinfect well in accordance with Section 33 21 13.13, Disinfection of Water Systems.
24. Install temporary blind flange in accordance with Section 33 21 19, Water Wells.
25. Conduct a 72-hour constant-rate pumping test after completion of all three wells in accordance with Section 33 21 13.1, Well Pumping Test.
26. Raw water quality sampling will be collected and transported by the engineer to the JEA Springfield laboratory for analysis. The analysis conducted will include primary and secondary drinking water standards, radionuclides, SOCs, VOCs and the requirements listed under the "black water rule". The Contractor shall be aware of this sampling requirement and assist and facilitate the engineer with the collection of the groundwater samples for the raw water quality analysis.
27. Following completion and acceptance of each well, the Contractor shall remove from the site the drill rig and equipment, temporary security fencing and gate, sediment control, unused materials, all debris, and other miscellaneous items resulting from or used in the operations.

2.03 SPECIFICATIONS AND DRAWINGS

A. The Specifications and Drawings establish the performance, quality requirements, location, and general arrangement of materials and equipment, and establish the minimum standards for quality of workmanship and appearance. Should there be questions concerning the applicability or interpretation of a particular Specification section or part of a Specification section or Drawing, the questions should be directed to Engineer prior to the submittal of a proposal for the Work under this Contract.

2.04 REASONABLY IMPLIED PARTS OF THE WORK SHALL BE DONE THOUGH ABSENT FROM SPECIFICATIONS

A. A part of the work that is necessary or required to perform the work satisfactorily and legally operable, even though it is not specifically included in the Specifications or on the Drawings, shall be performed as incidental work as if described in the Specifications and shown on the Drawings.

PART 3 SEQUENCE OF OPERATIONS

3.01 SCHEDULING

A. Prior to starting the work, confer with Owner to develop an approved work Schedule. All drilling and testing work described herein will require completion within the following durations from the date of Owner's Notice to Proceed:

Well No. 1:	
Substantial Completion:	130 calendar days
Final Completion:	160 calendar days
Well No. 2:	
Substantial Completion:	260 calendar days
Final Completion:	290 calendar days
Backup Well No. 3, if authorized:	
Substantial Completion:	390 calendar days
Final Completion:	420 calendar days

The Contractor shall prepare and submit a comprehensive project schedule at the beginning of the Project.

B. Work conducted outside normal working hours (sunrise to sunset) shall be scheduled in advance with the Owner and Engineer and conducted in accordance with Owner's contract requirements.

3.02 COORDINATION

A. Other contractors maybe performing Work on the Site which is unrelated to well construction. Contractor shall cooperate in the coordination of their separate activities in a manner that will provide the least interference to the work of others.

B. If any difficulty or dispute should arise in the accomplishment of the above, the problem shall be brought immediately to the attention of the Owner.

PART 4 SITE CONDITIONS

4.01 CUTTINGS AND SOLID WASTES

A. The Contractor shall be responsible for the regulatory compliant off-site disposal of all wastes including cuttings and drill mud generated during mud-rotary and reverse-air drilling.

4.02 SAFETY

A. Contractor shall conduct work in accordance with JEA safety requirements.

4.03 EROSION ABATEMENT AND WATER POLLUTION

A. It is imperative that any Contractor activities including tests requiring the pumping of water, do not contaminate or disturb the environment of the properties adjacent to the work. The Contractor shall, therefore, schedule and control his operations to confine all run off water from distributed surfaces in accordance with Section 01 57 13, Temporary Erosion and Sediment Control. Water from pumping operations that becomes contaminated with lime, silt, muck, and other deleterious matter, fuels, oils, bitumens, chemicals, and other polluting materials shall be disposed of in a regulatory compliant and environmentally safe manner.

PART 5 TEMPORARY CONSTRUCTION UTILITIES AND FACILITIES

5.01 CONTRACTOR'S WORK AREA

A. The Contractor shall conduct all activities within the construction limits of the JEA well site properties and in accordance with agreement with the Owner. The construction limits of the JEA well site properties are shown in Figures 2, 3, and 4 of Section 33 21 19, Water Wells.

B. The Contractor shall erect temporary 6-foot chain link security fencing and gate within the construction limits of the JEA well site properties in accordance with Section 33 21 12.01, Well Drilling Mobilization and Cleanup. The Contractor shall remove the temporary security fencing and gate following completion and acceptance of each well.

C. Materials shall be so stored as to ensure the preservation of their quality and fitness for the Work.

D. Additional area for staging materials may be available at the Site. Coordinate with Owner for additional staging areas.

E. Temporary water service is not available at the JEA well Site properties. The Contractor shall make provisions for conveying water supply to the Site using the following options:

1. Tap the finished water main adjacent to Longleaf Pine Parkway. If the Contractor choses to do so, the Contractor shall meter and pay JEA for their water usage.
2. Install a well for water supply during drilling operations only. If the Contractor chooses to drill a supply well, the well shall be abandoned by the Contractor at the end of the Project.

F. The contractor shall make arrangements for electric power, if required.

G. Contractor shall provide a chemical toilet and maintain the unit in a sanitary condition at all times.

PART 6 SUBMITTALS DURING CONSTRUCTION

6.01 GENERAL

A. Submittals to Engineer and JEA shall be sent via email to:

CDM Smith
Yanni Polematidis, PolematidisIM@cdmsmith.com
David Prah, PrahDJ@cdmsmith.com
cc: Erik Svenson, erik.svenson@jacobs.com
Blake Roberts blake.roberts@jacobs.com
Larry Gunn, larry.gunn@jacobs.com
Ivan Trullenque, ivan.trullenque@jacobs.com
Mickey Willoughby, willml@jea.com
Chris Cerreta, cerretacl@cdmsmith.com

B. Submitted data shall be fully sufficient in detail for determination of compliance with the Contract Documents.

C. Submittals must be received by CDM Smith, at a minimum of 1 week prior to delivery of materials to the Site.

D. Permits:

1. SJRWMD Well Construction Permit
2. Florida Department of Environmental Protection (FDEP) National Pollutant Discharge Elimination System (NPDES) Generic Permit for Stormwater Discharge from Large and Small Construction Activities
3. The Contractor shall furnish to the Owner and Engineer copies of all permits prior to the commencement of Work requiring permits.
4. Refer to Appendix 1 for a summary matrix of all relevant permits for this project. Contractor and Engineer shall discuss all permitting implications to construction activities during the Pre-Bid and Pre-Construction Meetings.

E. Contract Closeout Submittals:

1. As-built survey shall be conducted in accordance with JEA standards Section 501, in addition the following information will be included as part of the as-built survey:
   a. Top of finished well casing elevation for all wells (coordinate with Engineer for location).
   b. Horizontal location of all wells in state plane coordinates.
   c. Topographic survey with elevations taken in a 25-foot grid. Limits of the topographic survey shall be a minimum of 25-feet beyond any improved or impacted areas.
   d. Trees 6-inches in diameter at breast height or greater.
2. Final Well Logs: Two copies.
3. Video Logs: Two copies.
4. Field Geophysical Logs: Provide electronic copies of ASCII raw data files in *.LAS format and PDF files of each log on an external USB drive before leaving Site.
5. Final Geophysical Logs: Email final version of ASCII files in *.LAS format and PDF files of each log.
6. Well Pumping Tests: Written record of flow and water level measurements collected during the variable rate step drawdown test and 72-hour constant rate test prior to leaving Site.
7. Copies of well completion reports and other relevant correspondence submitted to the regulatory agencies.

6.02 SCHEDULE OF VALUES

A. Submit completed schedule of values to include all work under the agreement.

1. Unit Price Work: Reflect unit price quantity and price breakdown.
2. Lump Sum Work: Reflect total price.
3. Front-end loaded Schedule of Values will not be acceptable.
4. Summation of the complete schedule of values representing all work under the agreement shall equal the Contract Price.

END OF SECTION

SECTION 01 57 13
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUBMITTALS

A. FDEP NPDES Generic Permit for Stormwater Discharge from Large and Small Construction Activities.

B. Storm Water Pollution Prevention Plan (SWPPP) in accordance with FDEP NPDES Generic Permit requirements.

1.02 SUMMARY

A. This section covers Work to implement structural and nonstructural Best Management Practices (BMP) to control soil erosion by wind or water and keep eroded sediments and other construction-generated pollutants from moving off Project sites. This Specification covers all project activities, including material sources, disposal sites, and offsite mitigation areas unless specific project activities are excluded elsewhere in this Specification controlling the Work.

B. Temporary erosion controls include, but are not limited to:

1. Sodding,
2. Grassing,
3. Mulching,
4. Setting,
5. Watering,
6. Reseeding onsite surfaces and spoil and borrow area surfaces and providing interceptor ditches at ends of berms. Contractors should use these erosion control methods as needed to maintain or eliminate erosion during construction beyond the silt fencing limits shown on Figures 2, 3, and 4 in Section 33 21 19, Water Wells.

C. Temporary sedimentation controls include, but are not limited to:

1. Silt dams.
2. Traps.
3. Barriers.
4. And appurtenances at the foot of sloped surfaces. Contractor should use these sedimentation control methods as needed to ensure that sedimentation pollution will be either eliminated or maintained.

D. Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

1.03 REFERENCE DOCUMENTS

A. Florida Building Code.

B. Florida Department of Environmental Protection NPDES Generic Permit for Stormwater Discharge from Large and Small Construction Activities

C. U.S. Environmental Protection Agency:

1. Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites, 2007. EPA-833-R-06-004.
2. National Menu of BMPs, 2012.

PART 2 PRODUCTS

2.01 EROSION CONTROL

A. Seed to be Scarified Argentines Bahia, if required.

B. Silt fencing to be provided as specified in the Contractor's approved SWPPP.

2.02 SEDIMENTATION CONTROL

A. Bales are to be clean, seed-free, cereal hay type.

B. Silt fencing to be provided as specified in the Contractor's approved SWPPP.

C. Filter stone- crushed stone conforming to Florida Department of Transportation specifications

D. Concrete block – hollow, non-load-bearing type.

E. Concrete- exterior grade not less than 1-inch thick.

PART 3 EXECUTION

3.01 PERMIT REQUIREMENTS

A. The Contractor shall be responsible for obtaining a NPDES Generic Permit for Stormwater Discharge from Large and Small Construction Activities prior to commencement of work. Pursuant to the NPDES Generic Permit, the Contractor shall also develop a SWPPP to document how the permit requirements will be met.

B. The Contractor shall not begin work at the Well No. 2 and Backup Well (No. 3) sites until the SJRWMD Environmental Resource Permit and Army Corps of Engineers 404 Permit/Nationwide Permit has been acquired by the Owner. The Contractor shall not begin work until approved by the St. Johns County Development Review Committee.

3.02 EROSION CONTROL

A. Minimum procedures for grassing are:

1. Scarify slopes to a depth of not less than six inches and remove large clods, rock, stumps, roots larger than 1/2-inch in diameter and debris
2. Sow seed within 24 hours after the ground is scarified with either mechanical seed rills or rotary hand seeders.
3. Apply mulch loosely and to a thickness of between 3/4-inch and 1-1/2 inches.
4. Apply netting over mulched areas or sloped surfaces
5. Roll and water seeded areas in a manner, which will encourage sprouting of seeds and growing grass. Reseed areas, which exhibit unsatisfactory growth. Backfill and seed eroded areas.

3.03 SEDIMENTATION CONTROL

A. Install and maintain silt dams, traps, barrier and appurtenances as shown on Figures 2, 3, and 4 in Section 33 21 19, Water Wells.

B. Hay bales, which deteriorate, and filter stone, which is dislodged, shall be replaced.

C. Silt (Sediment) Fence:

1. Silt fence shall be installed in accordance with Figures 2, 3, and 4 in Section 33 21 19, Water Wells. When backup support is used, use steel wire with a maximum mesh spacing of 2 inches by 4 inches, or plastic mesh as resistant to ultraviolet radiation as the geotextile it supports. Provide wire or plastic mesh with strength equivalent to or greater than as required for unsupported geotextile (for example, 180 pounds grab tensile strength in the machine direction).
2. Attach geotextile to posts and support system using staples, wire, or in accordance with manufacturer's recommendations. Geotextile shall be sewn together at the point of manufacture, or at a location approved by Engineer, to form geotextile lengths as required.
3. Provide wood or steel support posts at sewn seams and overlaps and as shown on the Drawings and necessary to support fence.
4. Wood Posts: Minimum dimensions of 1-1/4-inch by 1-1/4-inch by the minimum length shown on the Drawings.
5. Steel Posts: Minimum weight of 0.90 lb/ft.
6. When sediment deposits reach approximately one-third the height of the silt fence, remove and stabilize deposits.

3.04 PERFORMANCE

A. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results, which comply with the requirements of the State of Florida or the Federal Government, Contractor shall immediately take steps that are necessary to correct the deficiency at the Contractor's own expense.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.01 DEFINITIONS

A. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.

B. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.

C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 2-inch caliper to a depth of 6 inches below subgrade.

D. Project Limits: Areas, as shown or specified, within which Work is to be performed.

1.02 QUALITY ASSURANCE

A. Obtain Engineer's approval of staked clearing, grubbing limits, prior to commencing clearing, grubbing.

1.03 SCHEDULING AND SEQUENCING

A. Prepare Site only after adequate erosion and sediment controls are in place. Limit areas exposed uncontrolled to erosion during installation of temporary erosion and sediment controls.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Clear, grub areas actually needed for Site improvements within limits shown or specified.

B. Do not injure or deface vegetation that is not designated for removal.

3.02 LIMITS

A. As shown on the Drawings.

B. Remove rubbish, trash, and junk from entire area within Project limits.

3.03 CLEARING

A. Clear areas within limits shown or specified.

B. Cut stumps not designated for grubbing flush with ground surface.

C. Cut off shrubs, brush, weeds, and grasses to within 2 inches of ground surface.

3.04 GRUBBING

A. Grub areas within limits shown or specified.

3.05 TREE REMOVAL OUTSIDE CLEARING LIMITS

A. Remove Within Project Limits: Dead, dying, leaning, or otherwise unsound trees that may strike and damage Project facilities in falling.

B. Cut stumps off flush with ground, remove debris, and if disturbed, restore surrounding area to its original condition.

3.06 PRUNING

A. Remove branches below the following heights: 20 feet above roadways and shoulders.

3.07 SALVAGE

A. Saleable log timber may be sold to Contractor’s benefit. Promptly remove from Project Site.

3.08 DISPOSAL

A. Clearing and Grubbing Debris:

1. Dispose of debris offsite.
2. Burning of debris onsite will not be allowed.
3. Limit offsite disposal of clearing and grubbing debris to locations that are approved by federal, state, and local authorities, and that will not be visible from Project.

END OF SECTION

SECTION 31 23 13
SUBGRADE PREPARATION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3)).
   b. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

1.02 DEFINITIONS

A. Optimum Moisture Content: As defined in Section 31 23 23, Fill and Backfill.

B. Prepared Ground Surface: Ground surface after completion of clearing and grubbing, excavation to grade, and scarification and compaction of subgrade.

C. Relative Compaction: As defined in Section 31 23 23, Fill and Backfill.

D. Subgrade: Layer of existing soil after completion of clearing, grubbing prior to placement of fill, roadway structure or base for floor slab.

E. Proof-Rolling: Testing of subgrade by compactive effort to identify areas that will not support the future loading without excessive settlement.

1.03 SEQUENCING AND SCHEDULING

A. Complete applicable Work specified in Section 31 10 00, Site Clearing prior to subgrade preparation.

1.04 QUALITY ASSURANCE

A. Notify Engineer when subgrade is ready for compaction or proof-rolling or whenever compaction or proof-rolling is resumed after a period of extended inactivity.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Keep subgrade free of water, debris, and foreign matter during compaction or proof-rolling.

B. Bring subgrade to proper grade and cross-section and uniformly compact surface.

C. Do not use sections of prepared ground surface as haul roads. Protect prepared subgrade from traffic.

D. Maintain prepared ground surface in finished condition until next course is placed.

3.02 COMPACTION

A. Under Earthfill: Compact upper 12 inches to minimum of 95 percent relative compaction as determined in accordance with ASTM D1557.

B. Under Pavement Structure, Floor Slabs On Grade, or Granular Fill Under Structures: Compact the upper 12 inches to minimum of 95 percent relative compaction as determined in accordance with ASTM D1557.

3.03 MOISTURE CONDITIONING

A. Dry Subgrade: Add water, then mix to make moisture content uniform throughout.

B. Wet Subgrade: Aerate material by blading, discing, harrowing, or other methods, to hasten drying process.

3.04 TESTING

A. Proof-roll subgrade with equipment specified in Article Compaction to detect soft or loose subgrade or unsuitable material, as determined by Engineer.

3.05 CORRECTION

A. Soft or Loose Subgrade:

1. Adjust moisture content and recompact.
2. Over excavate and replace with suitable material, as specified in Section 31 23 23, Fill and Backfill.

B. Unsuitable Material: Over excavate and replace with suitable material, as specified in Section 31 23 23, Fill and Backfill.

END OF SECTION

SECTION 31 23 23
FILL AND BACKFILL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. C117, Standard Test Method for Materials Finer Than 75-Micrometers (No. 200) Sieve in Mineral Aggregates by Washing.
   b. C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
   c. D75, Standard Practice for Sampling Aggregates.
   d. D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   e. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   f. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.02 DEFINITIONS

A. Relative Compaction:

1. Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D1557.
2. Apply corrections for oversize material to either as-compacted field dry density or maximum dry density, as determined by Engineer.

B. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.
2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

C. Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, and subgrade preparation.

D. Completed Course: A course or layer that is ready for next layer or next phase of Work.

E. Lift: Loose (uncompacted) layer of material.

F. Well-Graded:

1. A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes.
2. Does not define numerical value that must be placed on coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.
3. Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

G. Influence Area: Area within planes sloped downward and outward at 60-degree angle from horizontal measured from:

1. 1 foot outside outermost edge at base of foundations or slabs.
2. 1 foot outside outermost edge at surface of roadways or shoulder.
3. 0.5 foot outside exterior at spring line of pipes or culverts.

H. Selected Backfill Material: Materials available onsite that Engineer determines to be suitable for specific use.

I. Imported Material: Materials obtained from sources offsite, suitable for specified use.

J. Structural Fill: Fill materials as required under structures, pavements, and other facilities.

K. Embankment Material: Fill materials required to raise existing grade in areas other than under structures.

1.03 SUBMITTALS

A. Informational Submittals:

1. Manufacturer’s data sheets for compaction equipment.
2. Certified test results from independent testing agency.

1.04 QUALITY ASSURANCE

A. Notify Engineer when:

1. Soft or loose subgrade materials are encountered wherever embankment or site fill is to be placed.
2. Fill material appears to be deviating from Specifications.

1.05 SEQUENCING AND SCHEDULING

A. Complete applicable Work specified in Section 31 10 00, Site Clearing; and Section 31 23 13, Subgrade Preparation, prior to placing fill or backfill.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Gradation Tests:

1. As necessary to locate acceptable sources of imported material.
2. During production of imported material, test as follows:
   a. Granular Fill: One test per 750 tons.
   b. Sand: One test per 750 tons.
   c. Base Course Rock: One test per 1500 tons.
   d. Foundation Stabilization Rock: One test per 1500 tons.

2.02 GRANULAR FILL

A. Imported sand classified as SP in accordance with the Unified Soil Classification System with maximum 8 percent by weight passing No. 200 sieve.

B. Free from dirt, clay balls, and organic material.

2.03 WATER FOR MOISTURE CONDITIONING

A. Free of hazardous or toxic contaminates, or contaminants deleterious to proper compaction.

PART 3 EXECUTION

3.01 GENERAL

A. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.

B. Place and spread fill and backfill materials in horizontal lifts of uniform thickness, in a manner that avoids segregation, and compact each lift to specified densities prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.

C. Tolerances:

1. Final Lines and Grades: Within a tolerance of 0.1 foot unless dimensions or grades are shown or specified otherwise.
2. Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.

D. Settlement: Correct and repair any subsequent damage to structures, pavements, curbs, slabs, piping, and other facilities, caused by settlement of fill or backfill material.

3.02 BACKFILL UNDER AND AROUND STRUCTURES

A. Under Facilities: Within influence area beneath structures, slabs, pavements, curbs, piping, conduits, duct banks, and other facilities, backfill with granular fill, unless otherwise shown. Place granular fill in lifts of 12-inch maximum thickness and compact each lift to minimum of 95 percent relative compaction as determined in accordance with ASTM D1557.

3.03 FILL

A. Outside Influence Areas beneath Structures, Tanks, Pavements, Curbs, Slabs, Piping, and Other Facilities: Unless otherwise shown, place granular fill as follows:

1. Allow for thickness of sod where required.
2. Maximum 12-inch thick lifts.
3. Place and compact fill across full width of embankment.
4. Compact to minimum 90 percent relative compaction as determined in accordance with ASTM D1557.
5. Dress completed embankment with allowance for sod, crest surfacing, and slope protection, where applicable.

3.04 SITE TESTING

A. Maximum dry density, Optimum moisture content, Gradation, and Plasticity:

1. One sample from each type of finished product or more often as determined by Engineer, if variation in gradation is occurring, or if material appears to depart from Specifications.
2. If test results indicate material does not meet Specification requirements, terminate material placement until corrective measures are taken.
3. Remove material placed in Work that does not meet Specification requirements.

B. In-Place Density Tests: In accordance with ASTM D1556. During placement of materials, test as follows:

1. Granular Fill: One test per lift per 1,000 sf plan area.

3.05 REPLACING OVEREXCAVATED MATERIAL

A. Replace excavation carried below grade lines shown or established by Engineer as follows:

1. Beneath Fill or Backfill: Granular fill.
2. Beneath Slabs-On-Grade: Granular fill.

END OF SECTION

SECTION 32 92 00
TURF AND GRASSES

PART 1 GENERAL

1.01 DEFINITIONS

A. Maintenance Period: Begin maintenance immediately after each area is planted (seed, sod) and continue for a period of 8 weeks after all planting under this section is completed.

B. Standard Specifications: Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

C. Satisfactory Stand: Grass or section of grass of 10,000 square feet or larger that has:

1. No bare spots larger than 3 square feet.
2. Not more than 10 percent of total area with bare spots larger than 1 square foot.
3. Not more than 15 percent of total area with bare spots larger than 6 square inches.

1.02 SUBMITTALS

A. Action Submittals: Product labels/data sheets.

B. Informational Submittals:

1. Seed: Certification of seed analysis, germination rate, and inoculation:
   a. Certify that each lot of seed has been tested by a testing laboratory certified in seed testing, within 6 months of date of delivery. Include with certification:
      1) Name and address of laboratory.
      2) Date of test.
      3) Lot number for each seed specified.
      4) Test Results: (i) name, (ii) percentages of purity and of germination, and (iii) weed content for each kind of seed furnished.
   b. Mixtures: Proportions of each kind of seed.
2. Seed Inoculant Certification: Bacteria prepared specifically for legume species to be inoculated.
3. Certification of sod; include source and harvest date of sod, and sod seed mix.
4. Description of required maintenance activities and activity frequency.

1.03 DELIVERY, STORAGE, AND PROTECTION

A. Seed:

1. Furnish in standard containers with seed name, lot number, net weight, percentages of purity, germination, and hard seed and maximum weed seed content, clearly marked for each container of seed.
2. Keep dry during storage.

B. Sod:

1. Do not harvest if sod is excessively dry or wet to the extent survival may be adversely affected.
2. Harvest and deliver sod only after laying bed is prepared for sodding.
3. Roll or stack to prevent yellowing.
4. Deliver and lay within 24 hours of harvesting.
5. Keep moist and covered to protect from drying from time of harvesting until laid.

C. Hydroseeding Mulch: Mark package of wood fiber mulch to show air dry weight.

1.04 WEATHER RESTRICTIONS

A. Perform Work under favorable weather and soil moisture conditions as determined by accepted local practice.

1.05 SEQUENCING AND SCHEDULING

A. Complete Work under this section within 3 days following completion of soil preparation.

B. Notify Engineer at least 3 days in advance of:

1. Each material delivery.
2. Start of planting activity.

C. Planting Season: Those times of year that are normal for such Work as determined by accepted local practice.

1.06 MAINTENANCE SERVICE

A. Contractor: Perform maintenance operations during maintenance period to include:

1. Watering: Keep surface moist.
2. Washouts: Repair by filling with soil, fertilizing, seeding, and mulching.
3. Mulch: Replace wherever and whenever washed or blown away.
4. Mowing: Mow to 2 inches after grass height reaches 3 inches, and mow to maintain grass height from exceeding 3-1/2 inches.
5. Reseed unsatisfactory areas or portions thereof immediately at the end of the maintenance period if a satisfactory stand has not been produced.

PART 2 PRODUCTS

2.01 FERTILIZER

A. In accordance with Section 982 of the Standard Specifications. Product shall not be banned by the EPA.

2.02 SEED

A. In accordance with Section 981 of the Standard Specifications.

B. Summer Seed: Bahia

C. Winter Protective Seed: Annual ryegrass.

2.03 SOD

A. All sod shall be Bahia grass in accordance with Section 981 of the Standard Specifications

B. Strongly rooted pads, capable of supporting own weight and retaining size and shape when suspended vertically from a firm grasp on upper 10 percent of pad.

1. Grass Height: Normal.
2. Strip Size: Supplier’s standard.
3. Soil Thickness: Uniform; 1 inch plus or minus 1/4 inch at time of cutting.
4. Age: Not less than 10 months or more than 30 months.
5. Condition: Healthy, green, moist; free of diseases, nematodes and insects, and of undesirable grassy and broadleaf weeds. Yellow sod, or broken pads, or torn or uneven ends will not be accepted.

2.04 STRAW MULCH

A. Threshed straw of oats, wheat, barley, or rye, free from (i) seed of noxious weeds or (ii) clean salt hay.

2.05 HYDROSEEDING MULCH

A. Wood Cellulose Fiber Mulch:

1. Specially processed wood fiber containing no growth or germination inhibiting factors.
2. Dyed a suitable color to facilitate inspection of material placement.
3. Manufactured such that after addition and agitation in slurry tanks with water, the material fibers will become uniformly suspended to form homogenous slurry.
4. When hydraulically sprayed on ground, material will allow absorption and percolation of moisture.

2.06 TACKIFIER

A. Derived from natural organic plant sources containing no growth or germination-inhibiting materials.

1. Capable of hydrating in water, and to readily blend with other slurry materials.
2. Wood Cellulose Fiber: Add as tracer, at rate of 150 pounds per acre.
3. Manufacturers and Products:
   a. Chevron Asphalt Co.; CSS 1.
   b. Terra; Tack AR.
   c. J Tack; Reclamare.

PART 3 EXECUTION

3.01 PREPARATION

A. Grade areas to smooth, even surface with loose, uniformly fine texture.

1. Roll and rake, remove ridges, fill depressions to meet finish grades.
2. Limit such Work to areas to be planted within immediate future.
3. Remove debris, and stones larger than 1-1/2-inch diameter, and other objects that may interfere with planting and maintenance operations.

B. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface to dry off before seeding. Do not create muddy soil.

C. Restore prepared areas to specified condition if eroded or otherwise disturbed after preparation and before planting.

3.02 FERTILIZER

A. Apply evenly over area in accordance with manufacturer's instructions. Mix into top 2 inches of topsoil, when applied by broad cast method.

B. Application Rate: In accordance with Section 982 of the Standard Specifications.

3.03 SEEDING

A. Start within 2 days of preparation completion.

B. Either mechanical or hydroseeding method of seeding is acceptable.

C. Mechanical: Broadcast seed in two different directions, compact seeded area with cultipacter or roller.

1. Sow seed at uniform rate per manufacturer's recommendations.
2. Use Brillion type seeder.
3. Broadcasting will be allowed only in areas too small to use Brillion type seeder. Where seed is broadcast, increase seeding rate 20 percent.
4. Roll with ring roller to cover seed, and water with fine spray.

D. Hydroseeding:

1. Application Rate: Per manufacturer's recommendations.
2. Apply on moist soil, only after free surface water has drained away.
3. Prevent drift and displacement of mixture into other areas.
4. Upon application, allow absorption and percolation of moisture into ground.
5. Mixtures: Seed and fertilizer may be mixed together, apply within 30 minutes of mixing to prevent fertilizer from burning seed.

E. Mulching: Apply uniform cover of straw mulch at a rate of 2 tons per acre, wood fiber mulch at rate of 1,500 pounds per acre.

F. Tackifier: Apply over mulched areas with slopes steeper than 4:1 at rate of 5 gallons per 1,000 square feet in accordance with the manufacturers recommended requirements.

G. Water: Apply with fine spray after mulching to saturate top 4 inches of soil. Continue watering until the turf is established.

3.04 SODDING

A. Do not plant dormant sod, or when ground is frozen.

B. Lay sod to form solid mass with tightly fitted joints; butt ends and sides, do not overlap.

1. Stagger strips to offset joints in adjacent courses.
2. Work from boards to avoid damage to subgrade or sod.
3. Tamp or roll lightly to ensure contact with subgrade; work sifted soil into minor cracks between pieces of sod, remove excess to avoid smothering adjacent grass.
4. Complete sod surface true to finished grade, even, and firm.

C. Fasten sod on slopes to prevent slippage with wooden pins 6 inches long driven through sod into subgrade, until flush with top of sod. Install at sufficiently close intervals to securely hold sod.

D. Water sod with fine spray immediately after planting. During first week, water daily or more frequently to maintain moist soil to depth of 4 inches. Continue watering until the turf is established.

E. Apply top dress fertilizer at rate of 1 pound per 1,000 square feet.

3.05 FIELD QUALITY CONTROL

A. 8 weeks after seeding is complete and on written notice from Contractor, Engineer will, within 15 days of receipt, determine if a satisfactory stand has been established.

B. If a satisfactory stand has not been established, Engineer will make another determination after written notice from Contractor following the next growing season.

END OF SECTION

SECTION 33 21 12.01
WELL DRILLING MOBILIZATION AND CLEANUP

PART 1 GENERAL

1.01 WORK INCLUDED

A. This section covers the Work necessary to move in and move out personnel and equipment, setup and remove drill rigs and temporary facilities, and clean up the Sites following well completion.

B. The Contractor shall be responsible for site clearing, raising, grading, and stabilization at the properties for Well No. 2, Backup Well (No. 3), and the Backup Well (No. 3) temporary access driveway.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide all materials and equipment required to accomplish the Work as specified.

PART 3 EXECUTION

3.01 GENERAL

A. The location of Well Nos. 1, 2, and Backup Well (No. 3) is shown in Figure 1 of Section 33 21 19, Water Wells.

B. The Contractor shall clear and mow the Well No. 1 site as needed prior to starting construction.

C. At Well No. 1, the Contractor shall erect temporary 6-foot chain link security fencing and gate within the limits of the future JEA Rivertown Water Treatment Plant Site as needed for well construction, security, and safety of the public. Furthermore, the Contractor shall utilize the existing manual swing gate at the Well No. 1 site as an additional security measure. The approximate location of the temporary security fencing for Well No. 1 is shown in Figure 2 of Section 33 21 19, Water Wells. The Contractor is responsible for the final temporary security fence layout. Furthermore, cellular company personnel will need periodic access to the cellular tower area, the Contractor shall provide unimpeded access to the cellular tower area at all times.

D. The Contractor shall clear, grade, and stabilize the properties for Well No. 2 and Backup Well (No. 3) in accordance with the Rivertown WTP Well Nos. 2 and 3 Site Preparation for Well Drilling Drawings.

E. The Contractor shall clear, raise, stabilize, and construct access roads to the Well No. 2 and Backup Well (No. 3) sites in accordance with the Rivertown WTP Well Nos. 2 and 3 Site Preparation for Well Drilling Drawings.

F. For the permanent and temporary driveway for Backup Well (No. 3), Contractor shall provide the clearing and grubbing within the limits of construction inside JEA's limits of easement, as show on Contract Dwg. C-3. Contractor shall be responsible for installing temporary silt fencing between Backup (Well No. 3) site and Longleaf Parkway.

G. At Well No. 2 and Backup Well (No. 3), the Contractor shall install temporary 6-foot chain link security fencing and gate within the limits of the site clearing as needed for well construction, security, and safety of the public. The approximate location of the temporary security fencing and gate for Well No. 2 and Backup Well (Well No. 3) is shown in Figures 3 and 4 of Section 33 21 19, Water Wells. The Contractor is responsible for the final temporary security fence layout.

H. The Contractor shall install temporary security fencing and gate prior to starting construction of each well. In addition, the Contractor shall always secure the Site before leaving for the day.

I. The Contractor shall be responsible for installing temporary silt fences and/or barriers as required to avoid silt or turbid water transport from the work areas in accordance with Section 01 57 13, Temporary Erosion and Sediment Control. The temporary security fences and/or barriers shall be installed as shown in Figures 2, 3, and 4 of Section 33 21 19, Water Wells.

J. Set up well drilling equipment in the areas designated by the Engineer. Accomplish all required Work in accordance with applicable portions of these Specifications.

K. The Contractor shall be responsible for the regulatory compliant off-site disposal of all wastes including drilling mud and other related material.

3.02 ONSITE UTILITIES

A. Temporary water service is not available at the JEA well site properties. The Contractor shall make provisions for conveying water supply to the Sites using the following options:

1. Tap the finished water main adjacent to Longleaf Pine Parkway. If the Contractor choses to do so, the Contractor shall meter and pay JEA for their water usage.
2. Install a well for water supply during drilling operations only. If the Contractor chooses to drill a supply well, the well shall be permitted and abandoned by the Contractor at the end of the project. A copy of the work water well permit shall be provided to the Engineer prior to installation.

B. The Contractor shall make arrangements for electric power, if required.

3.03 SANITARY FACILITIES

A. The Contractor shall provide a chemical toilet of suitable type and maintain the unit in a sanitary condition at all times.

3.04 CONTAMINATION PRECAUTIONS

A. Avoid contamination of the project area. Do not dump waste oil, rubbish, or other waste materials on the ground.

B. Repair any leaks of hydraulic or motor oil immediately.

3.05 CLEANUP OF CONSTRUCTION AREAS

A. Upon completion and acceptance of each well, remove from the site the drill rig and equipment, temporary security fencing and gate, sediment control, unused materials, all debris, and other miscellaneous items resulting from or used in the operations.

B. The Contractor shall set a temporary blind flange in accordance with Section 33 21 19, Water Wells.

END OF SECTION

SECTION 33 21 13.03
GEOPHYSICAL LOGGING OF WELLS

PART 1 GENERAL

1.01 SUBMITTALS

A. Shop Drawings:

1. List of downhole equipment including manufacturer, manufacturer's specifications, and physical dimensions of downhole tools.
2. Type of recording equipment.
3. Wire line size, type, and weight rating.

B. Quality Control Submittals:

1. Verification of equipment calibration.
2. Calibration data.

C. Contract Closeout Submittals:

1. Field Geophysical Logs: Provide electronic copies of the ASCII raw data files in *.LAS format and PDF files of each log on an external USB drive before leaving the Site.
2. Final Geophysical Logs: Email final version of ASCII files in *.LAS format and PDF files of each log.

1.02 SEQUENCING AND SCHEDULING

A. Perform logging of each new well as soon as possible after constructing the well and conditioning it for logging.

B. Coordinate logging with pumping tests as necessary.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 LOGGING

A. Geophysical Logging shall Include:

1. Electric: Resistivity (16-inch and 64-inch normal) and Single Point Resistance.
2. Natural gamma ray.

3. Caliper.
4. Temperature (static and pumping).
5. Fluid resistivity or conductivity (static and pumping).
6. Flowmeter (static and pumping).

B. Use a logging interval of the total depth of the well or borehole, or as determined by Engineer.

C. Record logs in digital format.

D. Report logs in graphic (analog) form.

E. Vertical scale for the log shall be 5 inches per 100 feet of depth.

F. Record logs at the highest sensitivity consistent with a minimum of off-scale deflection, or as directed by Engineer.

G. Record scales, calibration and standardization, and other pertinent data on each log.

H. Record a duplicate (repeat) section of each log equal to 20 percent of total logged depth for wells up to 250 feet deep, and 10 percent of logged depth of wells deeper than 250 feet up to a maximum of 100 feet. The duplicate section will be selected by Engineer.

I. The Contractor shall demonstrate calibration of the geophysical logging tools in the field.

J. If artesian conditions are encountered at the well Sites, the wellhead shall be sealed at land surface with a pack-off or stand pipe during static logging.

K. The Contractor shall run the flowmeter tool inside the 20-inch casing under static (non-pumping) conditions at a minimum of three different tool speeds and record tool output and corresponding tool speed. These data shall be provided to the Engineer before leaving the Site.

L. Run the static flow log from the base of the final 20-inch casing to total depth, and again, from total depth to the base of the 20-inch casing.

M. Run the pumping fluid conductivity and temperature logs at a minimum rate of 1,650 gpm.

N. The pumping flow log shall be run at two different flow rates; 825 gpm and 1,650 gpm, or as directed by the Engineer.

END OF SECTION

SECTION 33 21 13.10
WELL PUMPING TESTS

PART 1 GENERAL

1.01 SUBMITTALS

A. Shop Drawings:

1. List and description of equipment proposed for pumping test, including pump curves and driver horsepower.
2. Calibration curves and supporting laboratory data for flowmeters, orifice plates, or pressure transducers.
3. Description of sand measuring equipment. Sketch of discharge piping, valving, flowmeters, and other appurtenances.

B. Well Pumping Tests: Written record of flow and water level measurements collected during the variable rate step drawdown test and 72-hour constant rate test prior to leaving Site.

1.02 SITE CONDITIONS

A. Environmental Requirements: Dispose of water produced during pumping tests in an environmentally sound manner in accordance with applicable federal, state, and local regulations. Water leaving the Site must be directed so as not to cause flooding or erosion. Temporary discharge piping is required to convey the water to the designated discharge location as indicated in Supplementals 3, 4, and 5 of Section 33 21 19, Water Wells. The Contractor shall be responsible for controlling inappropriate discharge of turbid water.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 TESTS REQUIRED

A. Step Drawdown Tests: Required for all three wells following completion.

B. 72-Hour Constant Rate Test: If Well Nos. 1 and 2 and Backup Well (No. 3) are constructed, Well No. 1 will be pumped, Well No. 2 and Backup Well (No. 3) will be monitored. If Backup Well (No. 3) is not constructed, Well No. 1 will be pumped, and Well No. 2 will be monitored. The 72-hour constant rate test is required after the construction of all wells is complete.

3.02 TEST PUMP AND DRIVER

A. Test Pump: Vertical lineshaft driven submersible turbine pump assembly or equal, complete with required column, shafting, discharge head and fittings, capable of pumping at a rate of 2,100 gpm at an impeller bowl setting of 100 feet with a pumping water level estimated at 60 feet below ground surface.

B. Driver: Engine and gear drive capable of operating the test pump continuously for a minimum of 72 hours.

C. Electric Power: Make arrangements for obtaining electric power, if required.

3.03 FLOW MEASUREMENT AND CONTROL

A. Contractor shall provide and install flowmeter. The flowmeter shall be located appropriately and properly aligned in accordance with standard practices and manufacturer's recommendations.

B. The flowmeter shall be capable of measuring the pump discharge within plus or minus 5 percent of true flow for rates from 800 gpm to 2,100 gpm.

C. The Contractor shall also furnish, install, and use a backup flowmeter during each pumping test.

D. The pumping tests shall be performed only with recently (within 6 months of use) calibrated flowmeters. Contractor shall submit the certificate of calibration for both flowmeters to the Engineer prior to testing.

E. Provide a gate valve, or equal, on the discharge side of the pump downstream of the flowmeter for adjustment of flow rate down to 800 gpm.

F. The pump drive, controls, and appurtenances shall be capable of being operated without interruption for a period of 72 hours.

G. The Contractor shall furnish engine-driven equipment or shall make his own arrangements for power for pumping tests.

3.04 WATER LEVEL MEASUREMENT AND CONTROL

A. Contractor shall provide and install two 1-inch diameter minimum ID pipes to permit installation of water level measuring device and electronic pressure transducer. The pipes shall terminate approximately 2 feet above the pump and be of sufficient strength to remain open for the duration of each test. The end of each pipe shall be capped and several 3/16-inch diameter holes drilled in the upper most and lower most 10 feet of each access pipe.

B. Water level measuring device and electronic pressure transducer to be provided by Engineer.

C. If wells are artesian, discharge head shall be capable of providing a watertight seal with the casing flange under artesian conditions. The wellhead assembly shall be equipped with the following items to allow water level monitoring before, during, and after testing:

1. 1-inch diameter threaded port for manual measurement of water level.
2. 1-inch diameter threaded port for installation of electronic pressure transducer.
3. If the wells are artesian, a 1/4-inch threaded port for installation of a manual pressure gauge.

3.05 PREPARATION

A. Access and Safety: Verify that access to the Site is adequate and that equipment can be safely setup and operated at the Site.

B. Verify that provisions for water, electric power, and other utilities available at the Site are adequate for execution of the Work.

3.06 OPERATION

A. The Contractor shall provide an operator during the total duration of all pumping tests as required by Owner. Failure of equipment to operate continuously throughout test may require Contractor to restart test at the beginning at no additional cost to Owner.

B. For each well following construction:

1. Variable rate step drawdown test required.
2. Four steps, approximate rates of 825, 1,240, 1,650, and 2,100 gpm. Coordinate actual rates with Engineer.
3. Contractor shall perform the following tasks during the variable rate step drawdown test:
   a. Operate the pump drive,
   b. Regulate the discharge rate,
   c. Record flow rate and water level once per hour during the test pumping period. Supplemental 1 shall be used by the Contractor to provide written record of pumping test data.
4. Pump at each stepped flow rate for approximately 120 minutes (8-hour total test time).

C. Following construction of all wells:

1. 72-hour constant-rate test required on one well.
2. 1,650 gpm anticipated pumping rate.
3. Contractor shall perform the following tasks during the 72-hour constant rate-test:
   a. Operate the pump drive,
   b. Maintain the discharge rate,
   c. Record flow rate and water level of the pumping well once per hour during the test pumping period. Supplemental 1 shall be used by the Contractor to provide written record of pumping test data.
4. Pump to remain in well up to 72 hours prior to and 72 hours following the 72-hour pumping period to allow the collection of background water levels.

D. Discharge water during each pumping test shall be directed to the discharge area as indicated on Figures 2, 3, and 4 of Section 33 21 19, Water Wells.

3.07 PRELIMINARY PUMPING TEST

A. Conduct a preliminary pumping test prior to the official 8-hour step tests and 72-hour constant rate pumping test. Operate the pump and equipment at such rates of discharge and for such periods of time as determined by the Engineer. Duration shall be 1 hour, unless otherwise directed by the Engineer, for purposes of checking operation of pumping test equipment and to design the official pumping tests.

3.08 BACKGROUND WATER LEVEL DATA COLLECTION

A. Background water level data shall be collected in the pumping well and monitoring well(s) for a minimum of 24 hours prior to and following the official 8-hour step tests and for a minimum of 72 hours prior to and following completion of the 72-hour constant rate test. The actual duration of the background data collection will be determined by the Engineer. Background water level data will be collected by the Engineer.

3.09 FURTHER DEVELOPMENT

A. If more than 20 parts per million fines are pumped out of the well after 15 minutes of pumping at the design pumping rate of the well, the Contractor shall discontinue the test and resume well development in accordance with Section 33 21 19, Water Wells.

B. After completion of the test, the Contractor shall sound the production well and if necessary, remove any sand or silt accumulated in the well as a result of the pumping test.

3.010 FIELD QUALITY CONTROL

A. Operators: Provide operators at the Site throughout the tests to continuously monitor and operate test equipment and regulate pumping rates.

3.011 SUPPLEMENTS

A. The supplement listed below, following "END OF SECTION," is a part of this Specification.

1. Supplement 1, Forms: Pumping Test Data Sheet.

END OF SECTION

PUMPING TEST DATA SHEET

Pumping Well No.:	Test Start Date:
Observation Well No(s).:	Test End Date:
Owner:	Weather:
Drilling Contractor:	Recorded by:
Well Depth (ft bls):	Well Diameter (in):
Water Level Tube Height (ft atoc):	Pump Setting Depth (ft):
Static Water Level (ft btoc):	Type of Test:

PUMPING WELL					
DATE	ACTUAL TIME	ELAPSED TIME (hours)	WATER LEVEL (ft btot)	FLOW RATE (gpm)	COMMENTS

Abbreviations: ft – feet, bls = below land surface, in = inches, atoc = above top of casing, btoc = below top of casing, btot = below top of tube, gpm = gallons per minute

SECTION 33 21 13.12
WELL VIDEO INSPECTION

PART 1 GENERAL

1.01 SUBMITTALS

A. Administrative Submittals: Schedule 10 days prior to performing inspections.

B. Shop Drawings:

1. Description of video equipment proposed for well inspection and recording information.
2. Provide a sketch showing dimensions of downhole tools, camera, light source, and showing approximate field of view when the camera is vertical in the well bore.

C. Quality Control Submittals: Provide Engineer with one copy of video (MP4 Video Files) on a thumb drive before leaving site.

D. Contract Closeout Submittals: MP4 Video Files as permanent record of video well inspections.

PART 2 PRODUCTS

2.01 VIDEO

A. Format: MP4 Video File.

PART 3 EXECUTION

3.01 EQUIPMENT

A. Provide equipment and supplies including, but not be limited to, video camera with lights, power source, and cables specifically designed and constructed for underwater operation in wells, that provides a clear, focused, well-lighted image of well, and has a system for lowering and retrieving the camera from the well; a video monitor, and video recorder.

B. Record image with video recorder directly to MP4 file.

C. Camera lens shall be capable of rotating up, from truly vertical, to 90 degrees, and also rotating side to side 360 degrees.

3.02 PREPARATION

A. Notify Owner at least 1 week prior to start of video inspection and recording.

B. Clean and sterilize equipment and support system with chlorine solution before lowering equipment into well.

3.03 INSPECTION AND TAPING

A. Perform inspection and recording only while water in well is clear. Schedule inspection after pumping test.

B. During inspection maintain continuous image on video monitor and continuously record image on video.

C. During inspection, display date and numbers indicating depth of camera below top of casing on video monitor. Record numbers with image on video.

END OF SECTION

SECTION 33 21 13.13
WATER WELL DISINFECTION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Water Works Association (AWWA):
   a. B300, Hypochlorites.
   b. B301, Liquid Chlorine.
   c. B303, Sodium ChloritFe.
   d. C654, Disinfection of Wells.

1.02 SUBMITTALS

A. Quality Control Submittal: Written documentation of the volume and concentration of chlorine solution added to the well.

1.03 SEQUENCING AND SCHEDULING

A. Commence Initial Disinfection after Completion of Following: Pump testing, geophysical logging, and borehole video of completed well.

PART 2 PRODUCTS

2.01 WATER FOR DISINFECTION AND TESTING

A. Clean, uncontaminated, and potable.

B. Contractor shall supply potable quality water and convey in disinfected pipelines or containers.

2.02 CONTRACTOR'S EQUIPMENT

A. Furnish chemicals and equipment, such as pumps and hoses, to accomplish disinfection.

2.03 MIXING DISINFECTANT

A. Use Following Proportions of Hypochlorite or Chlorine to Water:

1. Chlorine Gas or Liquid (100 Percent Cl): 1 pound per 11.75 gallons water.
   a. Apply liquid chlorine gas-water solution by means of a solution feed chlorinating device.
2. Calcium Hypochlorite (65 to 70 Percent Cl): 1 pound per 7.5 gallons water.
   a. If calcium hypochlorite is used, first mix dry powder with water to make a thick paste, then thin to a 1 percent solution (10,000 ppm chlorine).
3. Sodium Hypochlorite (5.25 Percent Cl): 1 gallon per 4.25 gallons water.
   a. If sodium hypochlorite procedure is used, dilute the liquid with water to obtain a 1 percent solution (10,000 ppm chlorine).

PART 3 EXECUTION

3.01 GENERAL

A. Disinfect all wells installed under this Project, that are intended to hold, transport, or otherwise contact raw water.

B. Prior to application of disinfectants, clean all tanks and pumps of loose and suspended material. Flush pumping system until clear of suspended solids and color. Use water suitable for flushing and disinfecting.

C. Conform to AWWA C654 for wells, except as modified in these Specifications.

D. Document and submit the volume and concentration of chlorine solution added to the well. The Contractor shall use the daily drilling log included as Supplemental 1 in Section 33 21 19, Water Wells for documentation and submittal purposes.

3.02 WELLS

A. Disinfection Procedures: In accordance with AWWA C654, unless herein modified.

1. After well has been completed and tested, it shall be cleaned of all foreign substances. Swab the inner lining using alkalies if necessary to remove oil, grease, or other extraneous matter.
2. Use chlorine solution of a volume and strength so that a concentration of at least 50 ppm of free chlorine is contained in the well.

3. Prepare and apply chlorine solution in accordance with manufacturer's directions.
4. Chlorine solution shall be placed into the well and the well surged for at least 5 minutes. After 4 hours, the well shall be pumped or bailed until the chlorine concentration is less than 5 ppm.
5. Temporary pump bowls, column, and air-line shall be thoroughly washed, first with clear water and then with a 200 ppm free chlorine solution immediately before being placed into the well.
6. Prior to capping place additional chlorine solution into the well in such volume and strength to result in a concentration of at least 50 ppm of free chlorine in all parts of the well.
7. Allow chlorine solution to stay in the well for 24 hours prior to capping. Then pump solution out of the well and dispose in accordance with applicable regulations and as described in this section.
8. Thoroughly wash the inside of the well casing above the water surface with 200 ppm free chlorine solution before capping.

3.03 DISPOSAL OF DISINFECTING WASTEWATER

A. Do not allow flow into a waterway without neutralizing disinfectant residual.

1. See AWWA C652-92 for acceptable neutralization methods.

B. The Contractor shall obtain all permits required for discharge.

END OF SECTION

SECTION 33 21 19
WATER WELLS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Petroleum Institute (API):
   a. SPEC 5L, Specification for Line Pipe, 38th Edition.
   b. API 10-A, Specification for Materials and Testing for Well Cements.
2. American Society for Testing and Materials (ASTM):
   a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded, and Stainless.
   b. A139, Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over).
   c. C33, Fine Aggregate.
   d. C150, Standard Specification for Portland Cement.
   e. C494, Standard Specifications for Chemical Admixtures for Concrete.
   f. D1586, Standard Method for Penetration Test and Split-Barrel Sampling of Soils.
   g. D1785, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   h. F480, Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), Schedule 40 and Schedule 80.
3. American Water Works Association (AWWA):
   a. A100, Standard for Water Wells.
   b. C200, Standard for Steel Water Pipe, 6 Inches or Larger.
   c. C206, Standard for Field Welding of Steel Water Pipe.
4. Florida Administrative Code (FAC).
   a. Chapter 62-302, Surface Water Quality Standards.

1.02 SUBMITTALS

A. Copies of well construction permits issued by the SJRWMD and/or other regulatory agencies.

B. Quality Control Submittals:

1. Daily drilling log.
2. Manufacturer's Mill Certificate on surface and final steel casings prior to installation.
3. Drilling Fluid Additives: NSF/ANSI Standard 60 certified for potable use.
4. Grout Seal Additives: NSF/ANSI Standard 60 certified for potable use.

C. Fluid management and discharge plan. Address at a minimum the following:

1. Lost circulation zones.
2. Reverse-air discharge.
3. Artesian flow management.
4. Discharge during pumping tests.
5. Management of turbidity.

D. Contract Closeout Submittals:

1. Final well logs (Two copies).
2. Video logs (Two copies).
3. Field Geophysical Logs: Provide electronic copies of ASCII raw data files in *.LAS format and PDF files of each log on an external USB drive before leaving the site.
4. Final Geophysical Logs: Email final version of ASCII files in *.LAS format and PDF files of each log.
5. Copies of well completion reports and other relevant correspondence submitted to the regulatory agencies.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver dry cement to site in bags or bulk. Store and protect from contamination in accordance with AWWA A100.

1.04 SCHEDULING AND SEQUENCING

A. Notify Owner of proposed drilling start date at least 5 working days before drilling begins. Notify Owner of anticipated delays whenever they become apparent. Notify Owner at least 2 working days in advance of weekend or after hours' work or work outside of normal working hours.

PART 2 PRODUCTS

2.01 CASING

A. Materials Permanently Installed in Wells: New steel pipe conforming to ASTM A53, Grade B, final casing shall be 20-inch OD with 0.375-inch wall thickness, and surface casing shall be 30-inch OD with 0.375-inch wall thickness.

B. Dimensions:

Nominal Diameter (inches)	Casing Type	Inside/Outside Diameter (inches)	Wall Thickness (inches)	Weight per/ft
20	Final	19.25/20	0.375	78.60
30	Surface	29.25/30	0.375	118.65

C. Pipe intended for joining by field butt-welding shall be provided with ends trued and beveled.

D. Fittings: Standard manufacture for the intended application and compatible with the well casing.

2.02 GROUT SEAL

A. Portland Cement: Conform to ASTM C150, Type II.

B. Grout Additives:

1. Additives such as bentonite to reduce shrinkage, other admixtures (ASTM C494) to reduce permeability, increase fluidity, and control set time, shall be suitable for use in water well construction.
2. Use of additives and composition of resultant slurry, shall be subject to Engineer's approval.

2.03 GROUT MIXES

A. Neat Cement: 1 cubic foot of Portland cement to not more than 6 gallons of water.

PART 3 EXECUTION

3.01 DRILLING EQUIPMENT

A. Provide rotary drilling rigs and accessories required to complete the well(s) as specified.

B. Provide drill rods with a minimum outside diameter of 5-inches.

3.02 TEMPORARY PIPING

A. Provide temporary settling tanks, piping, and appurtenances to filter and convey water produced by drilling, development, and testing to the designated discharge locations.

3.03 DRILLING

A. Wells shall be drilled by the direct circulation mud-rotary method prior to setting final casing, unless otherwise approved by Engineer.

B. The open borehole below the final casing shall be drilled using air reverse circulation rotary methods.

C. Drilling Fluids and Additives:

1. Approved for use in potable water wells.
2. Suitable to complete well as specified.

3.04 PILOT HOLE DRILLING AND SAMPLING

A. Drill exploratory pilot hole to full depth of each casing string prior to installation of casings.

B. Drill exploratory pilot hole while reverse-air drilling below the 20-inch final casing unless otherwise approved by Engineer.

C. Exploratory pilot holes shall be 8 to 12 inches in diameter.

D. As boreholes are advanced, collect representative formation samples at 10-foot intervals. Each sample shall be approximately 1 pint in volume. Samples shall be placed in a permeable cloth sample bag labeled in an indelible way, with date, well identification, and depth at which sample was collected. Samples will be stored onsite in a location which is not exposed to direct sunlight or rain. It shall be the Contractor’s sole responsibility to collect, protect, and deliver the formation samples, properly labeled, to the Owner’s onsite representative.

E. An appropriate container shall be a permeable cloth sample bag with attached marking label, such as the 4-1/2-inch by 6-inch bag manufactured by Hubco.

3.05 WATER SAMPLES

A. While drilling using reverse air methods, the Contractor shall collect representative water samples at the change of each drill rod (approximately 30 feet intervals). Samples shall be collected in new plastic bottles that have a capacity of not less than 16 fluid ounces and that are equipped with nonmetallic caps. Each bottle shall be rinsed twice with the water to be sampled before collecting the corresponding sample. Engineer reserves the right to shorten the sampling interval as necessary.

B. Sample bottles shall be clearly labeled in an indelible way with the description of the well, depth, time and date of collection. It shall be the Contractor's sole responsibility to collect, protect, and deliver the water samples, properly labeled after collection, to Owner's onsite representative. Should the water samples need to be temporarily stored on site, the Contractor shall store the samples in a location which is not exposed to direct sunlight or rain.

C. The Contractor shall make provisions as necessary during construction and testing activities to account for and control flowing artesian conditions which may be encountered in the Floridan aquifer at the well sites.

3.06 BOREHOLE

A. Drill boreholes to the approximate dimensions and depths as shown in Figure 5 and 6.

B. Drill boreholes sufficiently straight and plumb per Section 3.11 to permit installation of casing.

C. Prior to geophysical logging, condition the borehole to allow the free passage of the logging tools to bottom.

3.07 LOGS

A. Maintain up-to-date daily logs of drilling progress.

B. Maintain current copy of logs at drill site for inspection.

C. Maintain Borehole Log Containing:

1. Description of geologic materials and depth encountered.
2. Depths of lost circulation.
3. Methods used to regain circulation.
4. Time, depth, and description of unusual occurrences or problems during drilling.
5. Diameter and length of casing installed.

D. Daily Log: Use Daily Drilling Report form located at the end of this section.

E. Final Well Log:

1. Completion date.
2. Well identification.
3. Location.
4. Borehole diameters.
5. Depth to bottom of casing and bottom of borehole.
6. Diameters and wall thicknesses of casing.
7. Range of depth of each cemented zone and quantity of cement used.
8. Other information from daily logs pertinent to well construction.

3.08 MANAGEMENT DISPOSAL OF CUTTINGS AND DRILLING FLUIDS

A. The Contractor shall be responsible for collection, storage, and disposal of mud-rotary cuttings and drilling fluids.

B. The drilling will be accomplished using circulation systems designed and constructed so that under no conditions shall there be an overflow. The Contractor is required to take all necessary steps to prevent accidental spillage from occurring. Frac tanks and other containers shall be used for the settling and/or storage of drill cuttings and solids and must be leak free.

C. The Contractor shall submit plans for a fluid management system to the Engineer for review. This Project will require decanting and removal of solids of all drilling and testing fluids drilling and development operations. After settling, the liquid portion of the fluids will be directed from the settling tanks to the discharge areas designated in Figures 2, 3, and 4. During the final pumping test, when water is free of turbidity, discharge water will also be pumped to the discharge areas shown in Figures 2, 3, and 4. The Contractor shall be responsible for ensuring that no adverse environmental impacts or violations occur as a result of the well construction activities and discharge of drilling and testing fluids.

D. The Contractor shall meet the surface water quality threshold for turbidity established by FAC Chapter 62-302 Surface Water Quality Standards, which is no more than 29 NTUs above natural background conditions, prior to discharging. The natural background turbidity conditions of nearby surface water bodies will be established by the Engineer prior to commencement of work. The Engineer will also measure the turbidity level of water discharged from the well sites a minimum of once per day during reverse-air drilling and development activities.

3.09 PROTECTION OF WATER QUALITY

A. Prevent contaminated water, gasoline, or other harmful substances from entering well, either through opening or by seepage into ground.

B. Do not allow cuttings or drilling fluids to contaminate ground or surface water.

C. Contractor shall obtain any required permits for offsite discharge.

3.10 INSTALLATION OF CASING

A. It is the Contractor's sole responsibility to control the flow of the well at all times.

B. The Contractor is responsible for providing a contingency plan for installing surface or final casing through lost circulation zones that may be encountered. The Contractor shall submit to Engineer a plan for approval prior to any Work.

C. Install casing to approximate depth as shown on Figure 3 or as directed by Engineer.

1. Provide joint with same structural integrity as casing itself.
2. Provide centralizers, casing shoes, grouting accessories, and other fittings necessary to complete the well.

D. Join Casing Ends Watertight:

1. Steel: Welding shall be in conformance with AWWA C206.

E. Install Casing Centralizers:

1. One set 5 feet above bottom.
2. One set 40 feet above bottom.
3. One set 100 feet above bottom.
4. One set every 100 feet thereafter to nearest 100 feet from ground surface.

F. A centralizer set includes four equally spaced centralizing guides equally spaced around the casing at each required depth.

G. Attach Centralizers Vertically to Casing:

1. Arranged in four vertical and straight lines along casing.
2. Spaced 90 degrees apart to allow maximum clearance for tremie pipes.

H. Surface and Final Casings: Install and cement in hole not less than 5 inches greater in diameter than nominal diameter of casing, unless otherwise directed by Engineer.

3.11 STRAIGHTNESS AND ALIGNMENT TEST

A. The well shall be adequately plumb and straight so as not to interfere with the installation and operation of the permanent pump and appurtenances.

B. The well shall be deemed adequately plumb if the horizontal displacement from the vertical is less than 2/3 the diameter of the inner casing per 100 feet in the cased part of the well. The alignment test shall be conducted as described in AWWA A100 Appendix C.

C. The test shall be conducted on the upper 200 feet of the final 20-inch casing.

3.12 TEMPORARY CASING FLANGE

A. The temporary casing flange for each well shall be set 4 feet above the existing grade and capped with a 20-inch ANSI blind flange to create a watertight seal. The blind flange shall be equipped with a 2-inch access port and ball valve.

B. Refer to Figures 5 and 6 at the end of this section.

3.13 MIXING AND PLACING GROUT FOR CASING CONSTRUCTION

A. Consistency and method of mixing will be reviewed by Engineer prior to grouting. Top of each grout stage shall be tagged with the tremie pipe and the next stage of grout shall be placed with the tremie pipe positioned within 2 feet of the tag depth.

B. Engineer will review method of grout placement.

1. Force grout from bottom of casing to ground surface using the tremie pipe and pressure grout method.
2. Grout continuously filling entire annulus in one operation, if possible. Stage cement in separate lifts, if necessary.

3. Drilling operations not permitted until grout has cured.
4. Curing time for grout is 24 hours.

3.14 MIXING AND PLACING GROUT FOR BACKPLUGGING

A. Consistency and method of mixing shall be reviewed by the Engineer prior to grouting.

B. Grout shall be placed from the total depth of the borehole up to the target back plugging depth. Lost circulation zones may require a short interval of gravel.

C. Grout shall be placed at the bottom and working up the borehole using the tremie method.

D. Grouting may require several stages.

E. Minimum cure time between cement stages is 12 hours.

F. Cure time following placement of final cement stage is 24 hours.

3.15 WELL DEVELOPMENT

A. Develop wells until the water is free of sand and suspended solids, and the maximum production capacity of the wells is achieved. Sand content of the water shall not exceed 5 mg/L when pumping at 110 percent of the design pumping rate. The Contractor shall provide a sand content measuring device such as a Rossum centrifugal sand separator or a sand sampler as shown in Appendix D of AWWA A100, or equal. The Contractor shall also provide a tap for sampling discharge water during development. The Engineer will measure the sand content of the discharge water a minimum of once per day during development activities.

B. Develop wells in accordance with AWWA A100. Install air line and develop wells by surging the wells vigorously with air followed by high rate continuous air lifting.

C. Continue development until the wells are free of turbidity, sand, and no increase in capacity is observed, as directed by Engineer.

D. Air lifting compressor and equipment shall be capable of producing a minimum flow of 500 gpm through the casing during continuous air lifting.

E. Water and solids produced during the development shall be disposed of as specified in Section 33 21 13.10, Well Pumping Test, or other applicable sections.

F. The static water level in the wells shall be allowed to recover overnight prior to starting the well pumping test.

3.16 WELLHEAD COMPLETION

A. After each well has been completed and tested, it shall be thoroughly cleaned of all foreign substances.

B. Disinfect wells in accordance with Section 33 21 13.13, Water Well Disinfection.

C. Following disinfection, the Contractor shall install a casing flange with companion blind flange (leak-proof) equipped with a 2-inch access port and ball valve on the final joint of 20-inch casing of each well. The Contractor shall set the face of the casing flanges in accordance with Section 3.13, Temporary Casing Flange.

3.17 SUPPLEMENTS

A. The supplement and figures listed below, following "END OF SECTION," are a part of this Specification.

1. Supplement 1, Forms: Daily Drilling Report.
2. Figure 1, JEA Rivertown WTP Wells No. 1, 2, and 3 Location Map.
3. Figure 2, JEA Rivertown WTP Well No. 1 Proposed Site Plan.
4. Figure 3, JEA Rivertown WTP Well No. 2 Proposed Site Plan.
5. Figure 4, JEA Rivertown WTP Well No. 3 Proposed Site Plan.
6. Figure 5, JEA Rivertown WTP Well Nos. 1 and 3 Well Schematic.
7. Figure 6, JEA Rivertown WTP Well No. 2 Well Schematic.

END OF SECTION

DAILY DRILLING REPORT

Date:_____ Owner:_____

Well No.:_____

Casing/Hole Diameter _____ inch Well Location:_____

Depth of Well

Start of Shift _____ feet

End of Shift _____ feet

Depth to Water (belowground)

Start of Shift _____ feet

End of Shift _____ feet

Log of Materials Encountered

Description	Depth From	Depth To

Remarks: (Character of drilling, casing added, miscellaneous work items, problems, or unusual occurrences)

_____

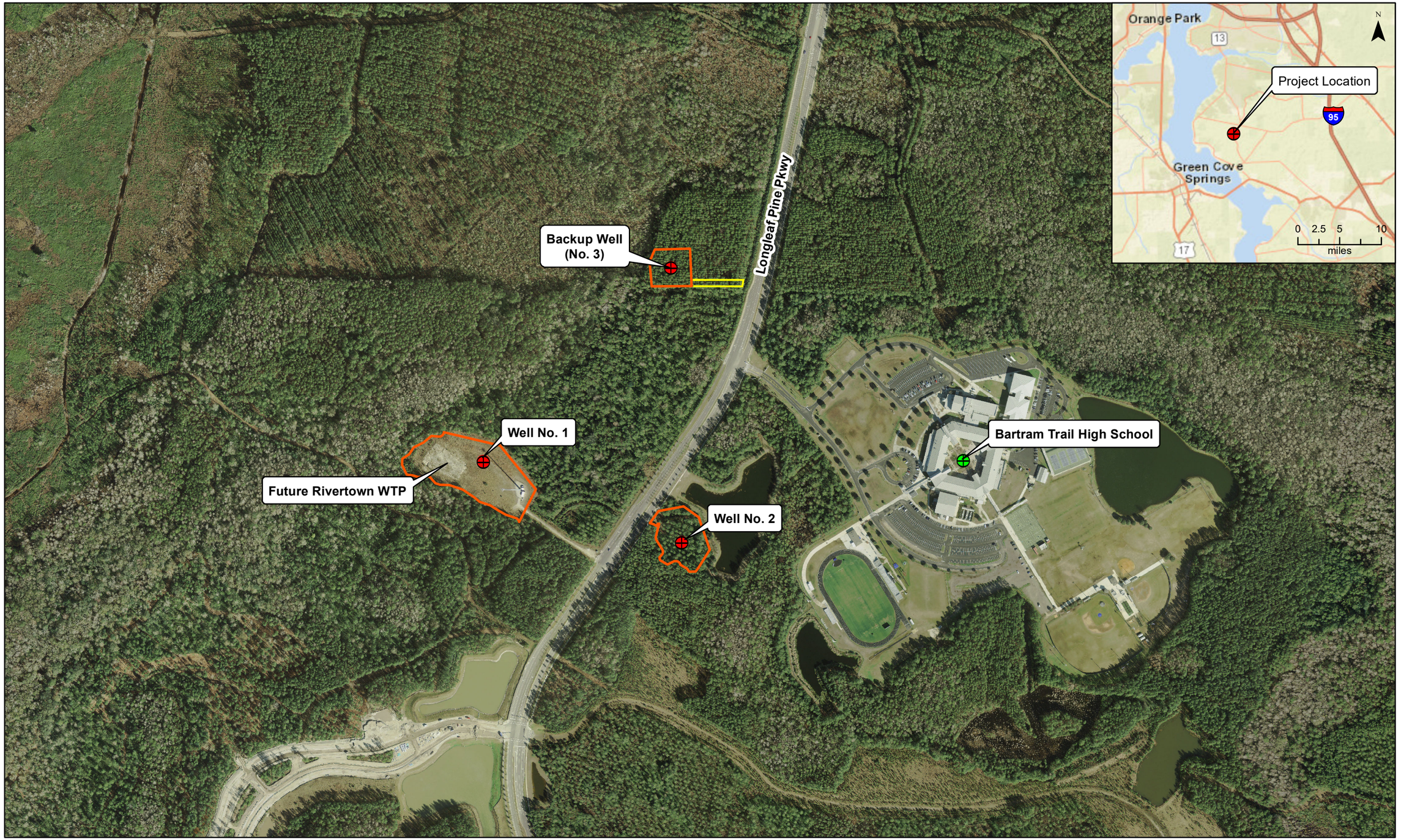
_____

_____

Driller:_____

Helper:_____

(Use other side for more comments)



LEGEND

- Proposed Well Locations
- Property Boundary
- Access Easement

0 500 1,000 2,000
Feet

N

Figure 1
Project Location Map
JEA Rivertown Water Treatment Plant
Well Nos. 1, 2, and Backup Well (No. 3)

JEA
JACOBS

Last Updated: DRAFT20200211
Figure1_Rivertown_Well_Location_Map
Source Data: FDOT APLUS 2016, Florida Geographic Library, JEA, ESRI, Duval County, Florida Division Emergency Management

N

0 80 160 240

Scale In Feet

DESIGNATED FLUIDS DISCHARGE AREA DURING REVERSE AIR DRILLING AND PUMPING TEST

JEA PROPERTY LINE (TYP)

100' SJRWMD WELL SETBACK

WATER GENERATED DURING REVERSE-AIR DRILLING WILL BE SETTLED AND FILTERED BEFORE BEING CONVEYED TO THE DESIGNATED DISCHARGE AREA. TURBIDITY OF THE DISCHARGE WATER SHALL NOT EXCEED 29 NTU ABOVE BACKGROUND.

TEMPORARY DISCHARGE PIPE

NEW WELL NO. 1

N 2 076 934.99
E 460 656.01

LONGLEAF PINE PARKWAY

EXISTING SWING GATE

SILT FENCING/ EROSION & SEDIMENT TRANSPORT CONTROL

APPROXIMATE LOCATION OF TEMPORARY CONSTRUCTION FENCE. CONTRACTOR IS RESPONSIBLE FOR FINAL TEMPORARY FENCE LAYOUT WITHIN THE FUTURE RIVERTOWN WTP SITE AS NEEDED FOR WELL CONSTRUCTION , SECURITY, AND SAFETY OF THE PUBLIC.

FIGURE 2 - WELL NO. 1 SITE PLAN

JEA RIVERTOWN WTP WELL NOS. 1, 2, & BACKUP WELL (NO. 3)

JACOBS

FILENAME: RIVERTOWN WELL NO. 1 SITE PLAN.dgn PLOT DATE: 2020\02\07 PLOT TIME: 3:24:57 PM

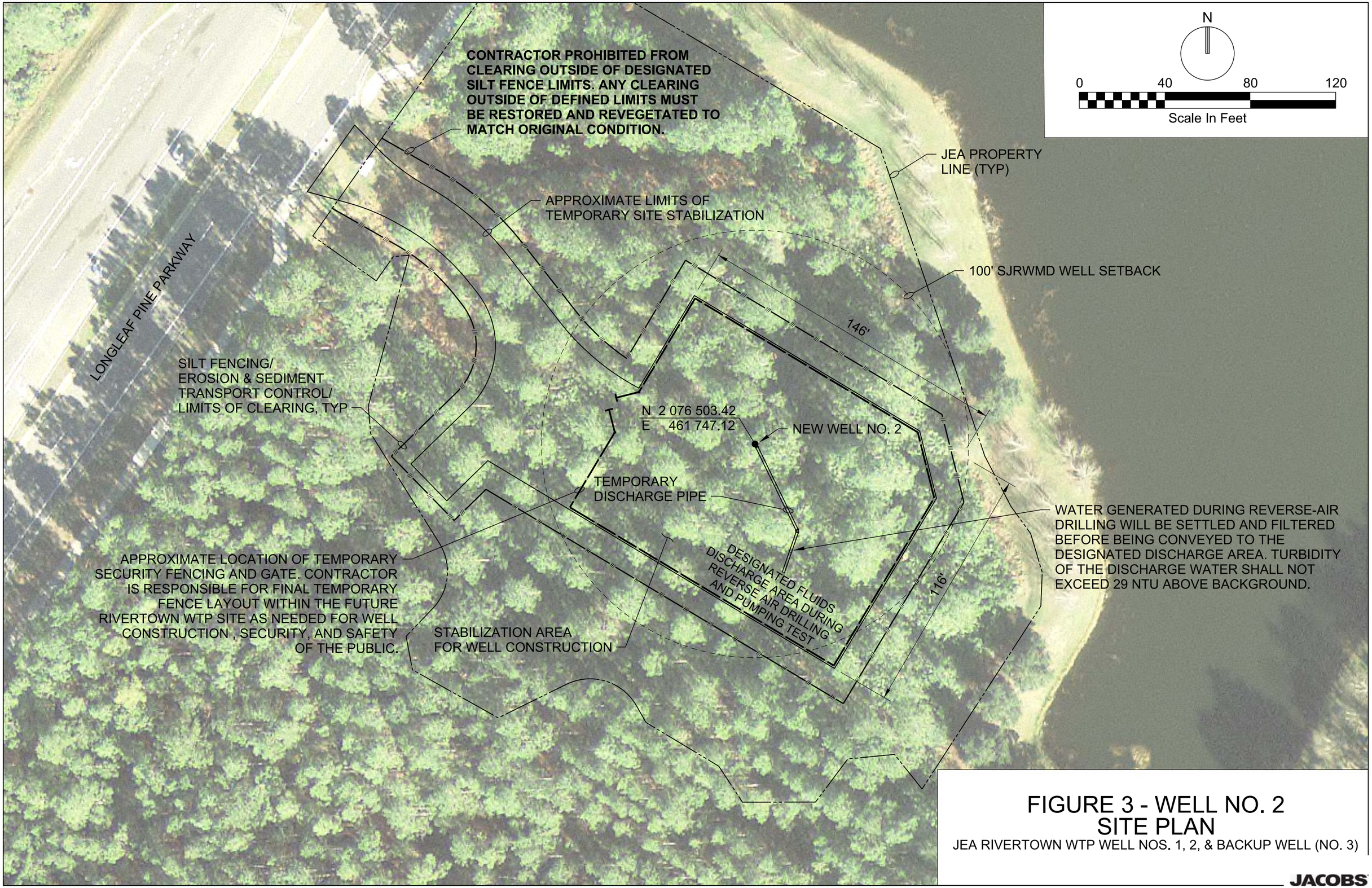


FIGURE 3 - WELL NO. 2 SITE PLAN

JEA RIVERTOWN WTP WELL NOS. 1, 2, & BACKUP WELL (NO. 3)

JACOBS

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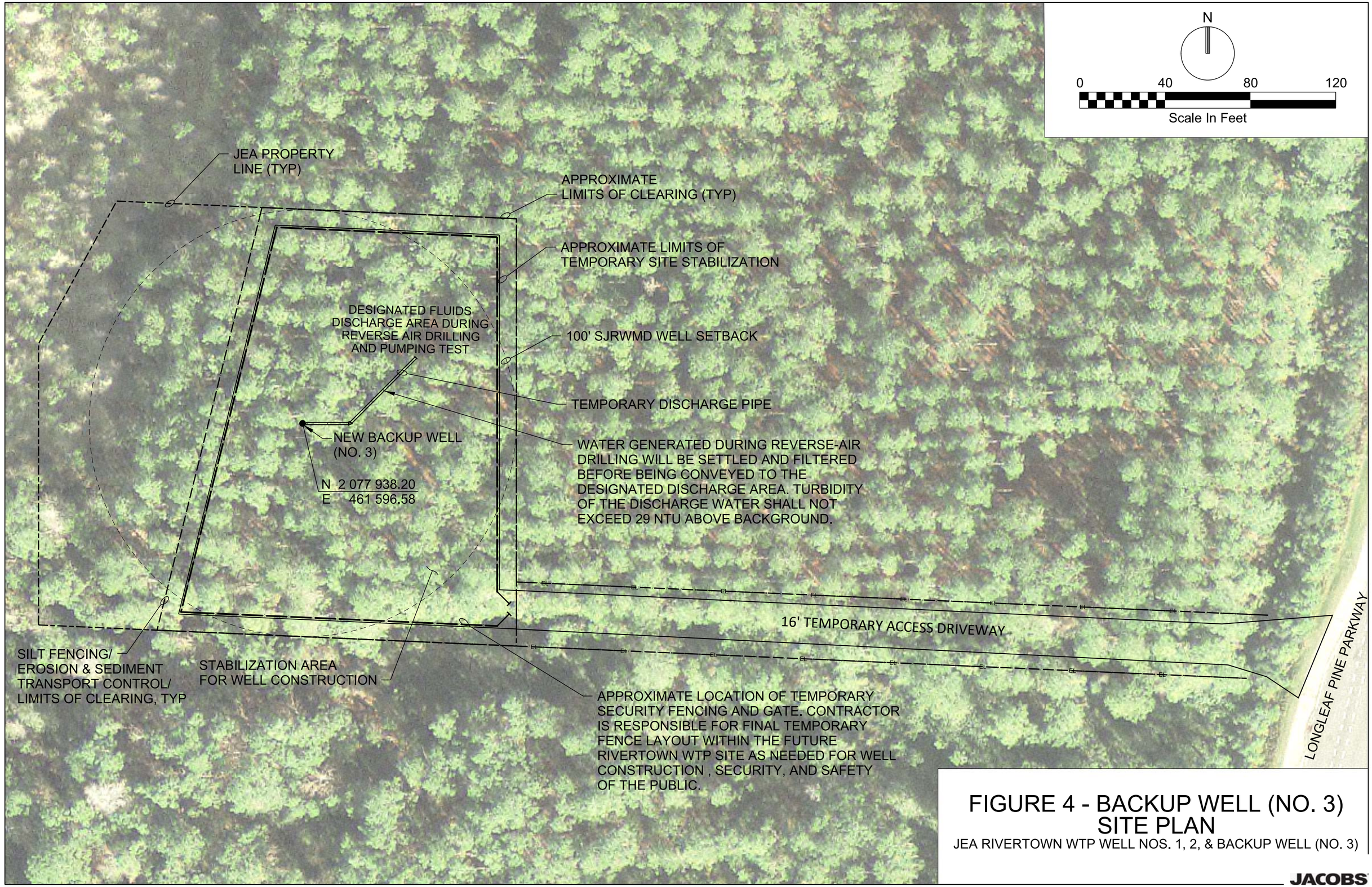

FIGURE 4 - BACKUP WELL (NO. 3) SITE PLAN

JEA RIVERTOWN WTP WELL NOS. 1, 2, & BACKUP WELL (NO. 3)

JACOBS

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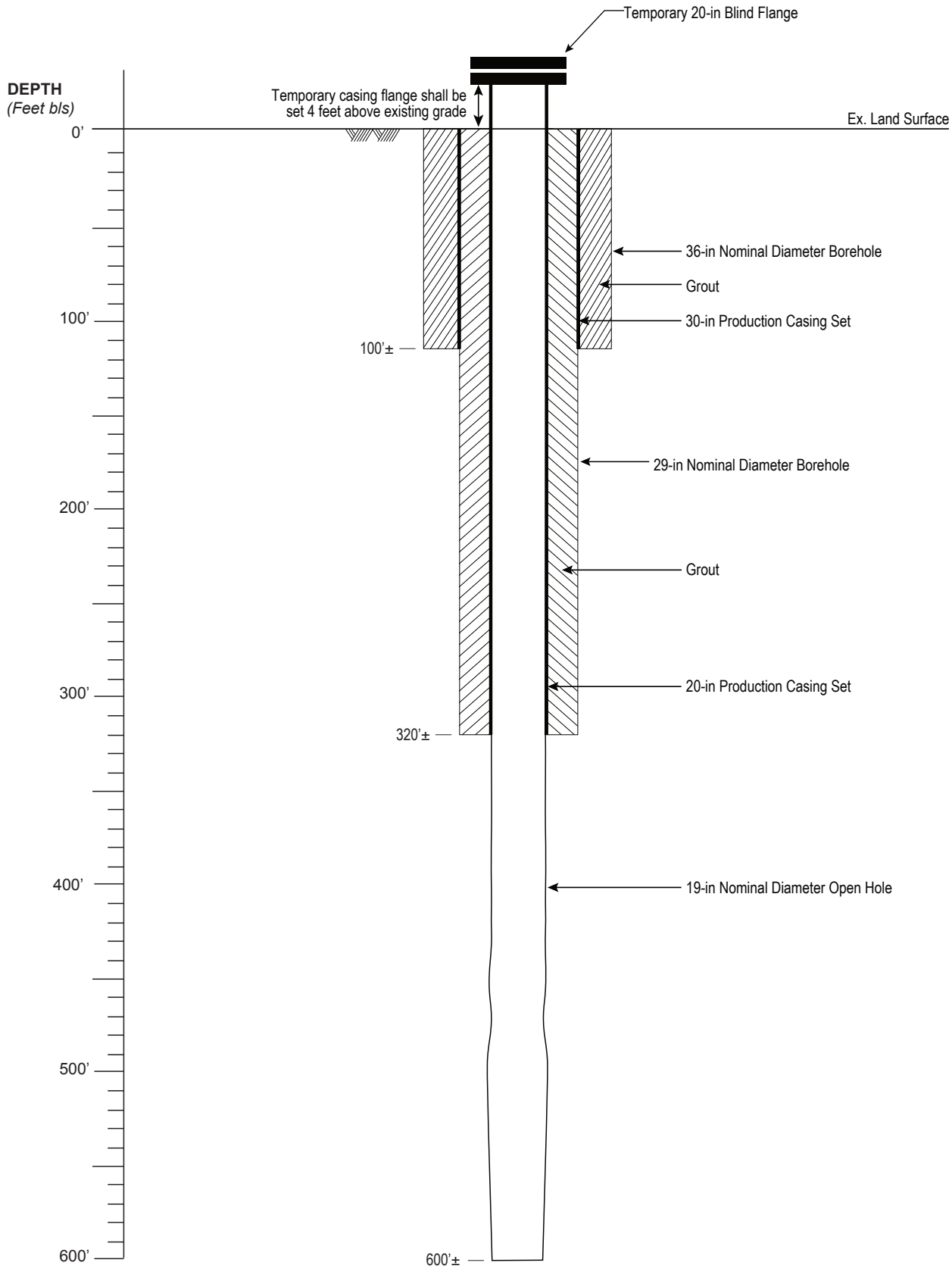

NOTES:

1. Actual casing lengths and well depth will depend on site-specific hydrogeologic conditions and will be field determined in concurrence with Engineer.
2. bls = below land surface

0830191423JAX Rivertown_Fig5_Well1_Schemematic_Specs_v1.ai

Figure 5.
Well No.1 Schematic
JEA Rivertown WTP Well Nos. 1, 2, and 3

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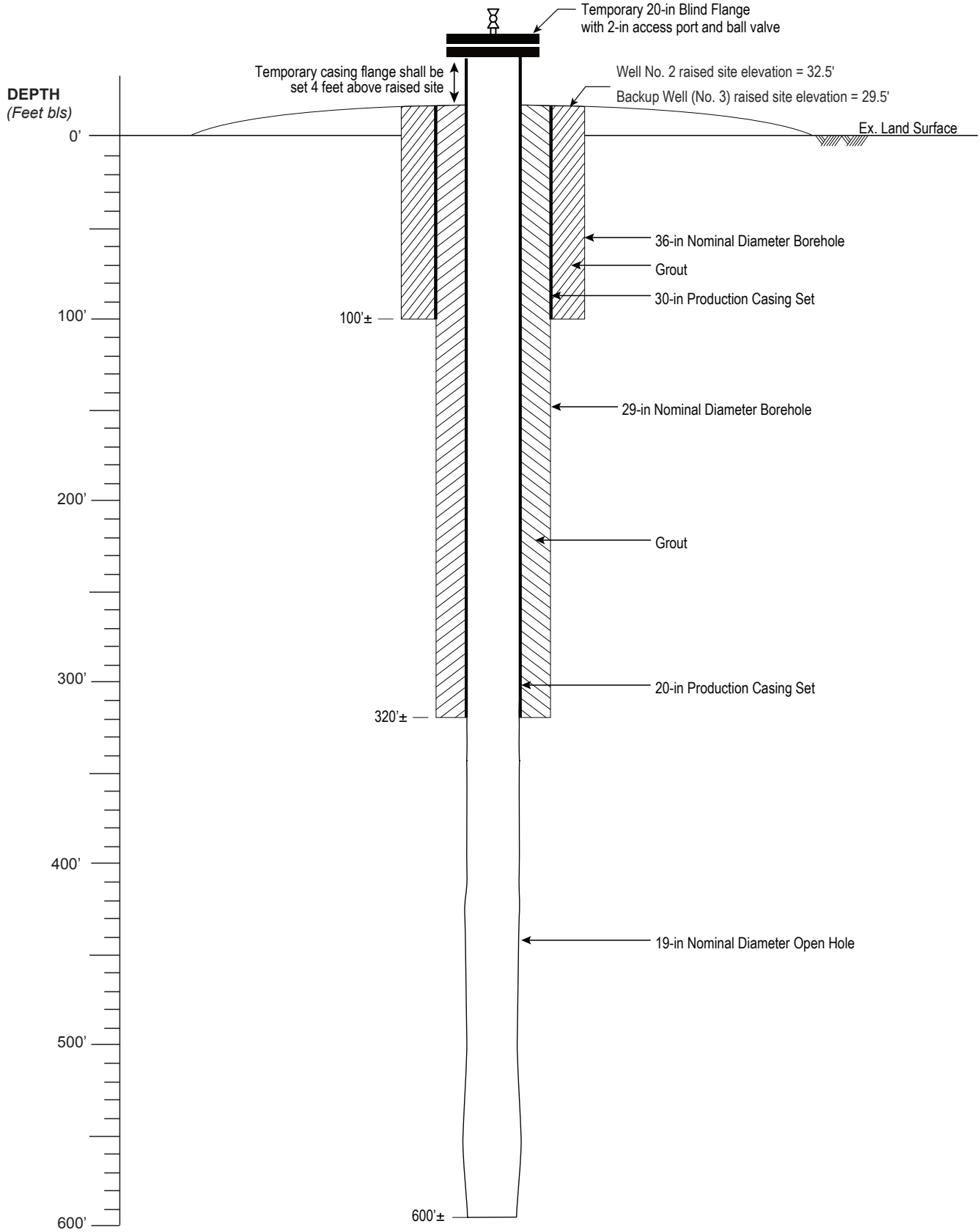

NOTES:

1. Construction details are based on lithogic date from nearby wells; however, actual casing lengths and well depth will depend on site-specific hydrogeologic conditions and will be field determined in concurrence with Engineer.
2. Raised site shall be constructed in accordance with the Rivertown WTP Well Nos. 2 & 3 Site Preparation for Well Drilling Drawings
3. bls = below land surface

Figure 6.
Well No. 2 and Backup Well (No. 3) Schematic
JEA Rivertown WTP Well Nos. 1, 2, and Backup Well (No. 3)

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APPENDICES

APPENDIX 1
Geotechnical Exploration and Evaluation Report

CSIGeo

Geotechnical · CMT · CEI

Geotechnical Exploration and Evaluation Report
Phase 2

Rivertown Water Treatment Plant
St. Johns County, Florida

CSI Geo Project No.: 71-19-127-02
CDM Smith Project No.: 237938
Purchase Order: 91630
JEA Contract No.: 141-18

Prepared by:

CSI Geo, Inc.
2394 St. Johns Bluff Road S., Suite 200
Jacksonville, FL 32246
Tel: (904) 641-1993
Fax: (904) 641-0057

Prepared for:

CDM Smith, Inc.

June 29, 2020

CSI Geo

Geotechnical · CMT · CEI

June 29, 2020

Mr. David J. Prah, P.E.
CDM Smith Inc.
4651 Salisbury Road, Suite 420
Jacksonville, Florida 32256

RE: Rivertown Water Treatment Plant
St. Johns County, Florida

Subject: Geotechnical Exploration and Evaluation Report (Phase 2)
CSI Geo Project No.: 71-19-127-02
CDM Smith Project No.: 237938, Purchase Order: 91630
JEA Contract No.: 141-18

Dear Mr. Prah:

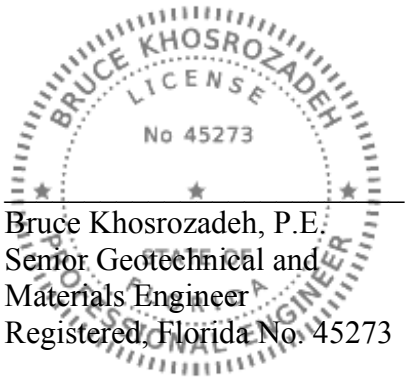
CSI Geo, Inc. (CSI Geo) has performed the authorized geotechnical exploration and laboratory testing program at the proposed site of the Jacksonville Electric Authority (JEA) Rivertown Water Treatment Plant in St. Johns County, Florida. The overall design includes three wells (Well Nos. 1, 2, and 3), a ground storage tank (GST), a retention pond, new pipelines, an access road, and miscellaneous structures. The geotechnical investigation was conducted in two phases. The preliminary phase (Phase No. 1) was conducted for the 100-foot diameter Ground Storage Tank (GST No. 1), retention pond, and miscellaneous structures located within the area of Well No. 1. The findings of Phase No. 1 were presented in a Preliminary Geotechnical Exploration and Evaluation Report submitted on January 22, 2020. The second and final phase (Phase No. 2) was conducted for Well Nos. 2 & 3, the access road, and the new pipelines. This report presents our understanding of the subsurface conditions along with our geotechnical design and construction recommendations for Phases No. 1 & 2.

We have enjoyed working with you on this project and look forward to working with you on future projects. If you have any questions concerning this report, please contact our office.

Sincerely,

CSI Geo, Inc.

Nader Amer, Ph.D
Project Engineer



Bruce Khosrozadeh, P.E.
Senior Geotechnical and Materials Engineer
Registered, Florida No. 45273

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- Recommended Soil Parameters for Sheet Pile Walls
- Tank Settlement Analysis Results
- Summary of Laboratory Test Results
- Grain Size Distribution Curves

Appendix C – General Information

- Key to Soil Classification
- Field and Laboratory Test Procedures

1.0 PROJECT INFORMATION

1.1 General Project Information

The purpose of this geotechnical exploration program was to develop information concerning the subsurface conditions in order to evaluate the site with respect to the proposed JEA Rivertown Water Treatment Plant (WTP) located along CR 244, just south of Greenbriar Road and west of Bartram Trail High School in St. Johns County, Florida. A Site Location Map is included in **Appendix A**.

The overall design includes three wells (Well Nos. 1, 2, and 3), a ground storage tank (GST), a retention pond, new pipelines, an access road, and miscellaneous structures. The geotechnical investigation was conducted in two phases. The preliminary phase (Phase No. 1) was conducted for the 100-foot diameter Ground Storage Tank (GST No. 1), retention pond, and miscellaneous structures located within the area of Well No. 1. The findings of Phase No. 1 were presented in a Preliminary Geotechnical Exploration and Evaluation Report submitted on January 22, 2020. The second and final phase (Phase No. 2) was conducted for Well Nos. 2 & 3, the access road, and the new pipelines. This report presents our understanding of the subsurface conditions along with our geotechnical design and construction recommendations for Phases No. 1 & 2.

1.2 Project Description and Existing Conditions

The overall proposed project features include Well Nos. 1, 2, and 3, concrete pads, a ground storage tank, chemical chlorine storage pad, high service pump station building, generator pad, fuel tank pad, a retention pond inside Well No. 1 area, the access road to Well No. 3, pipelines installed by Horizontal Directional Drilling (HDD) along the west side of Longleaf Pine Parkway, and open cut method of installation pipelines along the east side of Longleaf Pine Parkway.

The site in the gated area of Well No. 1 is relatively flat and cleared with scattered shrubs and small trees. An elevated pre-load embankment approximately two feet higher than the surrounding existing ground surface is situated at the northwest corner of the site. The pre-load embankment was constructed as part of previous plans to construct a ground storage tank, and

the pre-load embankment was intended to reduce the anticipated total settlement. Also, an existing cell tower is located at the southeast corner of the site.

The sites at Wells Nos. 2 and 3 are heavily wooded and gently sloping. Well No. 2 area was partially wet during our geotechnical investigation. We understand that a new access road to Well No. 3 will be constructed, and that the eastern portion of the access road will be retained using permeant sheet pile walls at the intersection with Longleaf Pine Parkway.

The new pipelines consist of HDD pipelines to be installed along the western side of Longleaf Pine Parkway with the entry and exit pits located in front of Well No. 1 area from the south, and Well No. 3 area from the north. The new pipelines also consist of pipes to be constructed using open cut method of installation and to be installed across Longleaf Pine Parkway to connect with existing pipelines along the eastern side of Longleaf Pine Parkway. The site at the new pipeline corridors is generally flat along Longleaf Pine Parkway embankment and surrounded by wetlands and heavily wooded areas from the east and west outside the roadway embankment.

Information regarding this project was provided to CSI Geo, Inc. (CSI Geo) by Mr. David Prah, P.E. of CDM Smith, Inc. (CDM Smith).

2.0 GEOTECHNICAL EXPLORATION

2.1 Field Exploration

The locations of the test borings (Standard Penetration Test borings & Auger borings) were selected by CDM Smith and located in the field by personnel from CSI Geo using handheld GPS equipment. Therefore, the test locations should be considered approximate. The approximate geographical coordinates for each test location are presented on the Report of SPT Borings and Report of Core Borings included in **Appendix B**. All Standard Penetration Test (SPT) borings were grouted to full depth after boring completion. Soil samples collected were visually classified in the field and then transported to our laboratory for re-classification and testing. Representative soil samples obtained during our field exploration program were visually classified using the Unified Soil Classification System (USCS). The approximate locations of the SPT and auger borings are shown on the Field Exploration Plan sheet included in **Appendix A**. A brief discussion of the drilling, sampling, and field-testing techniques used during the field exploration program is provided in the Field and Laboratory Test Procedures sheet presented in **Appendix C**.

The Report of SPT Borings and Report of Core Borings sheets are included in **Appendix B** and present the descriptions of the subsurface soils encountered, the groundwater levels encountered and the penetration resistance, recorded at the time of drilling. The stratification lines and depth designations on the boring records represent the approximate boundary between the various soils encountered, and the transition from one stratum to the next should be considered approximate.

2.1.1 Ground Storage Tank

The ground storage tank was explored by means of four SPT borings (B-1 through B-4) located at equal distances along the perimeter of the tank and drilled to a depth of 50 feet below the existing ground surface. The center of the tank was explored by means of SPT boring B-5 drilled to a depth of 100 feet below the existing ground surface.

2.1.2 Pump Station Building, Wells, and Structures on Concrete Pads

The Well No. 1 concrete pad, the chemical chlorine storage pad, high service pump station building, generator pad, and fuel tank pad were explored by means of a total of six SPT borings

(B-6 through B-11) drilled to a depth of 20 feet below the existing ground surface. Wells Nos. 2 and 3 were explored by means of SPT borings B-18 and B-19, respectively, drilled to a depth of 20 feet below the existing surface. Boring B-19 was extended to 25 feet to extend beneath very loose soils encountered at a depth of 20 feet below the existing ground surface.

2.1.3 Horizontal Directional Drilling (HDD)

The HDD pipeline alignment was explored by means of a total of four SPT borings (B-12 through B-15). SPT boring B-12 was drilled to a depth of 40 feet and SPT borings B-13, B-14, and B-15 were drilled to a depth of 75 feet below the exiting ground surface.

2.1.4 Open Cut Method of Pipe Installation

The open cut pipelines were explored by means of SPT borings B-16 and B-17 drilled and extended to the depths of 25 and 30 feet, respectively, below the existing ground surface.

2.1.5 Access Road & Sheet Pile Walls

As instructed by CDM Smith, the area of the proposed access road was evaluated using SPT boring B-15 performed for the HDD pipeline due to its close proximity to the access road entrance and the sheet pile walls locations. SPT boring B-15 was drilled to a depth of 75 feet below the existing ground surface.

2.1.6 Retention Pond

The area of the proposed retention pond was explored by means of a total of two auger borings (A-1 and A-2) drilled to a depth of 15 feet below the existing ground surface.

2.2 Laboratory Testing

Quantitative laboratory testing was performed on representative samples of the soils collected during the field exploration program and were performed to better define the composition of the soils encountered. Representative samples for the laboratory testing program were selected and the laboratory tests were performed to determine moisture contents, fines content, organic content, grain size analyses, and Atterberg limits of the soils encountered. Results of the laboratory testing performed are included in **Appendix B**.

3.0 SUBSURFACE CONDITIONS

3.1 General

An illustrated representation of the subsurface conditions encountered in the proposed construction areas is shown on the Report of SPT Borings and Report of Core Borings sheets presented in **Appendix B**. The soil conditions outlined below highlight the major subsurface stratification. The Report of SPT Borings and Report of Core Borings in the **Appendix** should be consulted for a detailed description of the subsurface conditions encountered at each boring location. When reviewing the Report of SPT Borings and Report of Core Borings, it should be understood that soil conditions may vary between the borings and outside of the explored areas.

3.2 Soil Conditions

It should be cautioned that soil conditions at the site are highly erratic in nature and contain unsuitable material consisting of organic and highly organic soils and clays that are variable in thickness and depth throughout the site. It is emphasized that due to the erratic nature of these soils, the thickness and depth of the unsuitable material may vary from those noted herein, and that in some locations the unsuitable material may be deeper.

3.2.1 Ground Storage Tank

Unsuitable organic slightly silty sands (SP-SM/PT) were encountered in the upper 5 to 6 feet of depth below the existing ground surface in the areas of borings B-1 and B-2. However, the unsuitable organic soils appear to be erratic in nature and therefore, the presence of unsuitable organic soils should be expected at varying depths and thicknesses throughout the site. Removal of the unsuitable organic soils will be required, and it is strongly recommended that allowances are made for possible presence of such soils in other areas of the tank.

Below the organic soils, the area is generally underlain by very loose to medium dense sands (SP), slightly silty sands (SP-SM), and silty sands (SM) to the depths of 32 to 33.5 feet followed by dense silty sands and highly weathered limestone to the depths of 35.5 to 42 feet below the existing ground surface. Underlying the weathered limestone, medium dense to dense clayey sands (SC), silty sands (SM), and hard calcareous sandy silts (ML/MH), generally referred to as

Marl formation, were encountered until the boring termination depths of 50 and 100 feet below the existing ground surface.

3.2.2 Pump Station Building and Structures on Concrete Pads

Review of test borings (B-6 through B-11) indicates that these areas are generally underlain by unsuitable organic slightly silty sands (SP-SM/PT) and organic silty sands (SM/PT), generally in the upper 4 to 8 feet of depth below the existing ground surface. Wood was also encountered in boring B-6 between the depths of 8 and 9 feet below the existing ground surface. Generally, the unsuitable organic soils and wood pieces appear to be highly erratic in nature. It is emphasized that due to the erratic nature of these soils, the thickness and depth of the unsuitable material may vary from those noted herein, and that in some locations the unsuitable material may be deeper. It should be cautioned that over-excavation of the unsuitable organic soils will be required.

Beneath the unsuitable organic soils these areas are generally underlain by very loose to medium dense sands (SP), slightly silty sands (SP-SM), and silty sands (SM) until the boring termination depth of 20 feet below the existing ground surface.

3.2.3 Well No. 1

Unsuitable organic slightly silty sands (SP-SM/PT) were encountered in SPT boring B-9 in the upper 4 of depth below the existing ground surface. It should be noted that over-excavation of the unsuitable organic soils will be required. Beneath the unsuitable organic soils, loose to dense sands (SP) were encountered until the boring termination depth of 20 feet below the existing ground surface.

3.2.4 Well No. 2

Unsuitable highly organic silty sands (SM/PT) were encountered in the upper 2 of depth below the existing ground surface. It should be noted that over-excavation of the unsuitable organic soils will be required. Beneath the unsuitable organic soils, very loose to loose sands (SP) and slightly silty sands (SP-SM) were encountered to a depth of 12 feet, followed by very loose to medium dense clayey sands (SC) until the termination depth of 20 feet below the existing ground surface.

3.2.5 Well No. 3

The area of Well No. 3 is generally underlain by very loose to medium dense sands (SP), slightly silty sands (SP-SM), and clayey sands (SC) to a depth of 12 feet below the existing ground surface. Beneath these soils, firm sandy clays (CH) were encountered to a depth of 16 feet followed by loose silty sands (SM) until the boring termination depth of 25 feet below the existing ground surface.

3.2.6 Horizontal Directional Drilling (HDD)

Review of SPT borings B-12 through B-15 indicates that the HDD corridor is generally underlain by very loose to very dense sands (SP) and slightly silty sands (SP-SM) to a depth of 17 to 37 feet below the existing ground surface. It is noted that very soft sandy clays (CL) and silts (MH) were encountered between 17 and 32 feet of depth in borings B-12 and B-13. Beneath these soils, very loose to medium dense slightly silty sands (SP-SM), clayey sands (SC) and silty sands (SM) were encountered to depths ranging from 37 to 42 feet followed by very stiff to hard sandy clays (CH, CL / MARL) and medium dense to very dense clayey sands (SC / MARL) until the boring termination depths. It should be noted that soil conditions along the HDD corridor are erratic in nature and contain very soft clays with variable thicknesses and depths and may from those noted herein.

3.2.7 Open Cut Method of Pipe Installation

Review of SPT borings B-16 and B-17 indicates that the pipeline areas to be installed by open cut method of installation are generally underlain by very loose to medium dense sands (SP), slightly silty sands (SP-SM), and silty sands (SM) to a depth of 17 to 22 feet below the existing ground surface. Beneath these soils, very soft to firm sandy clays and clays (CH) were encountered to a depth of 22 feet, followed by slightly silty sands (SP-SM) until the deepest termination depth of 25 feet below the existing ground surface.

3.2.8 Access Road & Sheet Pile Walls

Due to its close proximity, SPT boring B-15 performed for the HDD alignment was utilized to evaluate the general subsurface conditions for the access road and sheet pile walls. Review of SPT boring B-15 indicates that the area of the access road and sheet pile walls is generally underlain by very loose to dense sands (SP) and slightly silty sands (SP-SM) to a depth of 37 feet

below the existing ground surface. Beneath these soils, very stiff to hard sandy clays (CH / MARL) were encountered until the boring termination depth of 75 feet below the existing ground surface.

3.2.9 Retention Pond

Review of auger borings A-1 and A-2 indicates that the area of the retention pond is generally underlain by fine sands (SP), slightly silty fine sands (SP-SM), and silty fine sands (SM) until the borings termination depth of 15 feet below the existing ground surface. It should be cautioned that soil conditions within the proposed retention pond are highly erratic in nature and contain unsuitable material consisting of unsuitable organic and highly organic soils and clays that are variable in thickness and depth throughout the site. It is emphasized that due to the erratic nature of these soils, presence of unsuitable organic and clayey soils should be anticipated, and that the thickness and depth of the unsuitable material may vary from those noted herein, and that in some locations the unsuitable material may be deeper.

3.3 Groundwater Conditions

The groundwater levels were measured and recorded as encountered at the time of drilling. The depths of the groundwater level and estimated seasonal high water level at the test locations are marked on the Report of SPT Borings and Report of Core Borings sheets presented in the **Appendix B**.

3.3.1 Ground Storage Tank and Miscellaneous Structures

Review of the test borings B-1 through B-11 indicates that groundwater was encountered at depths ranging from 6 to 7 feet below the existing ground surface. The estimated seasonal high ground water table ranged from 5 to 6 feet below the existing ground surface.

3.3.2 Well No. 1

Review of the test boring B-9 indicates that groundwater was encountered at the depth of 6 feet below the existing ground surface. The estimated seasonal high ground water table is estimated to be at 5 feet below the existing ground surface.

3.3.3 Well No. 2

Review of the test boring B-18 indicates that groundwater was encountered at the depth of 3 feet below the existing ground surface. The estimated seasonal high ground water table is estimated at 1.5 feet below the existing `ground surface. Standing water was observed in the vicinity of the boring.

3.3.4 Well No. 3

Review of the test boring B-19 indicates that groundwater was encountered at the depth of 1.5 feet below the existing ground surface. The estimated seasonal high ground water table is estimated to be at ground surface. Standing water was not observed at the time of drilling.

3.3.5 Horizontal Directional Drilling (HDD) Pipelines

Review of the test borings B-12 through B-15 indicates that groundwater was encountered was encountered at depths ranging from 2 to 7 feet below the existing ground surface.

3.3.6 Open Cut Pipelines

Review of the test borings B-16 and B-17 indicates that groundwater was encountered was encountered at depths ranging from 4.5 to 6 feet below the existing ground surface. The estimated seasonal high ground water table ranged from 3.5 to 5 feet below the existing ground surface.

3.3.7 Access Road & Sheet Pile Walls

Review of the test boring B-15 indicates that groundwater was encountered at the depth of 5 feet below the existing ground surface.

3.3.8 Retention Pond

Review of the borings A-1 and A-2 indicates that groundwater was encountered at depths ranging from 1.5 to 4 feet below the existing ground surface. The estimated seasonal high ground water table ranged from 0.5 to 3 feet below the existing ground surface.

Determination of the estimated seasonal high groundwater table was made using the methodology described by the United States Department of Agriculture (USDA) Soil

Conservation Service (SCS). In sandy soils the method involves examining soil cuttings from the borings for subtle changes in root content and soil coloration. These subtle changes are indicators of the highest level the groundwater level has been for a prolonged period.

Fluctuations of the groundwater level should be anticipated as a result of fluctuations of the nearby creeks and tributaries, seasonal climatic variations, surface water runoff patterns, construction activities, and other related factors. During seasonal high precipitation periods, groundwater levels can be expected to vary from the levels recorded during this exploration. Therefore, design drawings and specifications should account for the possibility of groundwater level variations, and construction planning should be based on the assumption that such variations will occur.

4.0 GEOTECHNICAL ENGINEERING EVALUATION AND RECOMMENDATIONS

4.1 Basis of Evaluation & Recommendations

The following recommendations are based on the previously presented project information and the data provided to us. The discovery of site and/or subsurface conditions during construction that deviate from the data obtained in this exploration should be reported to us for our review.

4.2 Foundation Design & Construction Recommendations

Based on the results of our evaluation, the storage tank, the buildings, and miscellaneous structures can be founded on shallow bearing footings proportioned for a maximum gross allowable soil bearing capacity of 2,000 psf, provided that the unsuitable organic soils and very loose soils encountered in the upper 8 feet of depth are removed in their entirety and replaced with suitable compacted material in the dry.

Upon satisfactory removal of all unsuitable soils, we recommend that the exposed soils must first be compacted in the dry. This compactive effort should help improve the overall uniformity and bearing conditions of the near surface and underlying soils. Site work and construction techniques in general should be performed in accordance with our subsequent recommendations. The foundations may be constructed directly on compacted sands or natural soils, #57 stone, lean concrete, or structural fill. The granular free-draining soils should be compacted to a density of at least 95 percent of the Modified Proctor maximum dry density (ASTM D 1557). Extensive dewatering will be required to backfill and compact in the dry. If #57 stone is recommended as backfill of the over excavation, it is recommended that it should be wrapped around with filter fabric or geotextile as a separation layer to prevent settlement due to migration of fine soil particles into the aggregate layer.

Additionally, we recommend that techniques in **Section 4.4** be implemented to reduce the effects of settlement of ground storage tank and pipe connections.

4.3 Bearing Capacity and Anticipated Settlement

4.3.1 Ground Storage Tank

We understand that the GST will be supported on foundations placed at or near existing grade with some fill added. Using a 2,000 psf bearing capacity, we anticipate the total settlement of the tank to be on the order of 4.0 inches or less. Settlement was calculated using GeoStudio SIGMA/W model. We expect the majority of the settlement to be elastic (short-term) settlement. Based on the tank dimensions provided, we estimate the differential settlement between the center and edge of the tank to be on the order of 1.9 inches or less. A summary of the settlement analysis results is presented in **Appendix B**. These settlement values are below what is typically allowed by designers and tank manufacturers. However, we recommend that settlement mitigation techniques presented in **Section 4.4** of this report be considered.

4.3.2 Pump Station Building, Well Areas, and Structures on Concrete Pads

Bearing capacity was estimated using both the Terzaghi and Vesic methods. We recommend that shallow foundations should have a minimum footing width of 2 feet with an embedment depth of 2 feet. The maximum allowable soil bearing pressure for use in shallow foundation design should not exceed 2,100 psf. We recommend maximum footing sizes should be limited to 8-feet for isolated column footings and 4-feet for continuous wall footings. Using a maximum bearing pressure of 2,100 psf, we anticipate the total settlement will be on the order of 1-inch or and the differential settlement to be on the order of 0.25 inches less. Settlement was calculated using GeoStudio SIGMA/W model. This settlement is the result of elastic compression of the upper sandy soils. The elastic compression of the sandy soils should occur almost immediately upon the application of the structural dead load during construction. In general, the existing subgrade exhibits a soil unit weight of 105 pcf and friction angle of 29 degrees.

4.4 Settlement Mitigation Techniques for the Ground Storage Tank

4.4.1 Preloading

Based on the estimated total settlement and differential settlement results, it is our opinion that that the settlements are below, but close, to what is typically allowed by designers and tank manufacturers. Therefore, settlement mitigation measures may not be required during construction. If required, preloading is considered as a feasible settlement mitigation technique for the proposed tank. Preloading involves loading of the tank area prior to permanent

construction in order to induce settlement that would otherwise take place during and after construction. Preloading options include (1) filling the tank with water prior to putting it in operation or (2) placing and removing an earthen fill embankment prior to tank construction.

If required, preloading can be done by first constructing the storage tank without making pipe connections, followed by filling the storage tank with water in 25% increments. Settlement should be monitored during the preload operation and at the end of each increment by monitoring/ surveying the tank itself. This would allow the geotechnical engineer or his/her representative to determine how the soils are responding and when the preload can be terminated. After the preload is completed, the pipe connections can be made and the tank can be placed in operation. This technique is a viable option assuming accommodations are made to acquire and discharge the water.

4.4.2 Pipe Connections

If the estimated differential settlement of 1.9 inches is considered to be over the threshold allowed between the tank and pipe connections, we recommend moving the connections or fittings outward away from the tank, if feasible, so that the distortion caused by differential settlement is lessened compared to being closer to the tank. Flexible piping connections are another option, which are able to bend and compensate for any settlement between the tank and pipe connections.

4.5 Floor Slab Design & Construction Recommendations

The floor slab may be constructed directly on compacted fine sands, natural soils, or structural fill. The granular free-draining soils should be compacted to a density of at least 95 percent of the Modified Proctor maximum dry density to a depth of at least 12 inches. A gravel frost protection layer is not considered necessary, although a vapor barrier should be installed to help reduce dampness of the surface of the slab. In addition, a thin lift of approximately 3 inches of sand may be placed above the vapor barrier to minimize curling of the slab, which occurs due to the difference in curing rates between the top and bottom of the slab.

Based on our review and evaluation of the test data and site conditions, we recommend that a modulus of subgrade reaction “k” value of 100 pci to be used for concrete slab design.

4.6 Recommended Design Soil Parameters for Horizontal Directional Drilling (HDD)

Pipes installed using HDD should follow the latest JEA Water & Wastewater Standards Manual. We recommend that soil parameters assumptions and interpretations for the horizontal directional drilling design follow the information provided in the Recommended Design Soil Parameters for Horizontal Directional Drilling tables included in **Appendix B**. Soil parameters provided in the tables are representative of the soil conditions at the variable depths and have been generated based on N-values that were corrected for hammer efficiency and overburden pressure.

4.7 Open Cut Excavations for Pipes

In general, we consider the subsurface soil conditions at the site to be favorable for support of the proposed pipes over a properly prepared and compacted subgrade, provided that the site preparation and earthwork construction recommendations in this report are followed.

It should be noted that over-excavation will be required in several areas due to the presence of large roots and unsuitable organic soils. Depending on the design pipe invert elevations, it is likely that some excavated suitable soils will get mixed with unsuitable organic and/or plastic soils during construction and should be regarded as unsuitable for backfill purposes. We recommend that allowances be made for possible overruns in quantities of subsoil removal and replacement with select backfill.

Outside the limits of the unsuitable soils, the area generally consists of sands (SP & SP-SM) which should be considered suitable for use in construction. We anticipate that the buried pipelines will exert little downward pressure on the subgrade soils. In areas where the surrounding groundwater level is above the pipe invert elevation, the lines should be designed to resist lateral earth pressures and hydrostatic uplift pressures appropriate to their depth below the existing grade and the seasonal high-water level.

4.8 Access Road

Generally, the near surface subgrade soils along the access road consist of sands (SP & SP-SM) material, which should be considered suitable for use in construction. However, it is anticipated the majority of the near surface subgrade soils are underlain by large roots. Therefore, site preparation consisting of the removal of large trees, vegetation, surficial topsoil, and any unsuitable organic soils will be necessary. This should be followed by placement of the select backfill or structural fill as needed to achieve the design finished pavement grades. Following the removal of unsuitable organic soils and backfilling with suitable soils, we consider the subsurface conditions at the site to be favorable for support of the access road, if a properly prepared subgrade is provided.

4.9 Sheet Pile Wall Design Recommendations

We understand that the proposed access road embankment to Well No. 3 will require permanent sheet pile retaining wall to support the embankment. Therefore, we recommend that the soil parameters included in **Appendix B** of this report be used for the sheet pile wall design.

4.10 Suitability of Borrow Materials for Construction

It should be cautioned that soil conditions at the site are highly erratic in nature and contain unsuitable material consisting of organic and highly organic soils and clays that are variable in thickness and depth throughout the site. It is emphasized that due to the erratic nature of these soils, the thickness and depth of the unsuitable material may vary from those noted herein, and that in some locations the unsuitable material may be deeper.

The near surface soil in the areas of Well Nos. 1 & 2 are generally underlain by unsuitable organic slightly silty sands (SP-SM/PT) and highly organic silty sands (PT) encountered in the upper 2 to 8 feet of depth below the existing ground surface, which are considered unsuitable for backfilling and construction. It should be noted that over-excavation of the unsuitable organic soils will be required. The near surface soils in the remaining areas outside Wells No. 1 & 2, and at the retention pond, are generally underlain by fine sands (SP: USCS), slightly silty sands (SP-SM), silty sands (SM), and clayey sands (SC) in the upper 22 to 35 feet of depth below the existing grades, followed by sandy clays (CH/CL) to the termination depths of the borings.

Fine sands (SP) and slightly silty fine sands (SP-SM) are considered as select material. Silty fine sands (SM) may contain excess moisture and will be difficult to dry and to compact. Therefore, silty fine sands should not be used at this site under the tank or the building foundations. Plastic clayey sands (SC), highly plastic sandy clays (CL/CH), and unsuitable organic soils should be considered unsuitable for backfilling and compaction purposes.

We recommend that allowance be made for overruns in quantities of subsoil removal and replacement with select backfill. It should be noted that unsuitable organic soils boundaries and limits are approximate and represent soils encountered at each boring location. Subsurface variance between borings may occur and should be anticipated.

Unsuitable organic soils, silty soils, and plastic soils should be stockpiled separately from the select soils in order to avoid contaminating the select material. In addition, an extensive dewatering system will be required in order to lower the groundwater level prior to excavation. This practice should allow the select SP and SP-SM soils to drain adequately prior to being excavated and stockpiled. Without a dewatering system, the stockpiled material will stay saturated, thus being difficult to dry and to compact for backfilling purposes.

5.0 PAVEMENT DESIGN GUIDELINES & RECOMMENDATIONS

5.1 Site Preparation

If needed, a certain degree of site preparation consisting of the removal of large trees and their roots, unsuitable organic soils, sands with many roots, vegetation, surficial topsoil may be required. This should be followed by placement of the select backfill or structural fill as needed to achieve the design finished pavement grades.

5.2 Stabilized Subgrade

For new pavement construction, the areas to be paved should be stripped and grubbed, filled and compacted. The top 12 inches of soils beneath the base course material shall be a stabilized subgrade with a minimum LBR value of 40 and it shall be compacted to at least 98 percent of its Modified Proctor maximum dry density.

5.3 Limerock Base

The base course could consist of Limerock with a Limerock Bearing Ratio of 100. We recommend a base course at least six inches thick under standard pavements, i.e. under automobiles and lightweight truck; and eight inches for heavy equipment areas. The base course may be placed and compacted in one single layer. All base course materials should be placed and compacted to at least 98 percent of its modified proctor maximum dry density.

5.4 Wearing Surface

A 1-1/2 (minimum) inch layer of type III (or FDOT Type S-1) asphalt concrete having a minimum Marshall stability of 1,000 pounds is recommended for wearing surface in automobile parking areas. For heavy equipment areas, 2 inches of Type III or Type S-1 asphalt concrete is recommended. The asphalt concrete layer should be compacted to at least 98 percent of laboratory density.

6.0 SITE PREPARATION & CONSTRUCTION RECOMMENDATIONS

6.1 Existing Utilities

The locations of existing utilities should be established prior to construction. Provisions should be made to relocate utilities interfering with the proposed alignments and construction, as needed. Underground pipes that are not operational should be either removed, plugged, or grouted in place otherwise they may become conduits for subsurface erosion and cause settlements.

6.2 Initial Site Preparations

All vegetation, topsoil, gravel, roots and organic zones should be removed from the construction area for a distance of at least (5) feet beyond the construction area limits and structures footprint. The depth to which stripping will be required will vary to some degree. Some localized areas may require more than 12 inches of stripping to remove significant root zones.

6.3 Groundwater Control

Groundwater level was encountered at depths ranging from ground surface to 7.0 feet beneath the existing ground surface at the time of drilling. Generally, dewatering may be achieved by conventional open pumping using ditches graded to a sump or by using a deep well point system. However, it is anticipated that extensive dewatering will be required to backfill and compact in the dry. The groundwater level should be maintained at least 2 feet below the bottom of any excavations made during construction and below the surface of any vibratory compaction operations.

6.4 Surface Water Control

The need for surface water runoff control should be anticipated during the site preparation and foundation construction process. Lack of proper controls could result in ponding of surface water in shallow foundation bearing areas and on compacted surfaces. Ponded water, combined with machine or foot traffic during construction operations or other activities, could disturb otherwise acceptable soils or previously compacted existing soils, causing instability, “pumping”, and generally unacceptable conditions. The ponded water will also impede or prevent necessary soil compaction operations and make construction trafficability difficult.

Surface water can be controlled by proper grading of the site and by the use of temporary drainage ditches, diversion berms, and/or pumping from drainage controlled collection points.

6.5 Removal of Unsuitable Materials & Excavation Backfill Recommendations

Unsuitable organic soils were encountered in the areas of Well Nos. 1 and 2 in the upper 2 to 8 feet below the existing grades. These unsuitable organic soils are considered unsuitable material and should be completely removed/excavated in their entirety and backfilled with suitable material. It should be cautioned that soil conditions at the site are highly erratic in nature and contain unsuitable material consisting of organic and highly organic soils and clays that are variable in thickness and depth throughout the site. It is emphasized that due to the erratic nature of these soils, the thickness and depth of the unsuitable material may vary from those noted herein, and that in some locations the unsuitable material may be deeper. The approximate limits of unsuitable organic limits are summarized in the table below:

APPROXIMATE OVER-EXCAVATION LIMITS OF REMOVAL OF UNSUITABLE SOILS

Location	Reference Boring(s)	Approximate Over-Excavation Depth*
Ground Storage Tank (GST)	B-1 & B-2	8 feet
Well No. 1 Pad	B-9	4 feet
Well No. 2 Pad	B-18	2 feet
Chemical Chlorine Storage	B-6	9 feet
High Service Pump Station Building	B-7 & B-8	8 feet
Fuel Tank	B-10	6 feet
Generator	B-11	5 feet

* Depth below existing ground surface

Excavated unsuitable soils should be replaced with No. 57 stone or clean sands placed in maximum 1-foot loose lifts and compacted in the dry to densities equivalent to 95 percent of the Modified Proctor maximum dry density. When #57 stone is recommended as backfill of the over excavation, it is recommended that it should be wrapped around with filter fabric or geotextile as a separation layer to prevent settlement due to migration of fine soil particles into the aggregate layer. When excavating to remove unsuitable materials, it is very likely that the excavated

suitable soils will get mixed with unsuitable organic soils during construction. Therefore, it is our opinion that some of the excavated material should be regarded as unsuitable for backfill purposes. We recommend that allowance be made for overruns in quantities of subsoil removal and replacement with select backfill. It should be noted that unsuitable organic soils boundaries and limits are approximate and represent soils encountered at each boring location. Subsurface variance between borings may occur and should be anticipated.

Due to the wooded nature of the site in some areas, extensive root zones should be expected. If left in place the root zones may contribute to some long-term decay related settlements. In the heavily wooded areas, and depending on design finished grades, it may be desirable to remove large root systems by using a root rake on track-mounted equipment to uproot and remove large root mat sections. It is recommended that the upper 12 to 18 inches of surficial soils be root raked. Insufficient removal in the surficial soils can result in low density results due to higher concentrations of low density material and high moisture contents.

6.6 Excavation Protection

All excavations should meet OSHA Excavation Standard Subpart P regulations for Type C soils. A trench box or braced sheet pile structures may be considered to support open excavations. The soil support system shall be designed according to OSHA by a Florida registered Professional Engineer.

6.7 Site & Fill Compaction

After initial clearing and stripping operations have been completed, and upon satisfactory removal of unsuitable organic soils, the exposed soils in the proposed construction areas should be compacted to densities equivalent to 95 percent of the Modified Proctor maximum dry density (ASTM D1557). This compactive effort should help improve the overall uniformity and bearing conditions of the near-surface and underlying soils.

Structural fill may be placed in loose lifts not exceeding 12 inches. Each lift of fill should be compacted until densities equivalent to at least 95 percent of the Modified Proctor maximum dry density are uniformly obtained. Structural fill should consist of an inorganic, non-plastic, granular soil containing less than 12 percent material passing through the No. 200 mesh sieve

(relatively clean sand with a Unified Soil Classification of SP or SP-SM). Areas not supporting foundations, pavements, or any structures, and not receiving structural fill, can be compacted in the dry to at least 90 percent of the Modified Proctor maximum dry density provided the soils consist of relatively clean soils with no unsuitable soils.

6.8 Disturbed Soil Conditions

Should the soils experience "pumping" and subsequent soil strength loss during compaction operations, compaction work should be terminated and: (1) the disturbed soils removed and backfilled with "dry" structural fill soils, which are then compacted; or (2) the excess moisture content within the disturbed soils allowed to dissipate before re-compaction. Furthermore, the groundwater level should be checked and controlled as necessary in order to help ensure proper drawdown of any high groundwater conditions that may be causing the "pumping" conditions during compaction or construction activity upon these soils.

6.9 Pipe Backfill and Compaction of Pipe Backfill

The SP and SP-SM type soils are considered select material and suitable for use as backfill. Silty sands (SM) can be treated as select material, however, they may contain excess moisture and may be difficult to dry and to compact. Clayey sands (SC) and sandy clays (CL/CH) should be considered as plastic and highly plastic materials, respectively, and should be excavated to a minimum depth of one foot below the design invert elevations and replaced with suitable SP and SP-SM fill material. If encountered, organic soils should be removed in their entirety. Plastic clayey sands (SC), highly plastic sandy clays (CL/CH), and all organic soils should be considered unsuitable for backfilling and compaction purposes.

It should be cautioned that soil conditions at the site are highly erratic in nature and contain unsuitable material consisting of organic and highly organic soils and clays that are variable in thickness and depth throughout the site. It is emphasized that due to the erratic nature of these soils, the thickness and depth of the unsuitable material may vary from those noted herein, and that in some locations the unsuitable material may be deeper. As mentioned earlier, some of the excavated suitable soils will likely get mixed with unsuitable soils and/or plastic soils during construction. Therefore, some or all the excavated material may become unsuitable for backfill purposes. We recommend that allowance be made for overruns in quantities of subsoil removal and replacement with select backfill.

The backfill material within the excavation should be placed in thin loose lifts not exceeding 6 inches in thickness. The backfill material should be compacted by the use of hand-operated equipment. The backfill material should be granular (SP & SP-SM) fill with less than 10 percent material passing the no. 200 mesh sieve and containing less than 3 percent organic matter. The backfill material should be compacted to a minimum density of 98% or 95% of maximum dry density obtained from the Modified Proctor compaction test (ASTM D1557), as required by JEA. The moisture content during compaction should be maintained within $\pm$ 3 percent of the optimum moisture content as obtained from the Modified Proctor compaction test. Handheld compaction equipment should be used for the backfill placed around the pipes and to a height of 2 feet above the pipes. Heavier equipment may be used on the remaining backfill lifts placed above 2 feet. However, care should be taken not to damage the pipe below. The pipe should be designed to withstand the anticipated dead (overburden) and live loads.

6.10 Roadway Subgrade Stabilization and Compaction

The upper one foot of the subgrade soil should be stabilized to achieve an LBR Value of 40 with a maximum plasticity index of 6. The stabilization procedures and the stabilizing materials should be as presented in the Standard Specifications.

6.11 Foundation Bearing Surface Preparation

The upper 24 inches of bearing soils should be compacted to densities equivalent to at least 95 percent of the material's maximum dry density as determined by the Modified Proctor test. Concentrated root zones or other unsuitable matter encountered at the bearing level should be completely removed and replaced with compacted structural fill material. If plastic soils are encountered at the bottom of the foundation they should be regarded as unsuitable soils and should be removed to a depth of at least 2 feet beneath the bottom of the foundation. Excavated unsuitable soils should be replaced with clean sands placed in maximum 1-foot loose lifts and compacted to densities equivalent to 95 percent of the Modified Proctor maximum dry density. As noted earlier, silty fine sands may contain excess moisture and will be difficult to dry and to compact. Therefore, silty fine sands should not be used at this site under the tank or the building foundations.

7.0 QUALITY CONTROL & TESTING GUIDELINES

Prior to initiating compaction operations, we recommend that representative samples of the structural fill material to be used and acceptable exposed in-place soils be collected and tested to determine their compaction and classification characteristics. The maximum dry density, optimum moisture content, gradation and plasticity characteristics should be determined. These tests are needed for compaction quality control of the structural fill and existing soils and to determine if the fill material is acceptable.

A representative number of in-place field density tests should be performed in the compacted existing soils and in each lift of structural fill or backfill to confirm that the required degree of compaction has been obtained. At least one test per lift should be made for every 1,000 square feet of structure area and every 25 feet for the tank's foundation perimeter. The bearing level soils should be inspected and tested by an engineering technician acting under the direction and supervision of the geotechnical engineer in order to evaluate the density and acceptability of the bearing material prior to steel placement and foundation construction.

8.0 REPORT LIMITATIONS

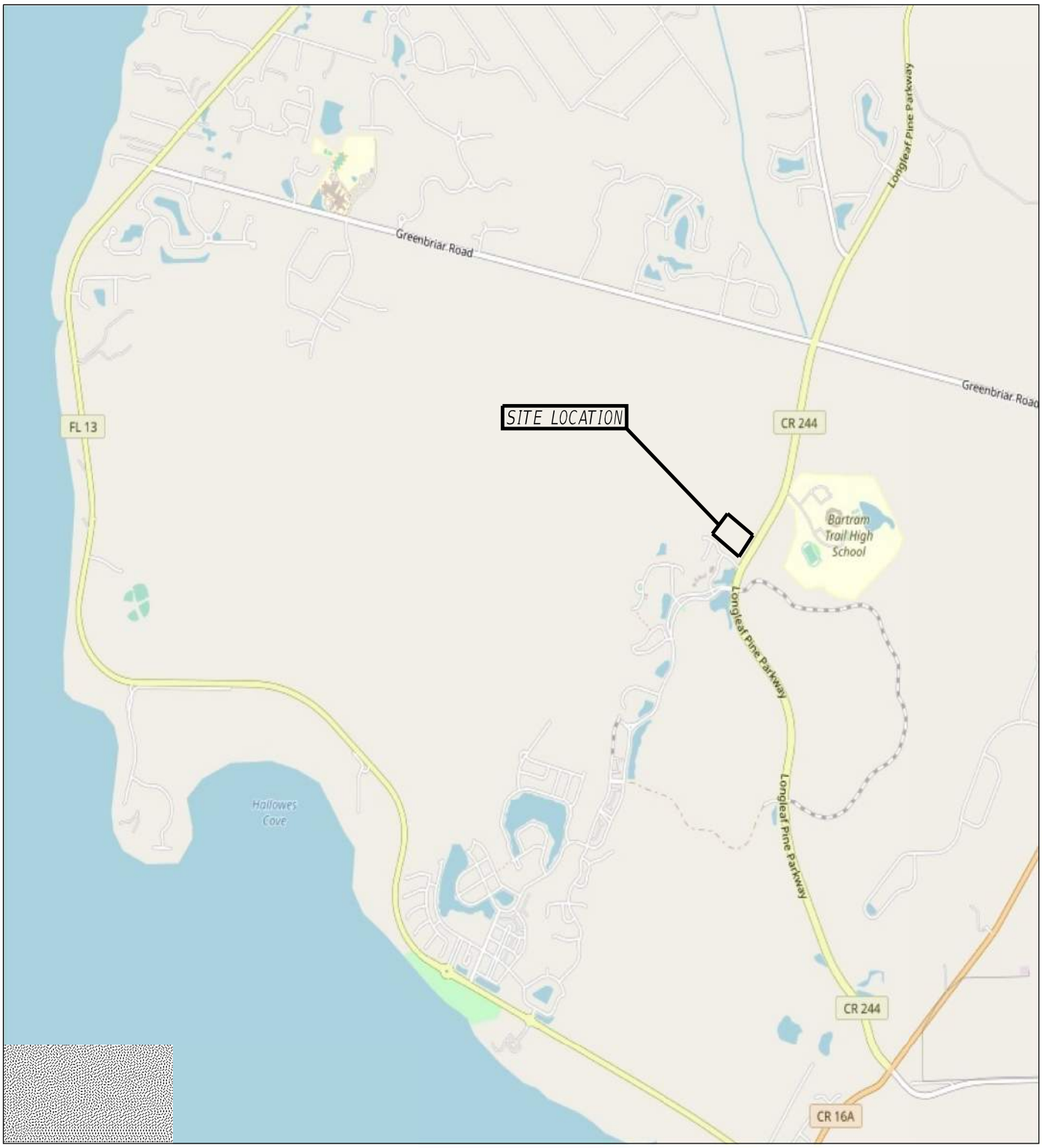
The subsurface exploration program including our evaluation and recommendations was performed in general accordance with accepted geotechnical engineering principles and standard practices. CSI Geo is not responsible for any independent conclusions, opinions, or interpretations made by others based on the data presented in this report.

This report does not reflect any variations that may occur adjacent or between soil borings. The discovery of any site or subsurface condition during construction that deviates from the findings and data as presented in this report should be reported to CSI Geo for evaluation. If the location of the proposed project features is changed, our office should be contacted so our recommendations can be re-evaluated. We recommend that CSI Geo be given the opportunity to review the final design drawings and specifications to ensure that our recommendations are properly included and implemented.

Appendix A – Maps

- Site Location Map
- Field Exploration Plan

Site Location Map



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SITE LOCATION MAP

RIVERTOWN WATER TREATMENT PLANT
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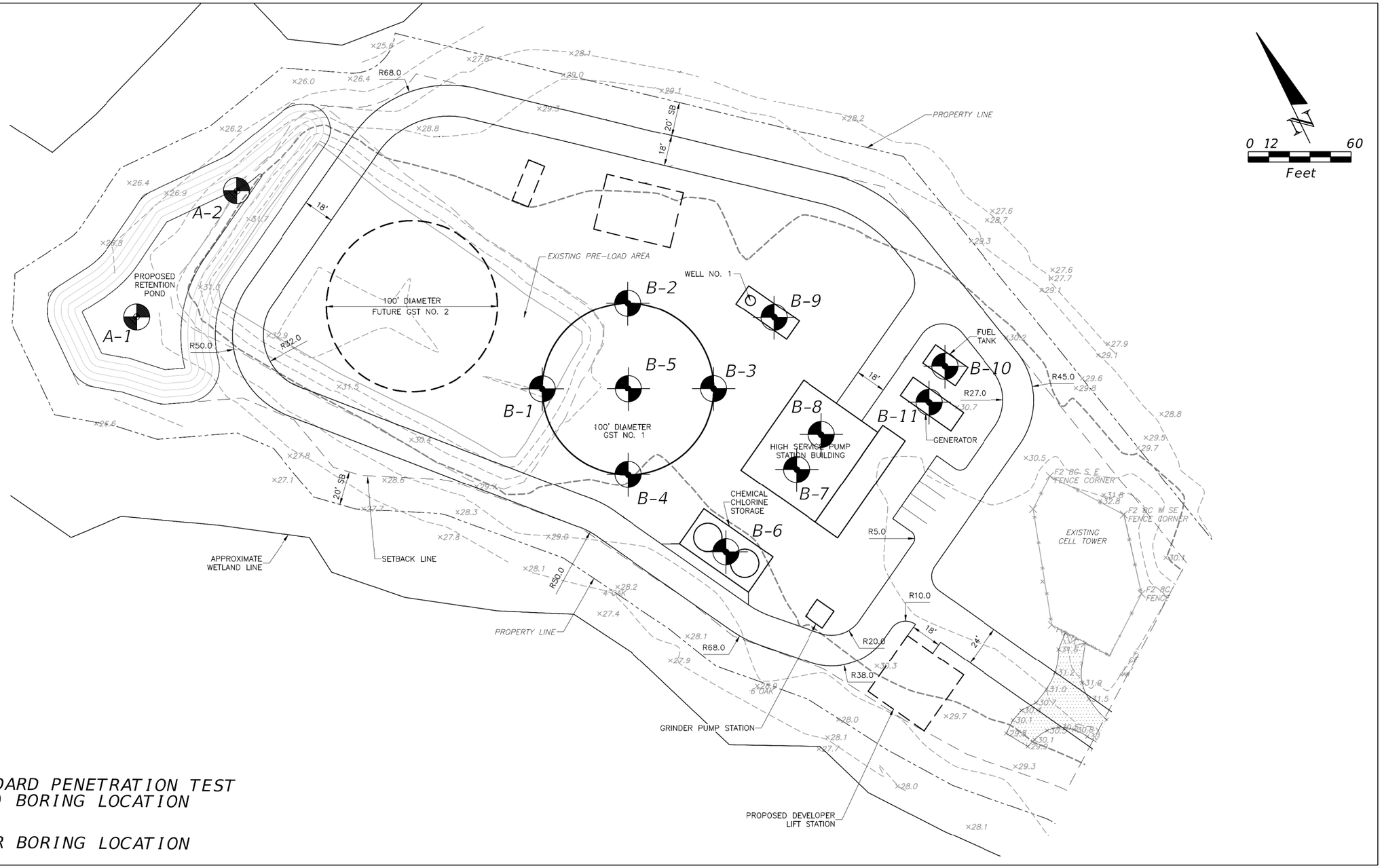
Field Exploration Plan



LEGEND

STANDARD PENETRATION TEST (SPT) BORING LOCATION

AUGER BORING LOCATION

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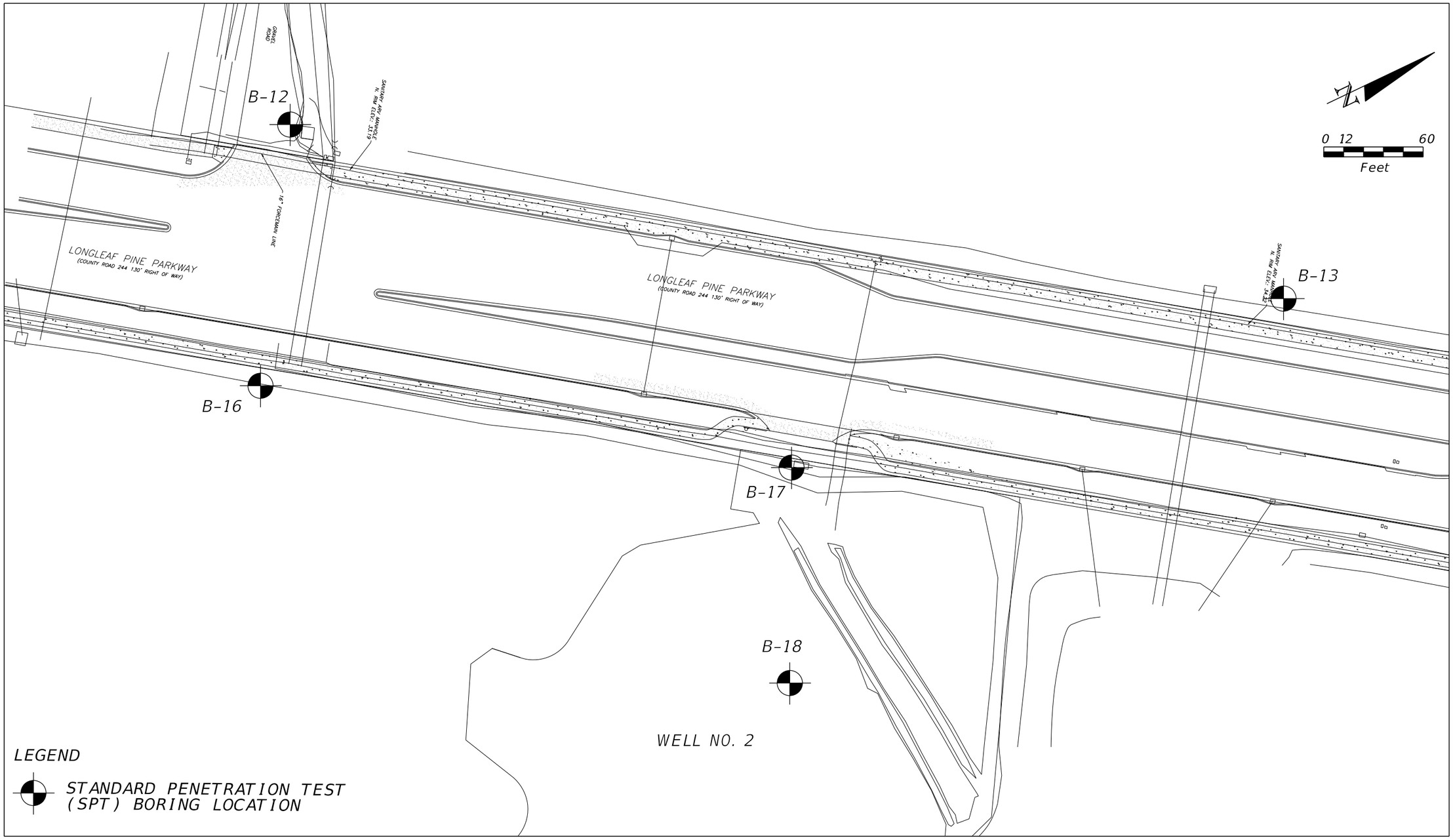
FIELD EXPLORATION PLAN

RIVERTOWN WATER TREATMENT PLANT
ST. JOHNS COUNTY, FLORIDA



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FIELD EXPLORATION PLAN

RIVERTOWN WATER TREATMENT PLANT
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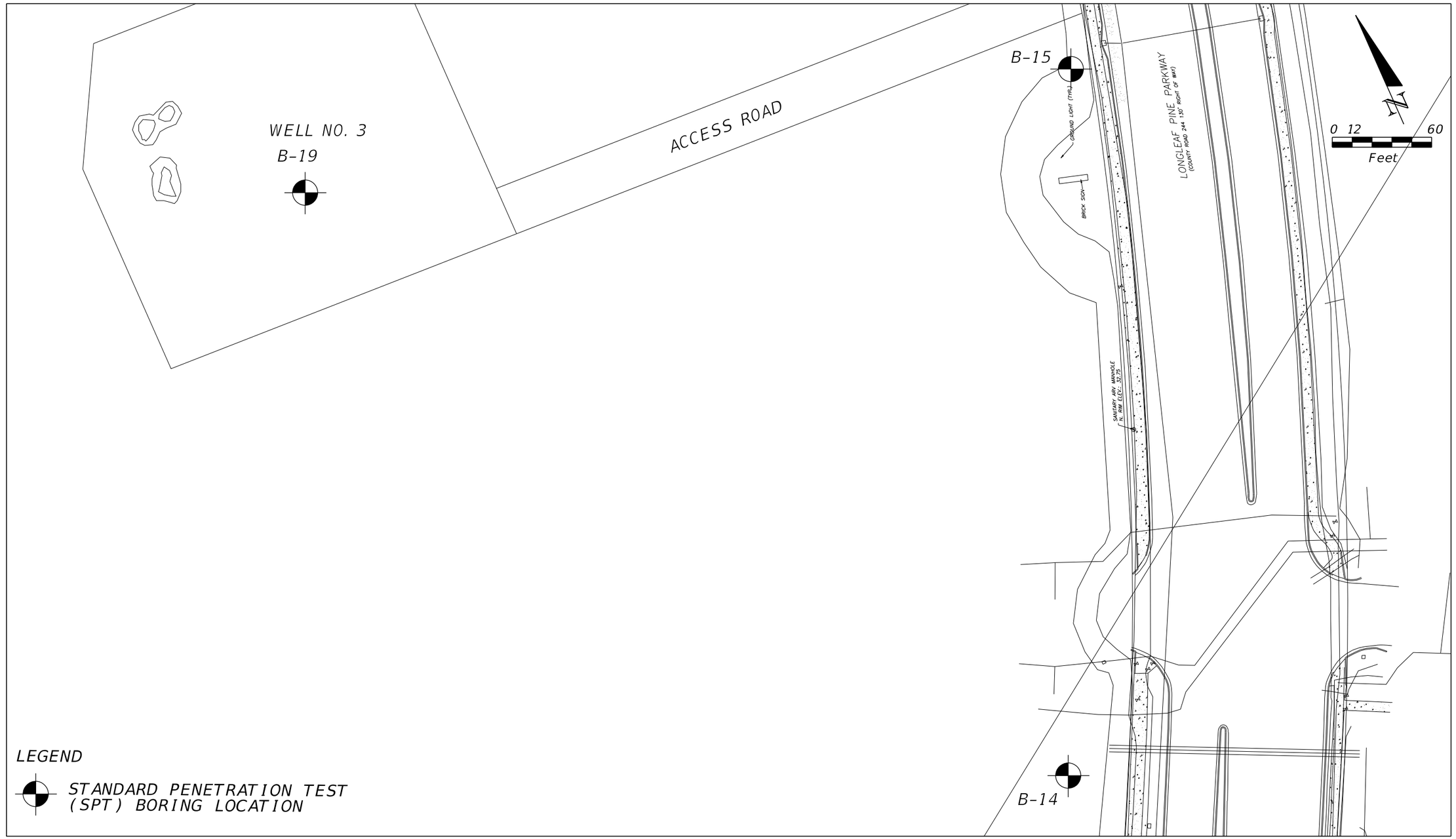

LEGEND

STANDARD PENETRATION TEST (SPT) BORING LOCATION

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FIELD EXPLORATION PLAN

RIVERTOWN WATER TREATMENT PLANT
ST. JOHNS COUNTY, FLORIDA

Appendix B – Field Exploration, Evaluation & Laboratory Testing

- Report of SPT Borings
- Report of Core Borings (Retention Pond)
- Recommended Soil Parameters for Horizontal Directional Drilling Design
- Recommended Soil Parameters for Sheet Pile Walls
- Tank Settlement Analysis Results
- Summary of Laboratory Test Results
- Grain Size Distribution Curves

Report of SPT Borings

LEGEND

FINE SAND (SP); SLIGHTLY SILTY FINE SAND (SP–SM); SLIGHTLY CLAYEY FINE SAND (SP–SC)

SILTY FINE SAND (SM)

CLAYEY FINE SAND (SC)

SANDY CLAY (CL/CH)

CLAY (CH)

SANDY SILT (MH)

ORGANIC SLIGHTLY SITLY SAND (SP–SM/PT); ORGANIC SILTY SAND (SM/PT); WOOD PIECES; HIGHLY ORGANIC SILTY SAND (PT)

LIMESTONE

SHELLS

GRAVEL

(SP) USCS SOIL CLASSIFICATION SYSTEM

ESTIMATED SEASONAL HIGH GROUND WATER LEVEL

GROUND WATER LEVEL AT TIME OF DRILLING

B.T. SPT BORING TERMINATION

50/X" BLOWS PER X INCREMENTS IN INCHES

WOH WEIGHT OF HAMMER

N STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT. NUMBERS TO THE LEFT OF BORING INDICATE N–VALUES

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER SPT N–VALUE (BLOWS/FT)
VERY LOOSE	LESS THAN 3
LOOSE	3–8
MEDIUM DENSE	8–24
DENSE	24–40
VERY DENSE	GREATER THAN 40

SILTS AND CLAYS

CONSISTENCY	AUTOMATIC HAMMER SPT N–VALUE (BLOWS/FT)
VERY SOFT	LESS THAN 1
SOFT	1–3
FIRM	3–6
STIFF	6–12
VERY STIFF	12–24
HARD	GREATER THAN 24

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA. 1.44 INCHES
SPOON OUTSIDE DIA. 2.0 INCHES
ASTM STANDARD DROP HAMMER

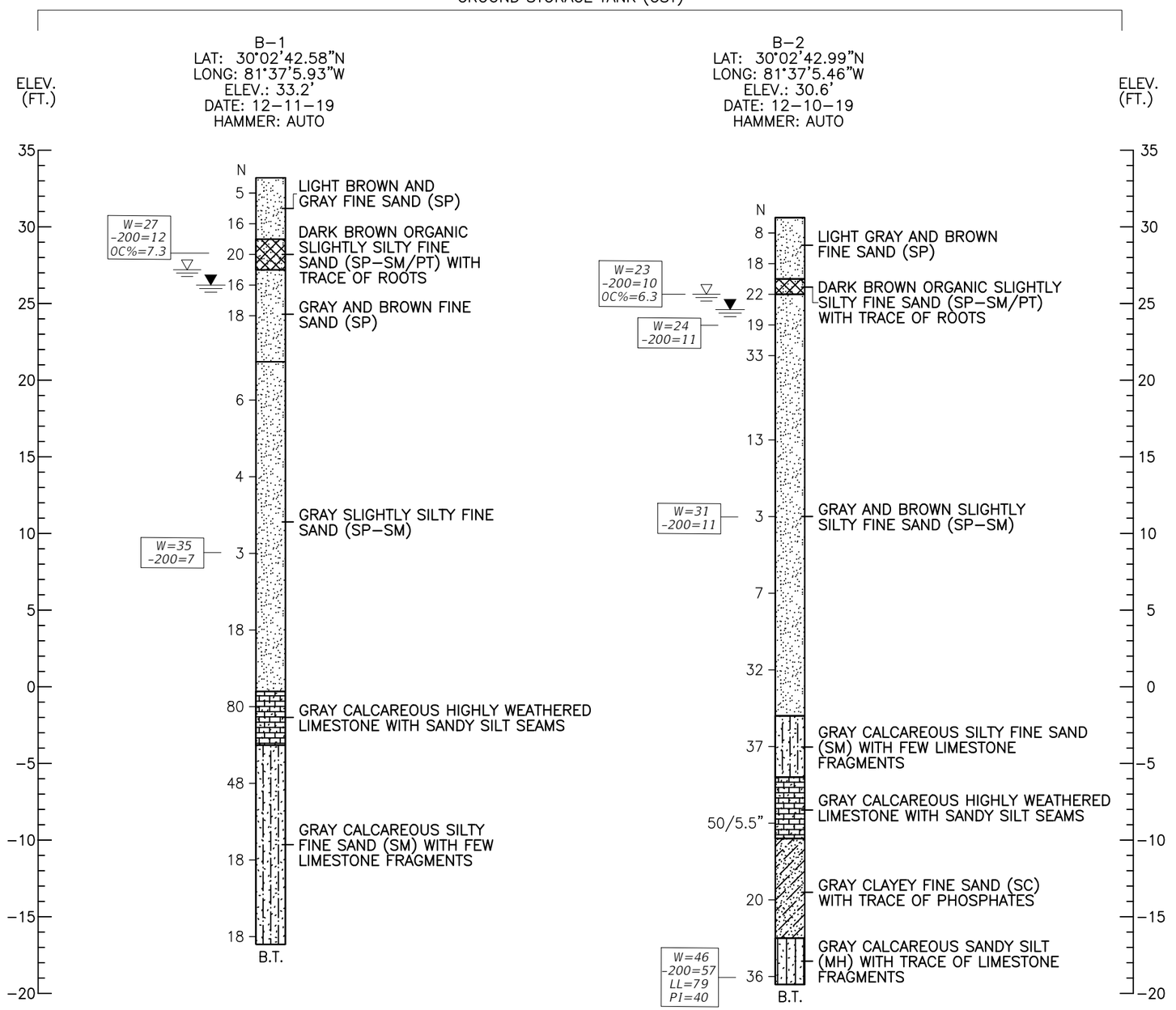
AVG. HAMMER DROP 30.0 INCHES
HAMMER WEIGHT 140.0 LBS

NOTES:

1) DRILL AND PENETRATION TESTING WAS PERFORMED IN ACCORDANCE WITH ASTM D–1586.

2) LAYER BOUNDARIES ARE APPROXIMATE AND MAY VARY BETWEEN OR AWAY FROM BORING LOCATIONS.

GROUND STORAGE TANK (GST)



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REPORT OF SPT BORINGS

RIVERTOWN WATER TREATMENT PLANT
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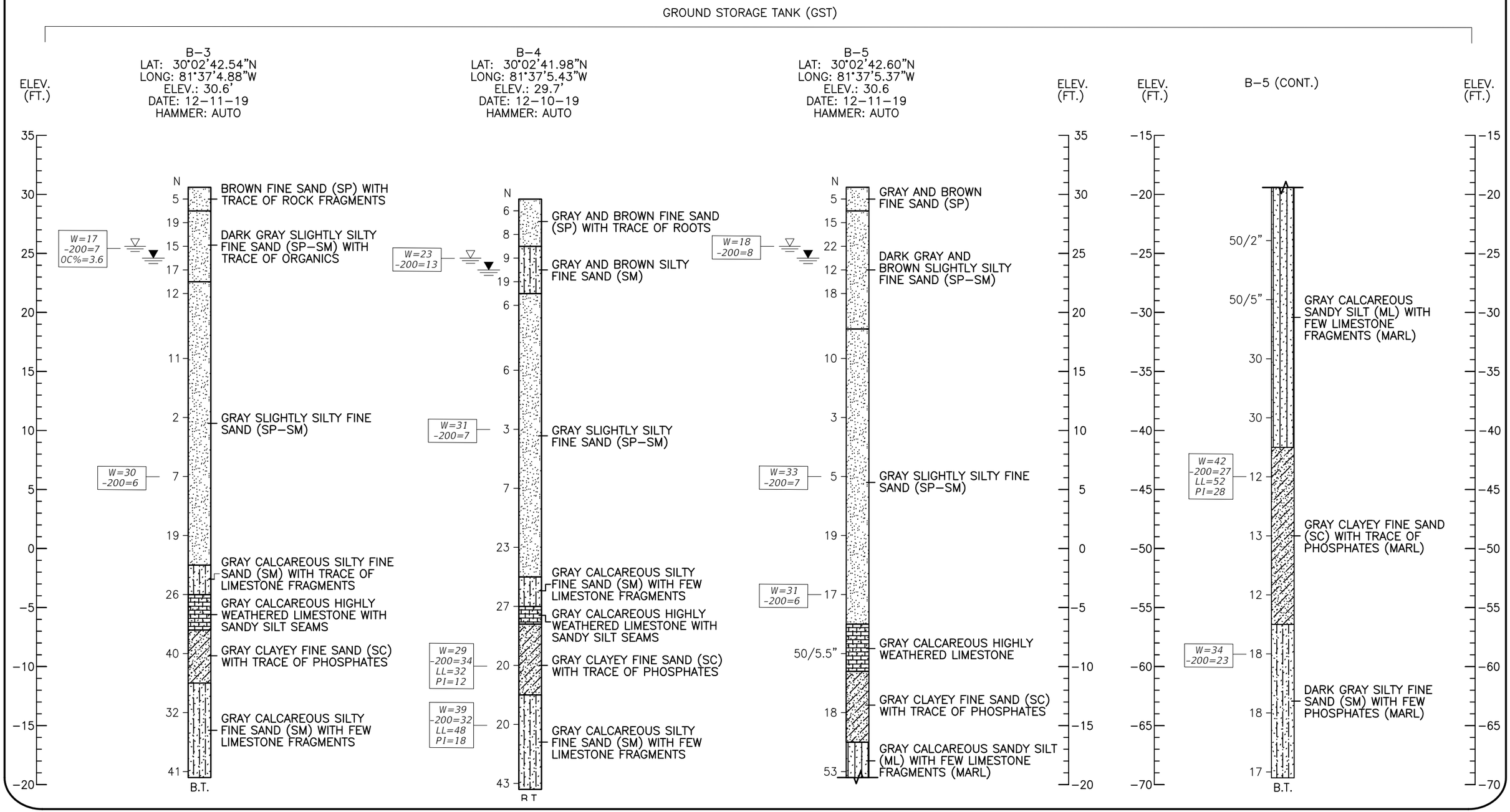
GROUND STORAGE TANK (GST)



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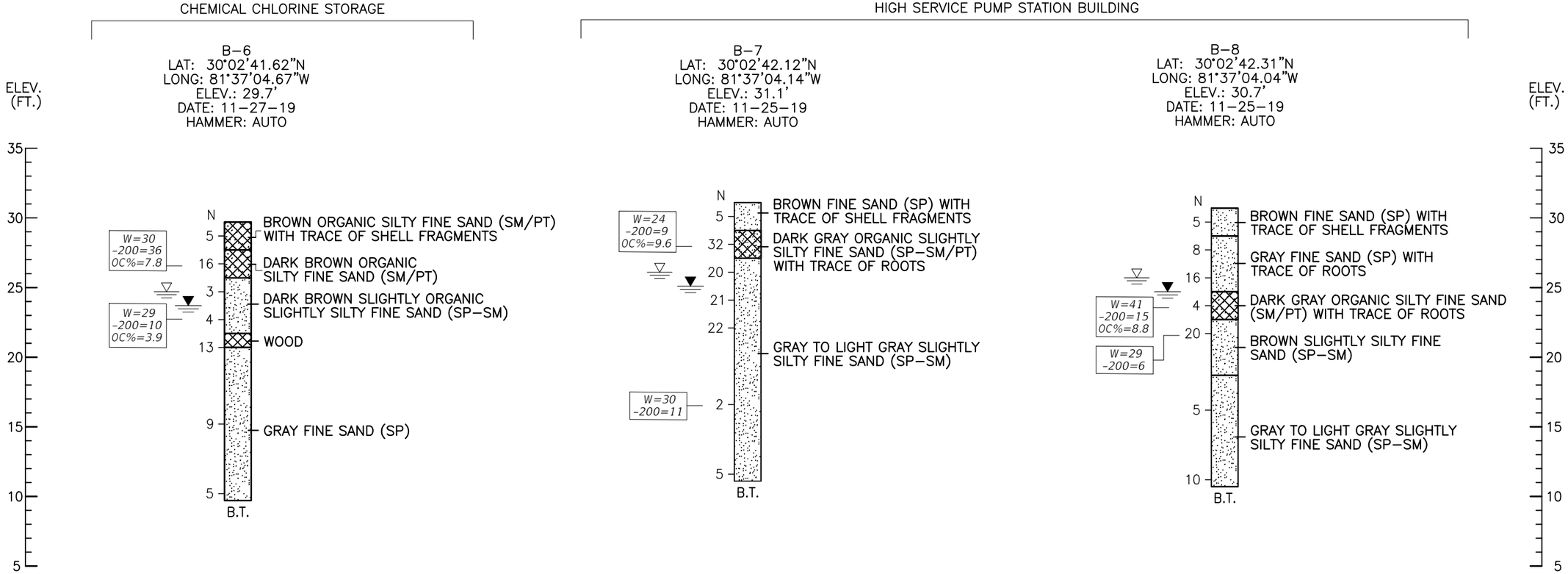
CHEMICAL CHLORINE STORAGE

HIGH SERVICE PUMP STATION BUILDING



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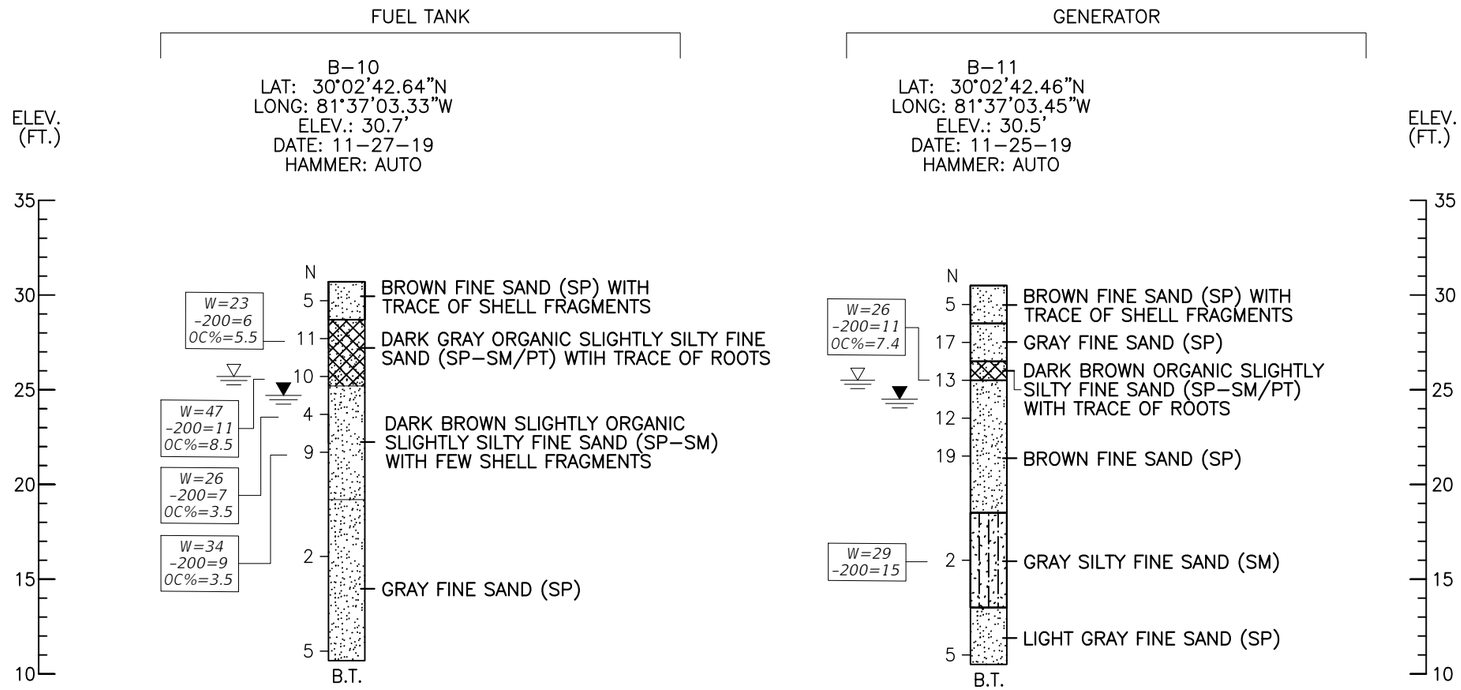

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REPORT OF SPT BORINGS

RIVERTOWN WATER TREATMENT PLANT
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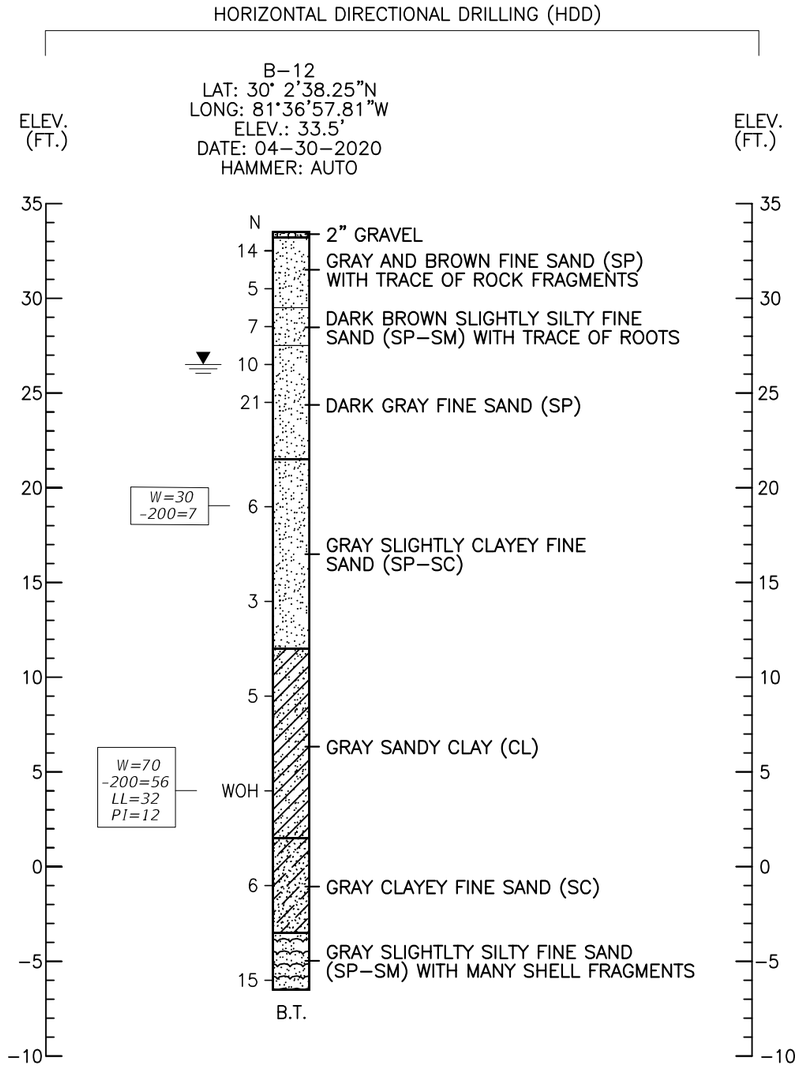
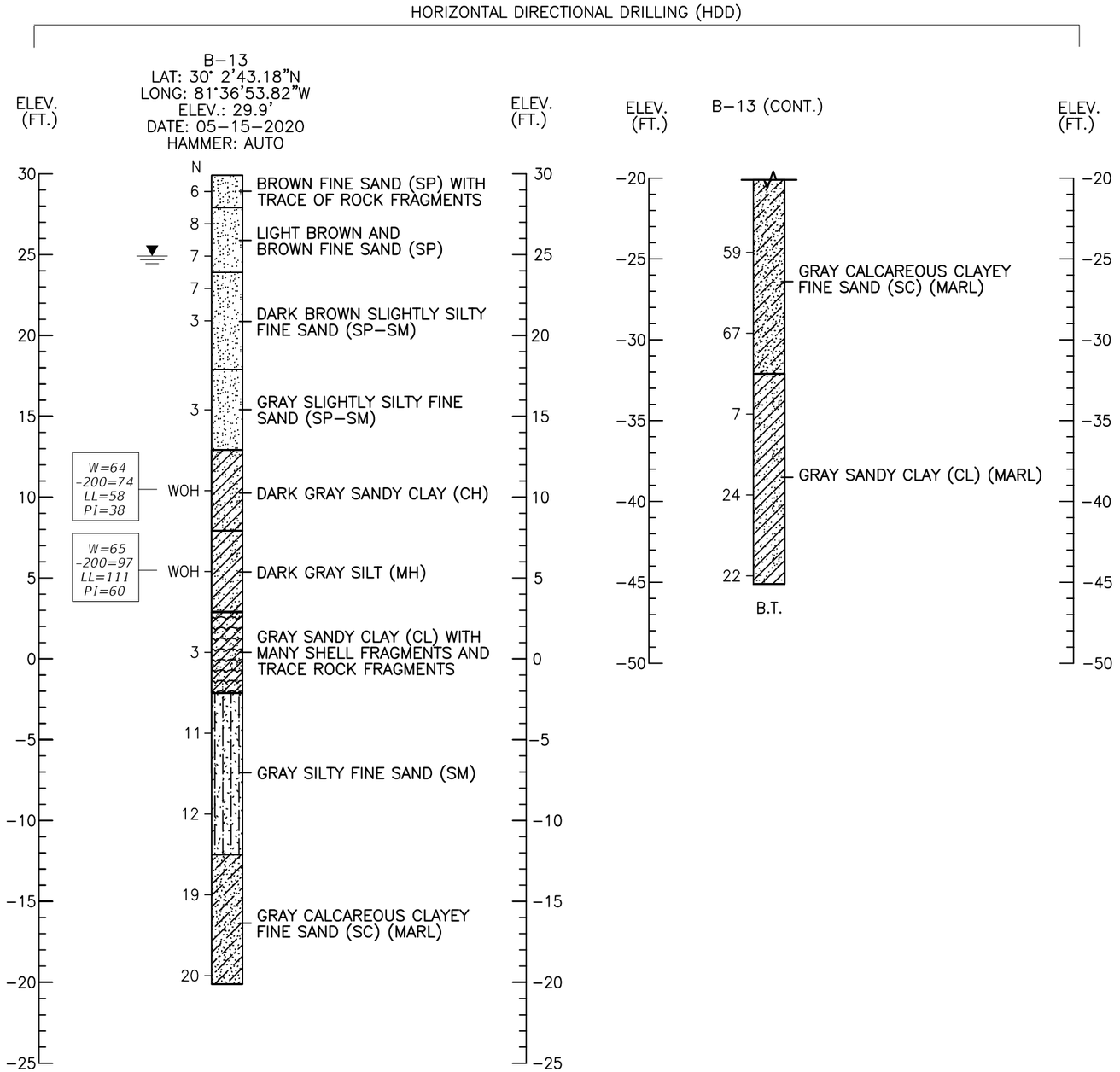
HORIZONTAL DIRECTIONAL DRILLING (HDD)



HORIZONTAL DIRECTIONAL DRILLING (HDD)



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REPORT OF SPT BORINGS

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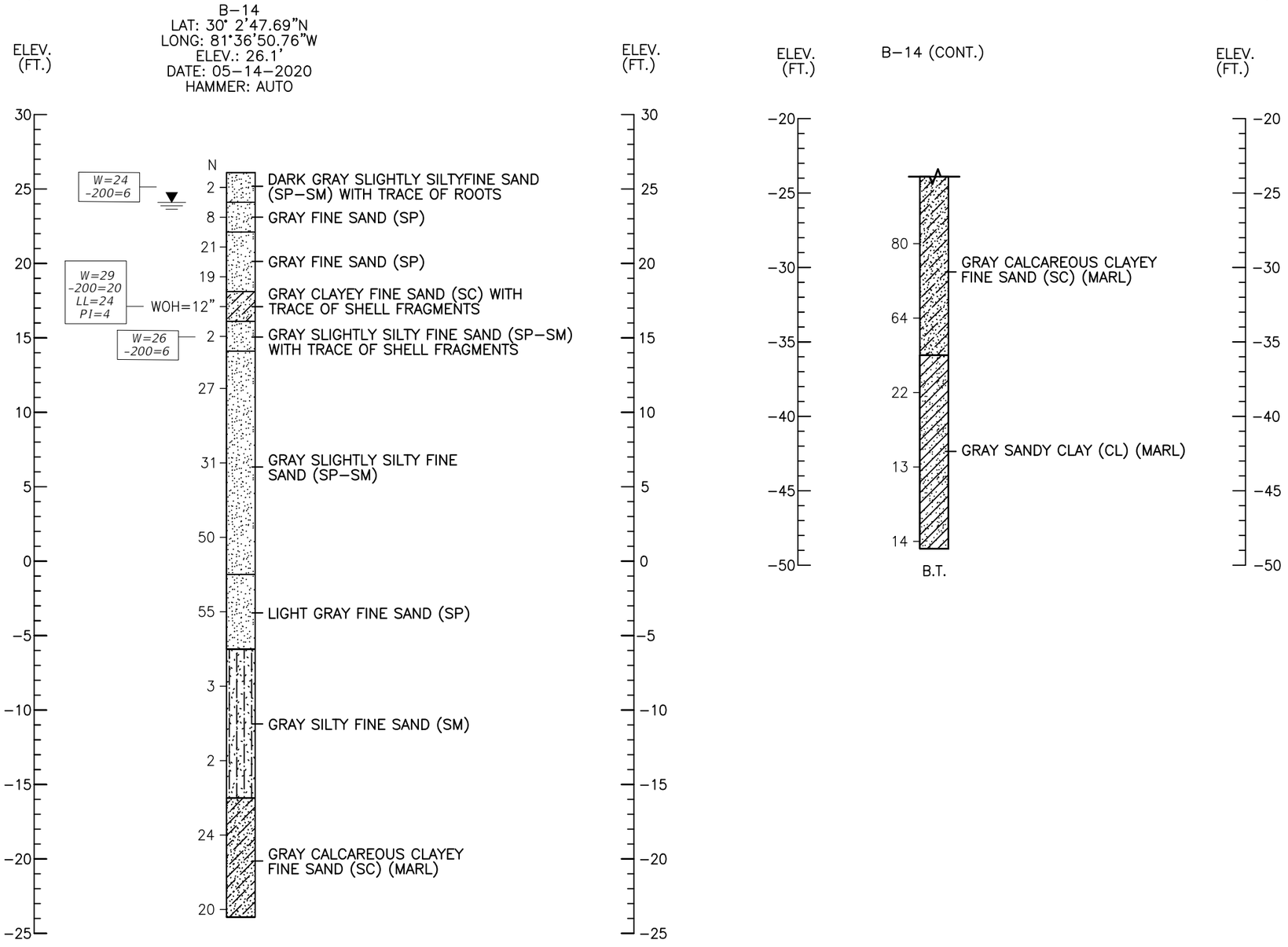
HORIZONTAL DIRECTIONAL DRILLING (HDD)



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REPORT OF SPT BORINGS
RIVERTOWN WATER TREATMENT PLANT
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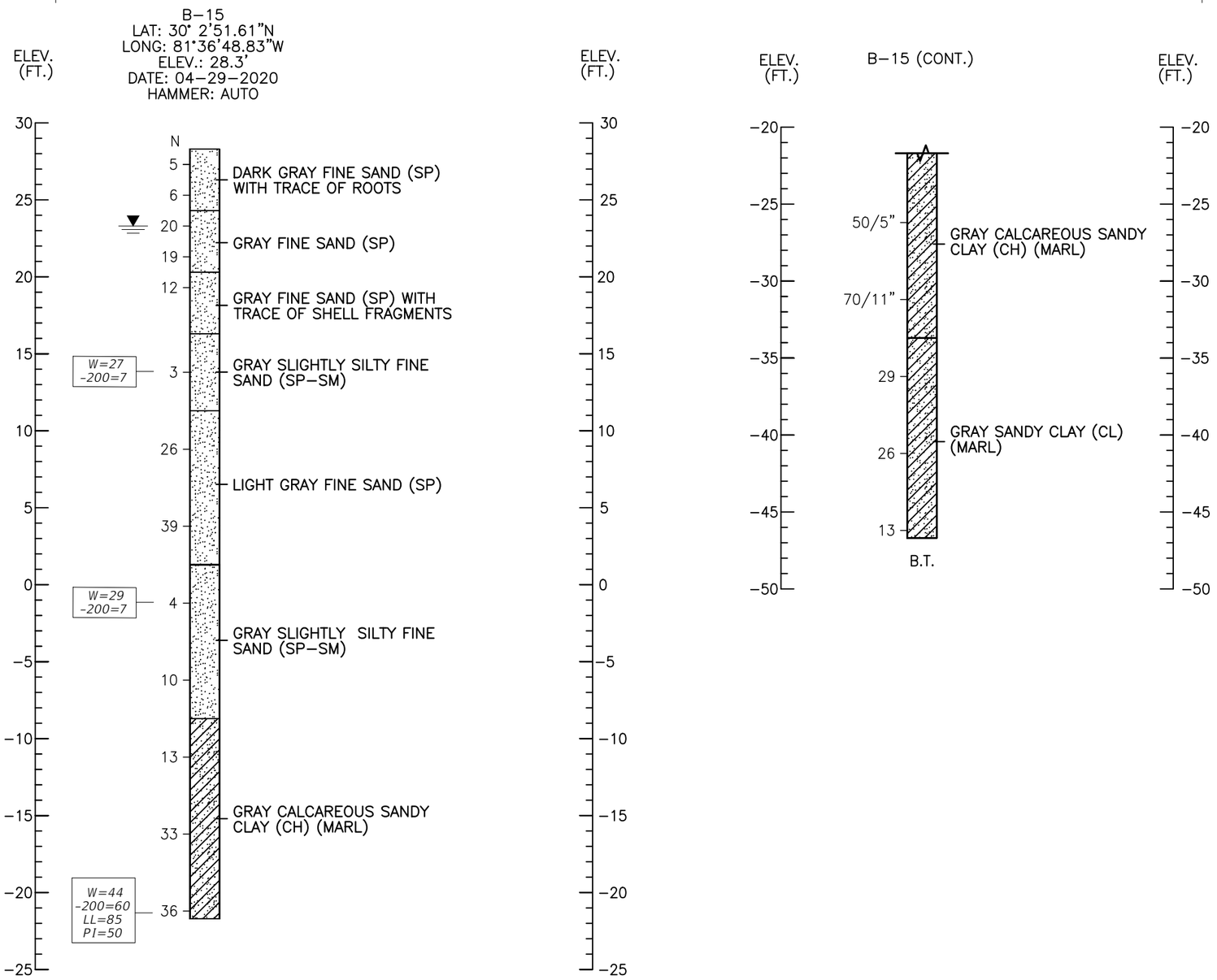
HORIZONTAL DIRECTIONAL DRILLING (HDD) & ACCESS ROAD



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RIVERTOWN WATER TREATMENT PLANT
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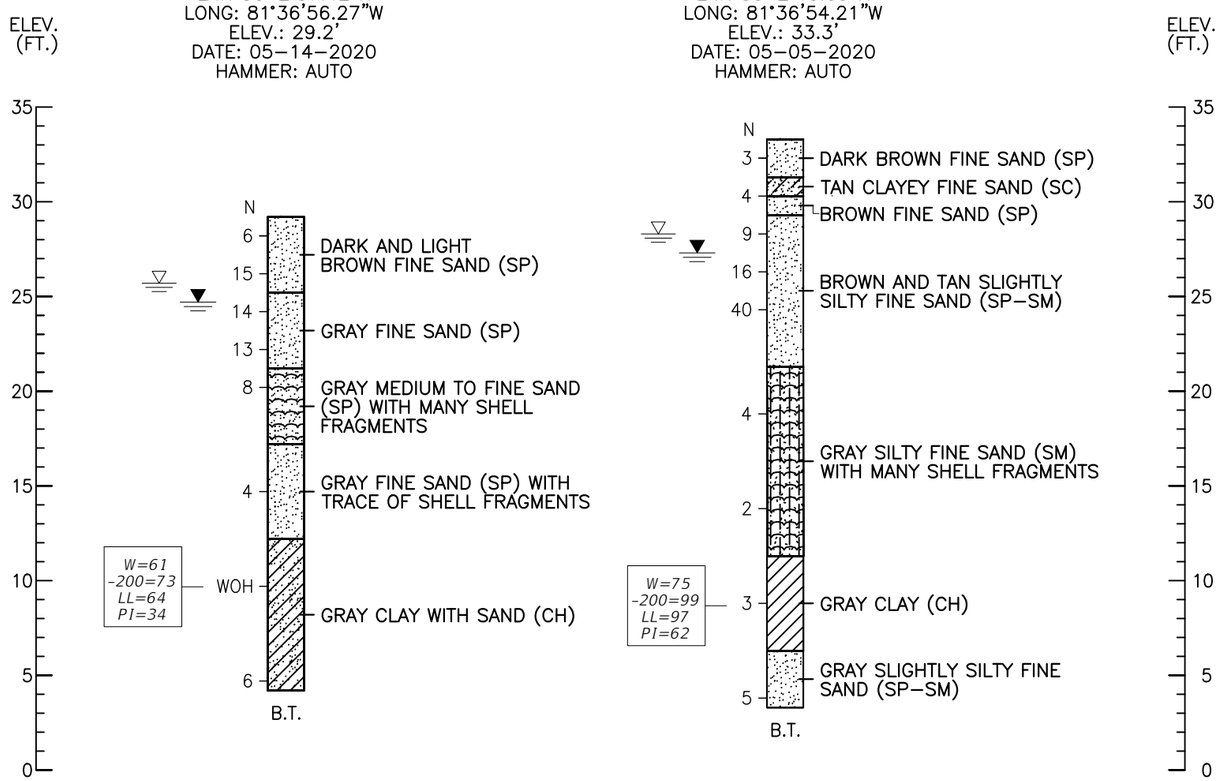
OPEN–CUT PIPELINES



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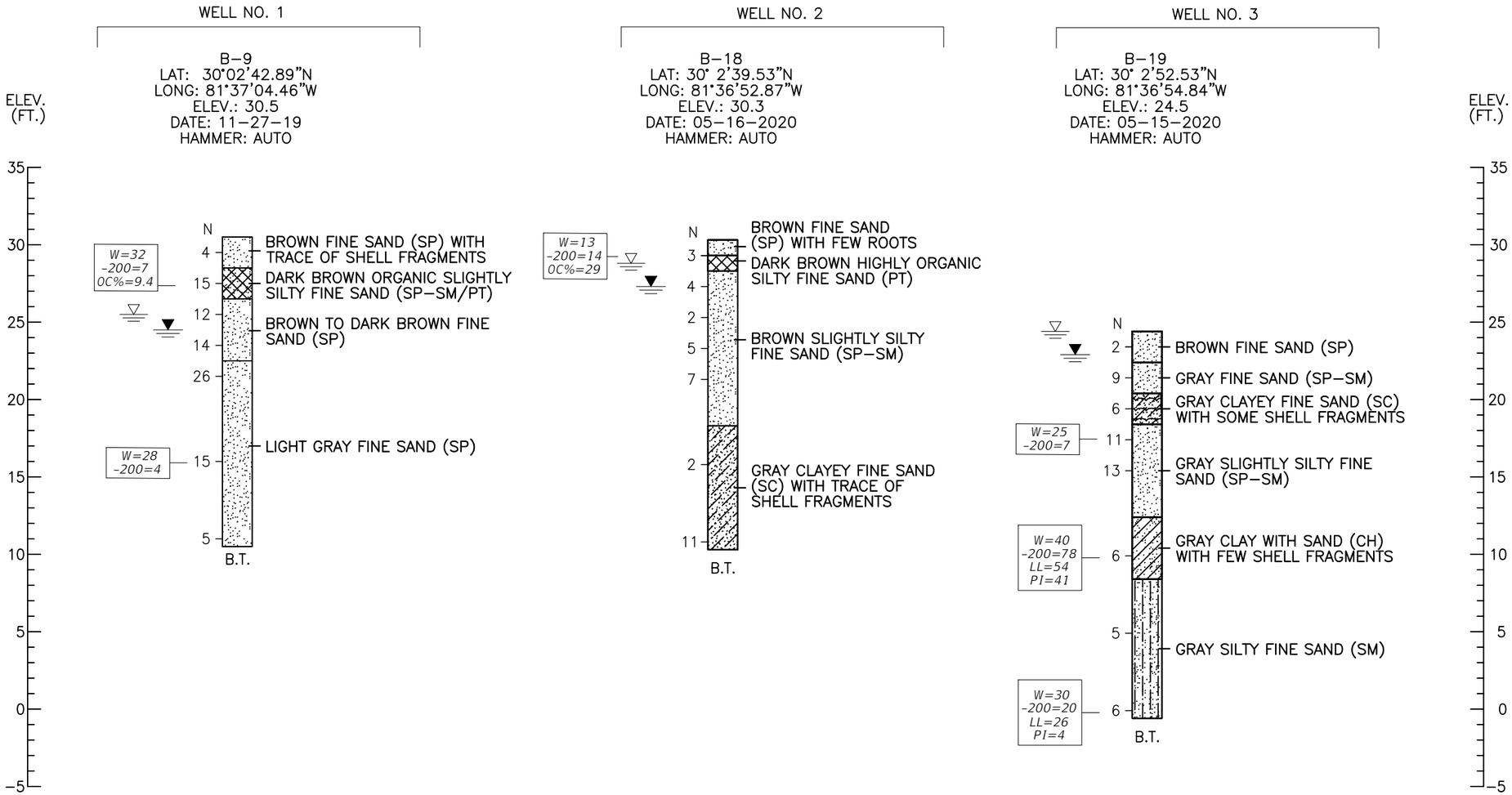

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REPORT OF SPT BORINGS

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Report of Core Borings

LEGEND

FINE SAND (SP);
SLIGHTLY SILTY FINE SAND (SP–SM)

SILTY FINE SAND (SM)

(SP) USCS SOIL CLASSIFICATION SYSTEM

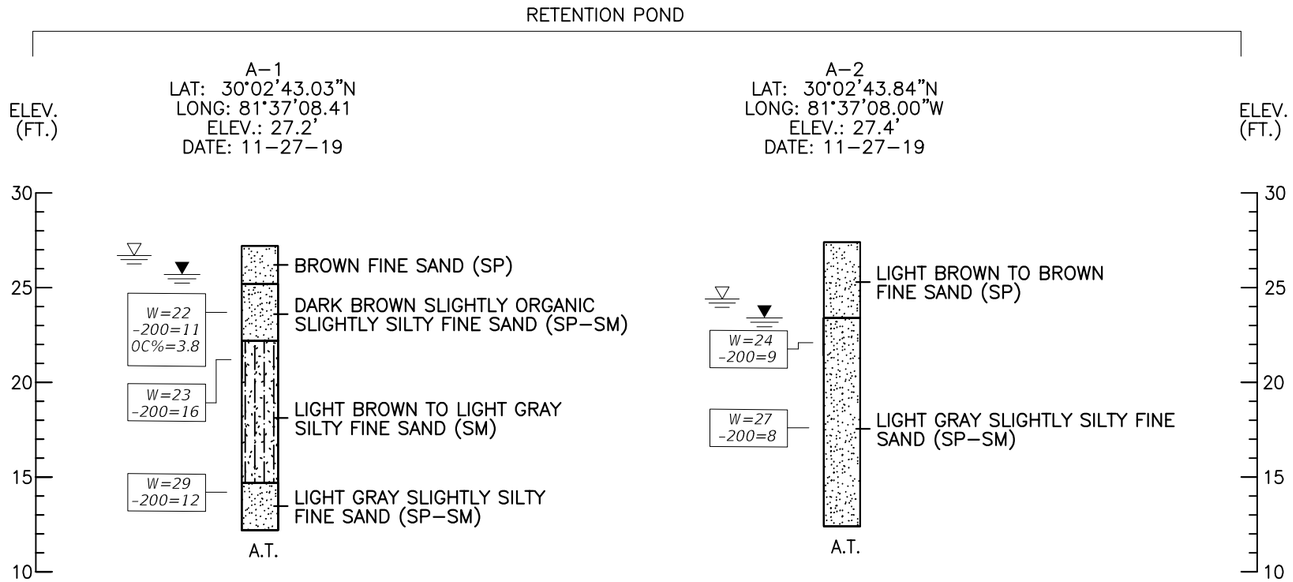
ESTIMATED SEASONAL HIGH GROUND WATER LEVEL

GROUND WATER LEVEL AT TIME OF DRILLING

A.T. AUGER BORING TERMINATION

NOTES:

LAYER BOUNDARIES ARE APPROXIMATE AND MAY VARY BETWEEN OR AWAY FROM BORING LOCATIONS.



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REPORT OF CORE BORINGS
RIVERTOWN WATER TREATMENT PLANT
ST. JOHNS COUNTY, FLORIDA

Recommended Soil Parameters for Horizontal Directional Drilling Design

RECOMMENDED SOIL PARAMETERS FOR HORIZONTAL DIRECTIONAL DRILLING DESIGN

Boring B-12

Soil Parameter	Loose to Medium Dense Sands	Loose Sands	Firm Clays	Very Soft Clays	Loose to Medium Dense Clayey Sands and Sands
Depth (ft)	0.0'- 12.0'	12.0'- 22.0'	22.0'- 27.0'	27.0'- 32.0'	32.0'- 40.0'
Saturated unit weight (pcf)	115	100	95	90	105
Effective unit weight for input purposes (pcf)	53	38	33	28	43
Estimated friction angle ϕ (degrees)	33	27	-	-	29
Cohesion (psf)	-	-	900	200	29
At Rest Pressure Coefficient (K_o)	0.46	0.55	1.0	1.0	0.52
Active Pressure Coefficient (K_a)	0.29	0.38	1.0	1.0	0.35
Passive Pressure Coefficient (K_p)	3.39	2.66	1.0	1.0	2.88

Soil parameters provided in the tables are representative of the soil conditions at the variable depths and have been generated based on N-values that were corrected for hammer efficiency and overburden pressure.

Boring B-13

Soil Parameter	Loose Sands	Very Soft Clays	Medium Dense Silty and Clayey Sands	Very Dense Clayey Sands	Stiff to Very Stiff Clays
Depth (ft)	0.0'- 17.0'	17.0'- 32.0'	32.0'- 52.0'	52.0'- 62.0'	62.0'- 75.0'
Saturated unit weight (pcf)	105	90	115	120	105
Effective unit weight for input purposes (pcf)	43	28	53	58	43
Estimated friction angle ϕ (degrees)	30	-	30	35	-
Cohesion (psf)	-	200	-	-	2,000
At Rest Pressure Coefficient (K_o)	0.50	1.0	0.50	0.43	1.0
Active Pressure Coefficient (K_a)	0.33	1.0	0.33	0.27	1.0
Passive Pressure Coefficient (K_p)	3.00	1.0	3.00	3.69	1.0

Soil parameters provided in the tables are representative of the soil conditions at the variable depths and have been generated based on N-values that were corrected for hammer efficiency and overburden pressure.

RECOMMENDED SOIL PARAMETERS FOR HORIZONTAL DIRECTIONAL DRILLING DESIGN

Boring B-14

Soil Parameter	Medium Dense to Dense Sands	Very Loose Sands	Dense to Very Dense Sands	Very Loose Silty Sands	Medium Dense Clayey Sands	Very Dense Clayey Sands (Marl)	Very Stiff Clays (Marl)
Depth (ft)	0.0'- 8.0'	8.0'- 12.0'	12.0'- 32.0'	32.0'- 42.0'	42.0'- 52.0'	52.0'- 62.0'	62.0'- 75.0'
Saturated unit weight (pcf)	115	95	120	100	120	120	105
Effective unit weight for input purposes (pcf)	53	33	58	38	58	58	43
Estimated friction angle ϕ (degrees)	33	27	36	26	32	35	-
Cohesion (psf)	-	-	-	-	-	-	2,000
At Rest Pressure Coefficient (K_o)	0.46	0.55	0.41	0.56	0.47	0.43	1.0
Active Pressure Coefficient (K_a)	0.29	0.38	0.26	0.39	0.31	0.27	1.0
Passive Pressure Coefficient (K_p)	3.39	2.66	3.85	2.56	3.25	3.69	1.0

Soil parameters provided in the tables are representative of the soil conditions at the variable depths and have been generated based on N-values that were corrected for hammer efficiency and overburden pressure.

Boring B-15

Soil Parameter	Medium Dense Sands	Very Loose Sands	Dense Sands	Loose Sands	Dense Clayey Sands	Hard Clays
Depth (ft)	0.0'- 12.0'	12.0'- 17.0'	17.0'- 27.0'	27.0'- 37.0'	37.0'- 62.0'	62.0'- 75.0'
Saturated unit weight (pcf)	115	100	120	105	120	115
Effective unit weight for input purposes (pcf)	53	38	58	43	58	53
Estimated friction angle ϕ (degrees)	33	28	36	28	33	-
Cohesion (psf)	-	-	-	-	-	2,000
At Rest Pressure Coefficient (K_o)	0.46	0.53	0.41	0.53	0.46	1.0
Active Pressure Coefficient (K_a)	0.29	0.36	0.26	0.36	0.29	1.0
Passive Pressure Coefficient (K_p)	3.39	2.77	3.85	2.77	3.39	1.0

Soil parameters provided in the tables are representative of the soil conditions at the variable depths and have been generated based on N-values that were corrected for hammer efficiency and overburden pressure.

Recommended Soil Parameters for Sheet Pile Walls

RECOMMENDED SOIL PARAMETERS FOR SHEET PILE WALLS

Boring B-15

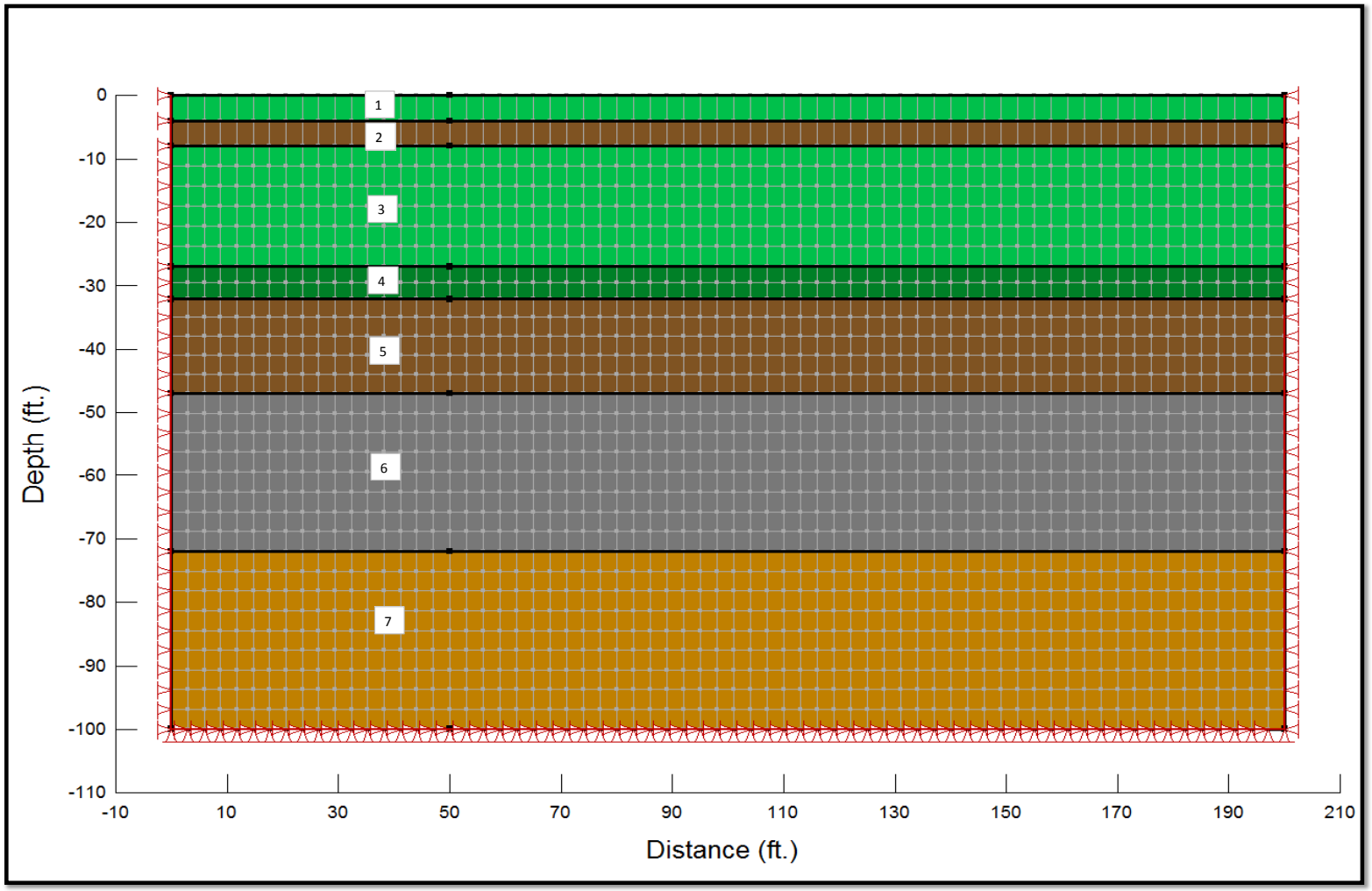
Soil Parameter	Medium Dense Sands	Very Loose Sands	Dense Sands	Loose Silty Sands
Depth (ft)	0.0'- 12.0'	12.0'- 17.0'	17.0'- 27.0'	27.0'- 37.0'
Saturated unit weight (pcf)	115	100	120	105
Effective unit weight for input purposes (pcf)	53	38	58	43
Estimated friction angle ϕ (degrees)	33	28	36	27
Estimated Wall Friction (degrees)	17	14	18	14
Cohesion (psf)	-	-	-	-
At Rest Pressure Coefficient (K_o)	0.46	0.53	0.41	0.55
Active Pressure Coefficient (K_a)	0.29	0.36	0.26	0.38
Passive Pressure Coefficient (K_p)	3.39	2.77	3.85	2.66

Tank Settlement Analysis Results

Settlement Analysis Results

Analysis Information	
Project:	Rivertown WTP
Location:	B-5
Bearing Pressure	2,000 psf
GWT:	5' in depth

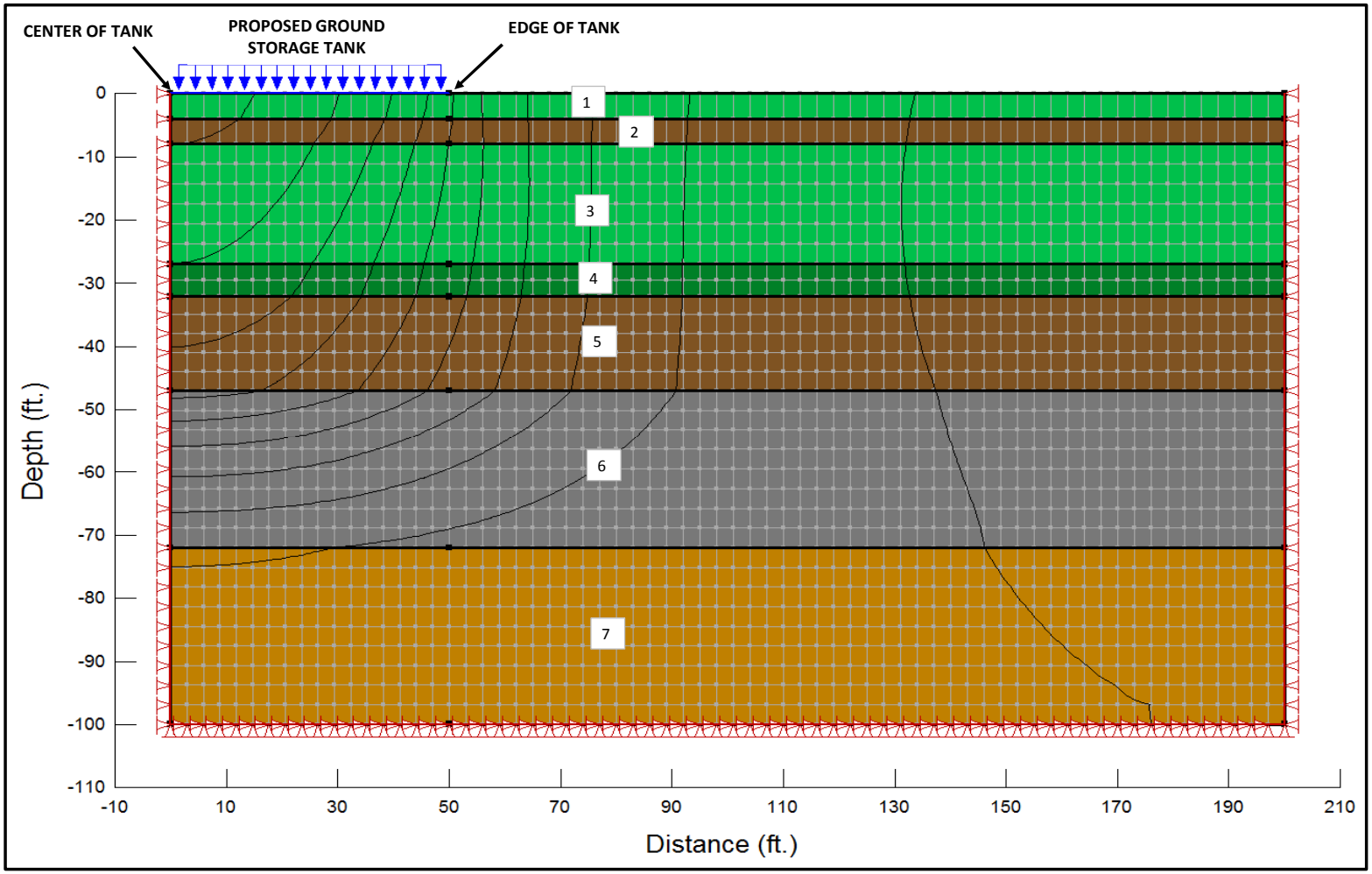
Soil Information									
Stratum	Color	Description	Unit Weight (pcf)	Elastic	Consolidation				
				E (ksf)	OCR	e_o	C_c	C_v (ft^2/day)	C_α
1		Medium Dense SP < 20	110	500	-	-	-	-	-
2		Medium Dense SM > 20	115	350	-	-	-	-	-
3		Medium Dense SP < 20	110	500	-	-	-	-	-
4		Medium Dense SP >20	115	700	-	-	-	-	-
5		Medium Dense SM > 20	115	350	-	-	-	-	-
6		Very Hard SILT	120	-	2.0	0.6	0.4	-	-
7		Medium Dense SC/SM < 20	110	250	-	-	-	-	-



Settlement Analysis Results

Settlement Results							
Section	Color	Description	Depth to Bottom	Elastic Settlement (in)	Primary Consolidation (in)	Total Settlement (in)	*Differential Settlement (in.)
1		Medium Dense SP < 20	4	0.1	---	0.1	0.0
2		Medium Dense SM > 20	8	0.2	---	0.2	0.1
3		Medium Dense SP < 20	27	0.6	---	0.6	0.3
4		Medium Dense SP >20	32	0.2	---	0.2	0.1
5		Medium Dense SM > 20	47	0.7	---	0.7	0.4
6		Very Hard SILT	72	---	1.6	1.6	0.8
7		Medium Dense SC/SM < 20	100	0.7	---	0.7	0.2
					Total	**4.0**	**1.9**

*Differential Settlement is Estimated between Center and Edge of Tank



Summary of Laboratory Test Results

SUMMARY OF LABORATORY TEST RESULTS

Rivertown Water Treatment Plant
St. Johns County, Florida
Water Treatment Plant - Structures

Boring No.	Sample No.	Approximate Depth (ft)	Natural Moisture Content (%)	Organic Content (%)	Percent Passing Sieve Size (%)						Atterberg Limits		Soil Classification Symbol
					#4	#10	#40	#60	#100	#200	LL	PI	
B-1	3	4.0 - 6.0	27	7.3						12			SP-SM/PT
B-1	8	23.5 - 25.0	35							7			SP-SM
B-2	3	4.0 - 5.0	23	6.3						10			SP-SM/PT
B-2	4	6.0 - 8.0	24							11			SP-SM
B-2	7	18.5 - 20.0	31							11			SP-SM
B-2	13	48.5 - 50.0	46							57	79	40	MH
B-3	3	4.0 - 6.0	17	3.6						7			SP-SM
B-3	8	23.5 - 25.0	30							6			SP-SM
B-4	3	4.0 - 6.0	23							13			SM
B-4	7	18.5 - 20.0	31							7			SP-SM
B-4	11	38.5 - 40.0	29							34	32	12	SC
B-4	12	43.5 - 45.0	39							32	48	18	SM
B-5	3	4.0 - 6.0	18							8			SP-SM
B-5	8	23.5 - 25.0	33							7			SP-SM
B-5	10	33.5 - 35.0	31							6			SP-SM
B-5	18	73.5 - 75.0	42							27	52	28	SC
B-5	21	88.5 - 90.0	34							23			SM
B-6	2	2.0 - 4.0	30	7.8						36			SM/PT
B-6	4	6.0 - 8.0	29	3.9	99	98	97	94	48	10			SP-SM
B-7	2	2.0 - 4.0	24	9.6						9			SP-SM/PT
B-7	6	13.5 - 15.0	30							11			SP-SM
B-8	4	6.0 - 8.0	41	8.8						15			SM/PT
B-8	5	8.0 - 10.0	29		100	100	100	97	44	6			SP-SM
B-9	2	2.0 - 4.0	32	9.4						7			SP-SM/PT
B-9	6	13.5 - 15.0	28							4			SP
B-10	2	2.0 - 4.0	23	5.5						6			SP-SM/PT
B-10	3	4.0 - 5.5	47	8.5						11			SP-SM/PT
B-10	4	6.0 - 8.0	26	3.5	100	98	91	86	37	7			SP-SM
B-10	5	8.0 - 10.0	34	3.5						9			SP-SM

SUMMARY OF LABORATORY TEST RESULTS

Rivertown Water Treatment Plant
St. Johns County, Florida
Water Treatment Plant - Structures

Boring No.	Sample No.	Approximate Depth (ft)	Natural Moisture Content (%)	Organic Content (%)	Percent Passing Sieve Size (%)						Atterberg Limits		Soil Classification Symbol
					#4	#10	#40	#60	#100	#200	LL	PI	
B-11	3	4.0 - 5.0	26	7.4						11			SP-SM/PT
B-11	6	13.5 - 15.0	29							15			SM
B-12	6	13.5 - 15.0	30							7			SP-SC
B-12	9	28.5 - 30.0	70							56	32	12	CL
B-13	7	18.5 - 20.0	64							74	58	38	CH
B-13	8	23.5 - 25.0	65							97	111	60	MH
B-14	1	0.0 - 2.0	24							6			SP-SM
B-14	5	8.0 - 10.0	29							20	24	4	SC
B-14	6	13.5 - 15.0	26							6			SP-SM
B-15	6	13.5 - 15.0	27		100	100	99	96	35	7			SP-SM
B-15	9	28.5 - 30.0	29							7			SP-SM
B-15	13	48.5 - 50.0	44							60	85	50	CH
B-16	7	18.5 - 20.0	61							73	64	34	CH
B-17	8	23.5 - 25.0	75							99	97	62	CH
B-18	1	1.0 - 2.0	13	28.9						14			PT
B-19	4	6.0 - 8.0	25							7			SP-SM
B-19	6	13.5 - 15.0	40							78	54	41	CH
B-19	8	23.5 - 25.0	30							20	26	4	SM

SUMMARY OF LABORATORY TEST RESULTS

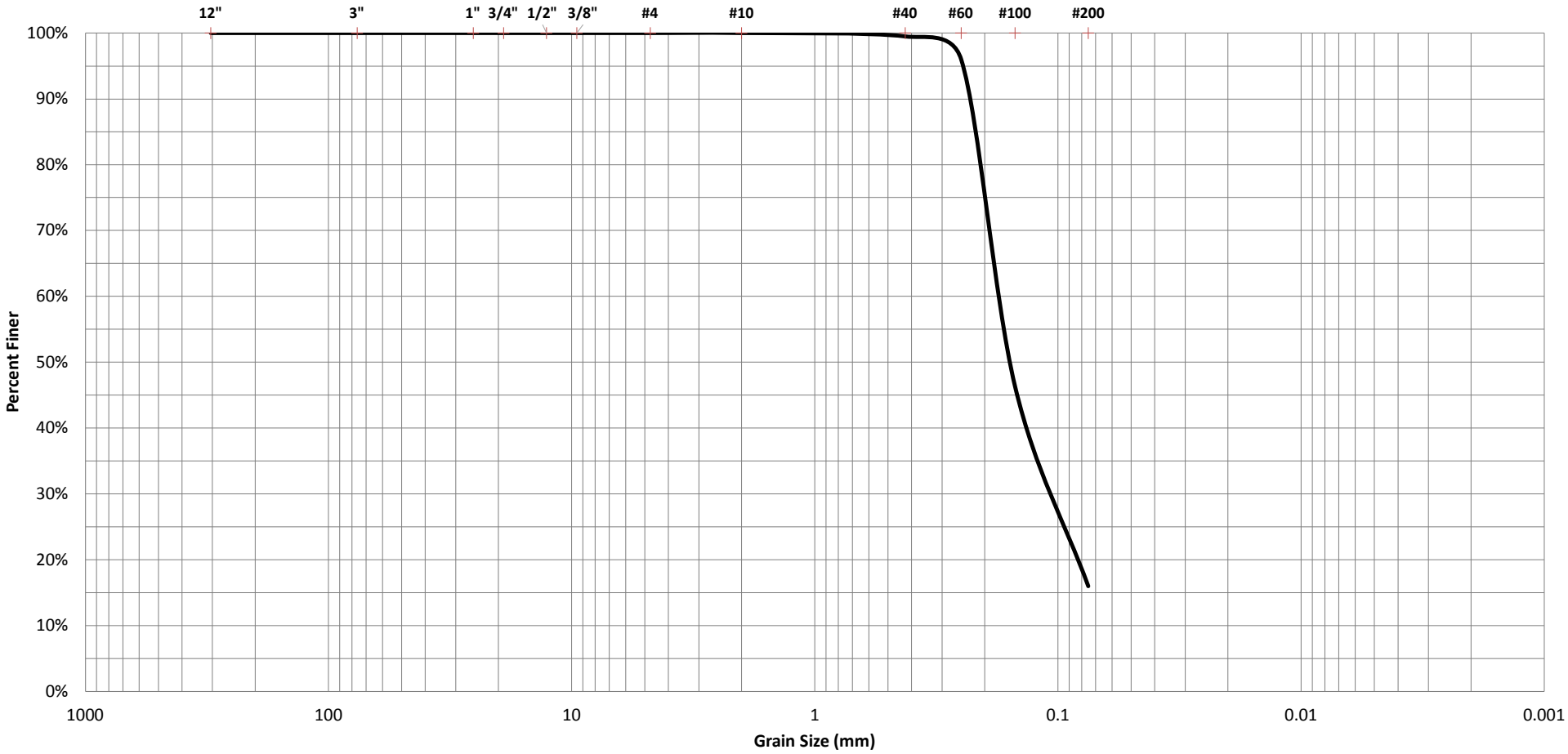
Rivertown Water Treatment Plant
St. Johns County, Florida
Retention Pond

Boring No.	Sample No.	Approximate Depth (ft)	Natural Moisture Content (%)	Organic Content (%)	Percent Passing Sieve Size (%)						Atterberg Limits		Soil Classification Symbol
					#4	#10	#40	#60	#100	#200	LL	PI	
A-1	2	2.0 - 5.0	22	3.8						11			SP-SM
A-1	3	5.0 - 7.0	23		100	100	99	96	46	16			SM
A-1	5	12.5 - 15.0	29							12			SP-SM
A-2	2	3.5 - 5.0	24		100	100	99	96	45	9			SP-SM
A-2	4	8.0 - 11.5	27							8			SP-SM

Grain Size Distribution Curves

GRAIN SIZE DISTRIBUTION GRAPH

US STANDARD SIEVE SIZES



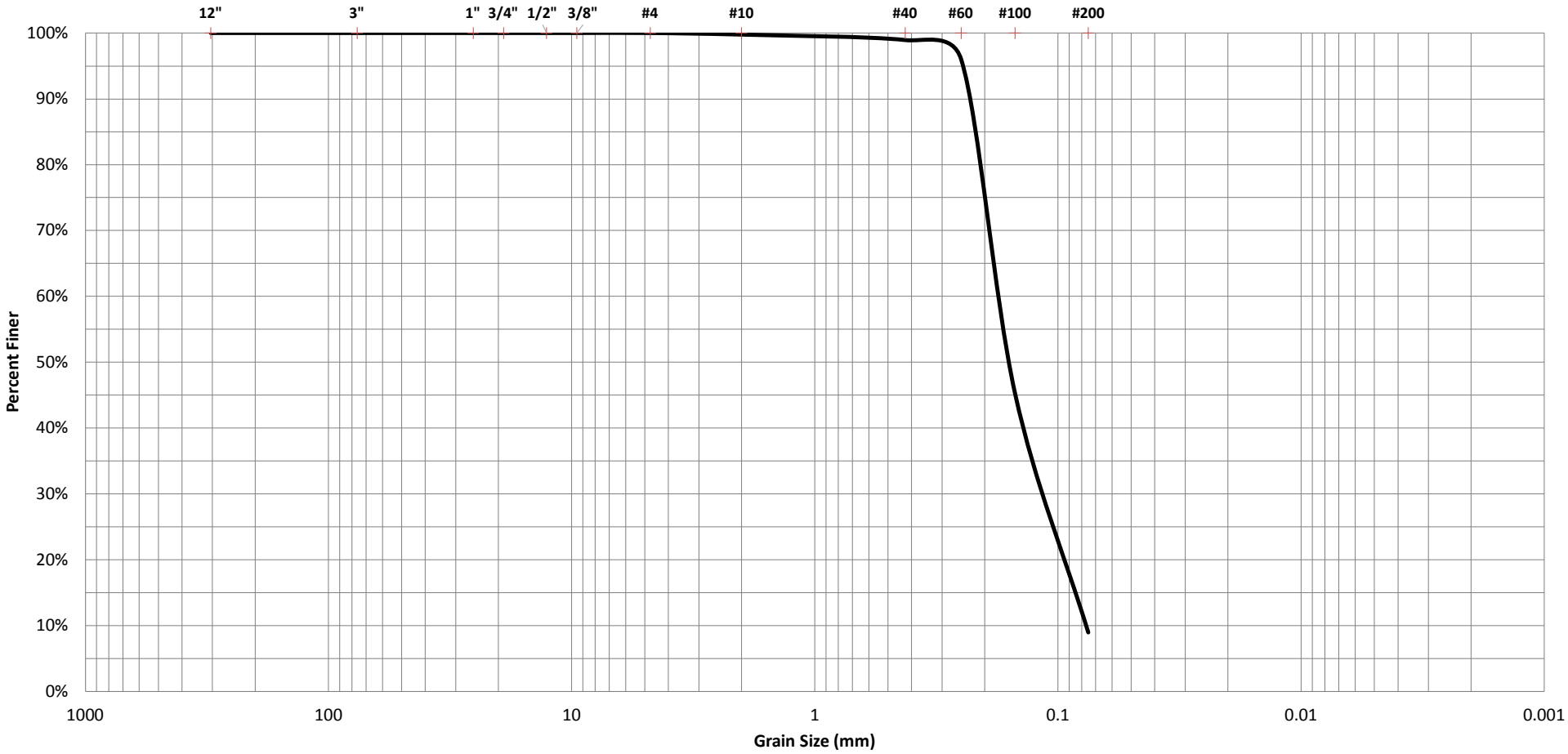
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

PROJECT NAME:	Rivertown Water Treatment Plant	**BORING NO. / SAMPLE NO.:**	A-1 (3)
CSI GEO PROJECT NUMBER:	71-19-127-02	**DEPTH (FT.) :**	5-7

W%	LL	PL	PI	DESCRIPTION / CLASSIFICATION		CSI Geo, Inc.
23	-	-	-	Light Brown to Light Gray Silty Fine SAND	SM	

GRAIN SIZE DISTRIBUTION GRAPH

US STANDARD SIEVE SIZES



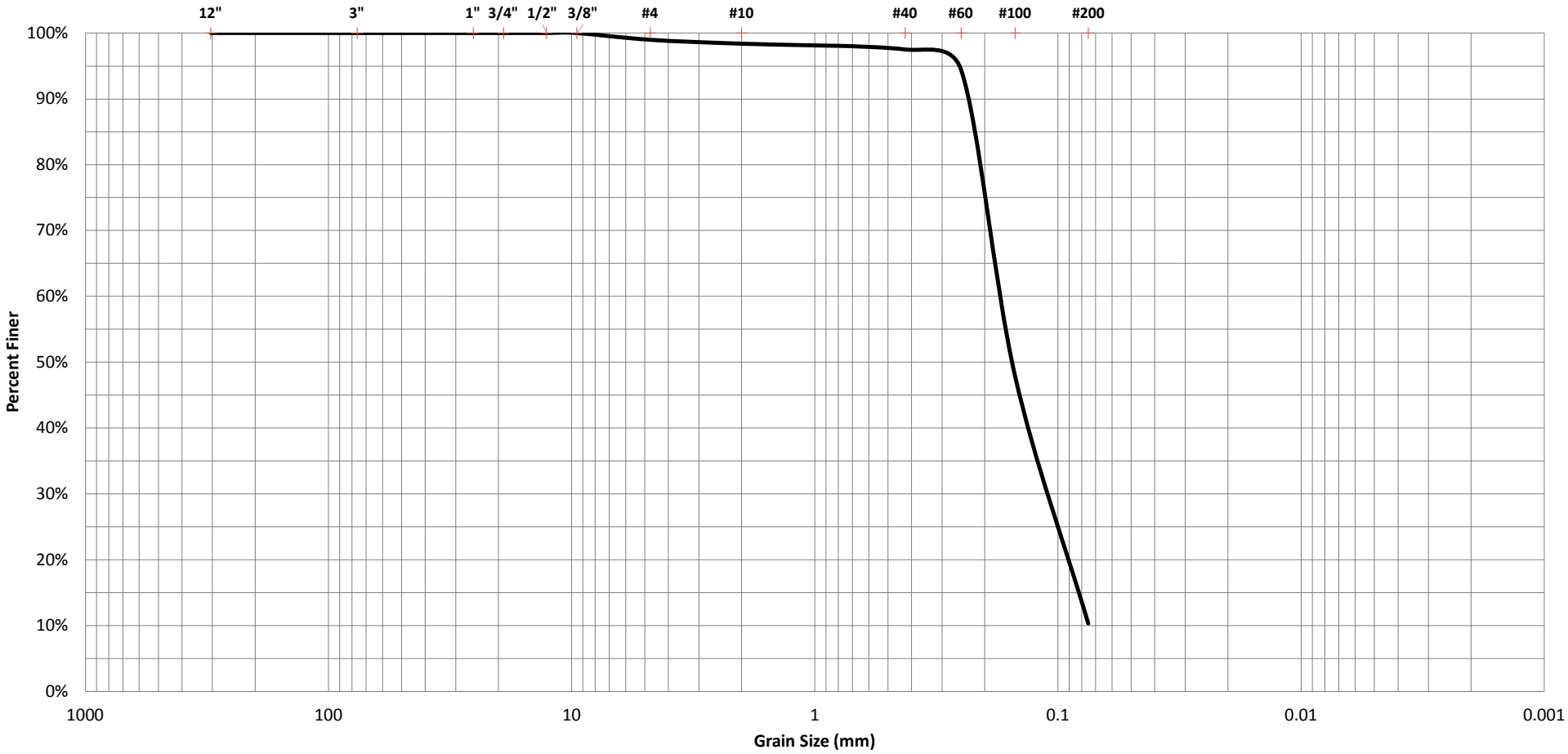
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

PROJECT NAME:	Rivertown Water Treatment Plant	**BORING NO. / SAMPLE NO.:**	A-2 (2)
CSI GEO PROJECT NUMBER:	71-19-127-02	**DEPTH (FT.) :**	3.5-5

W%	LL	PL	PI	DESCRIPTION / CLASSIFICATION		CSI Geo, Inc.
24	-	-	-	Light Gray Slightly Silty Fine SAND	SP-SM	

GRAIN SIZE DISTRIBUTION GRAPH

US STANDARD SIEVE SIZES



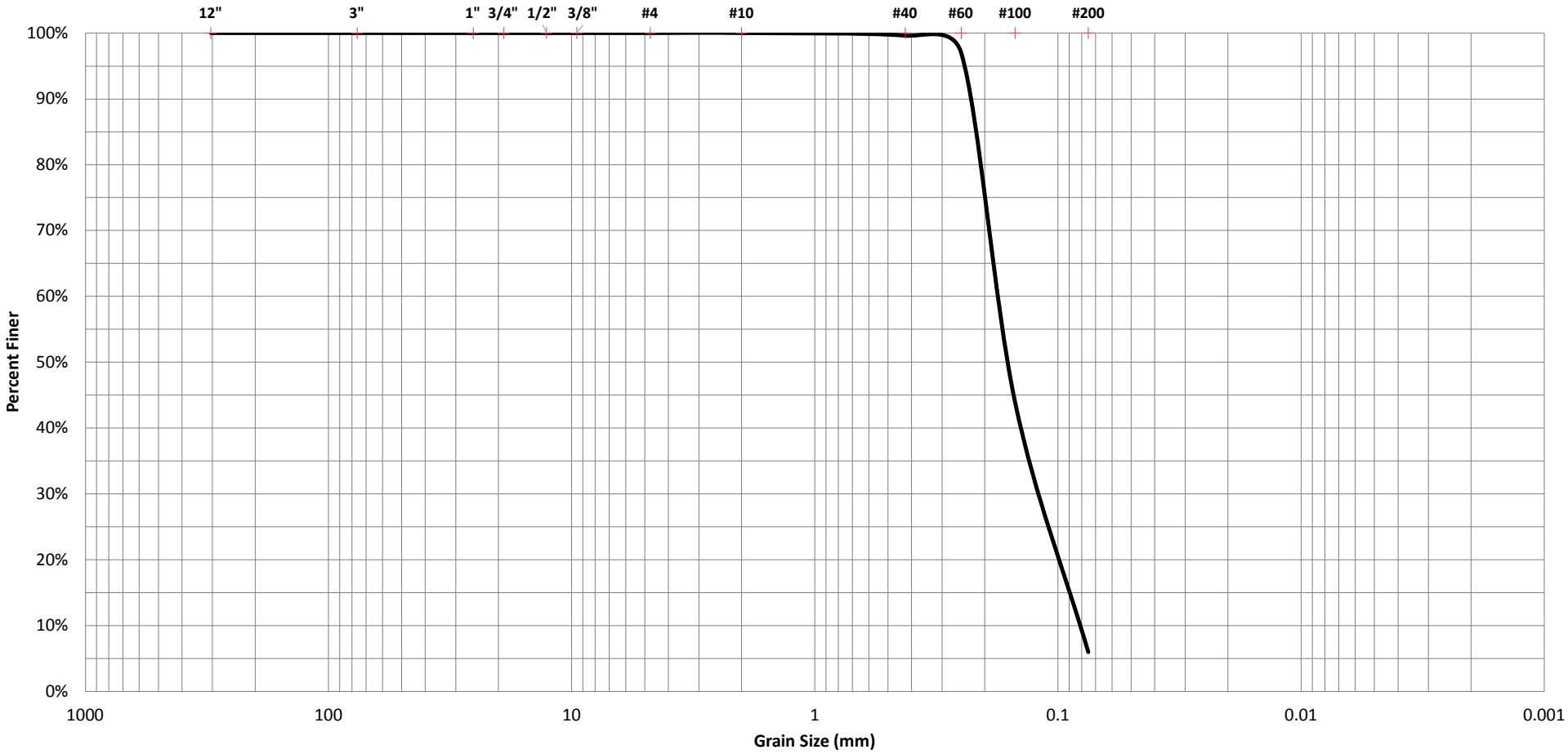
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

PROJECT NAME:	Rivertown Water Treatment Plant	**BORING NO. / SAMPLE NO.:**	B-6 (4)
CSI GEO PROJECT NUMBER:	71-19-127-02	**DEPTH (FT.) :**	6-8

W%	LL	PL	PI	DESCRIPTION / CLASSIFICATION		CSI Geo, Inc.
29	-	-	-	Dark Brown Slightly Organic Slightly Silty Fine SAND	SP-SM	

GRAIN SIZE DISTRIBUTION GRAPH

US STANDARD SIEVE SIZES



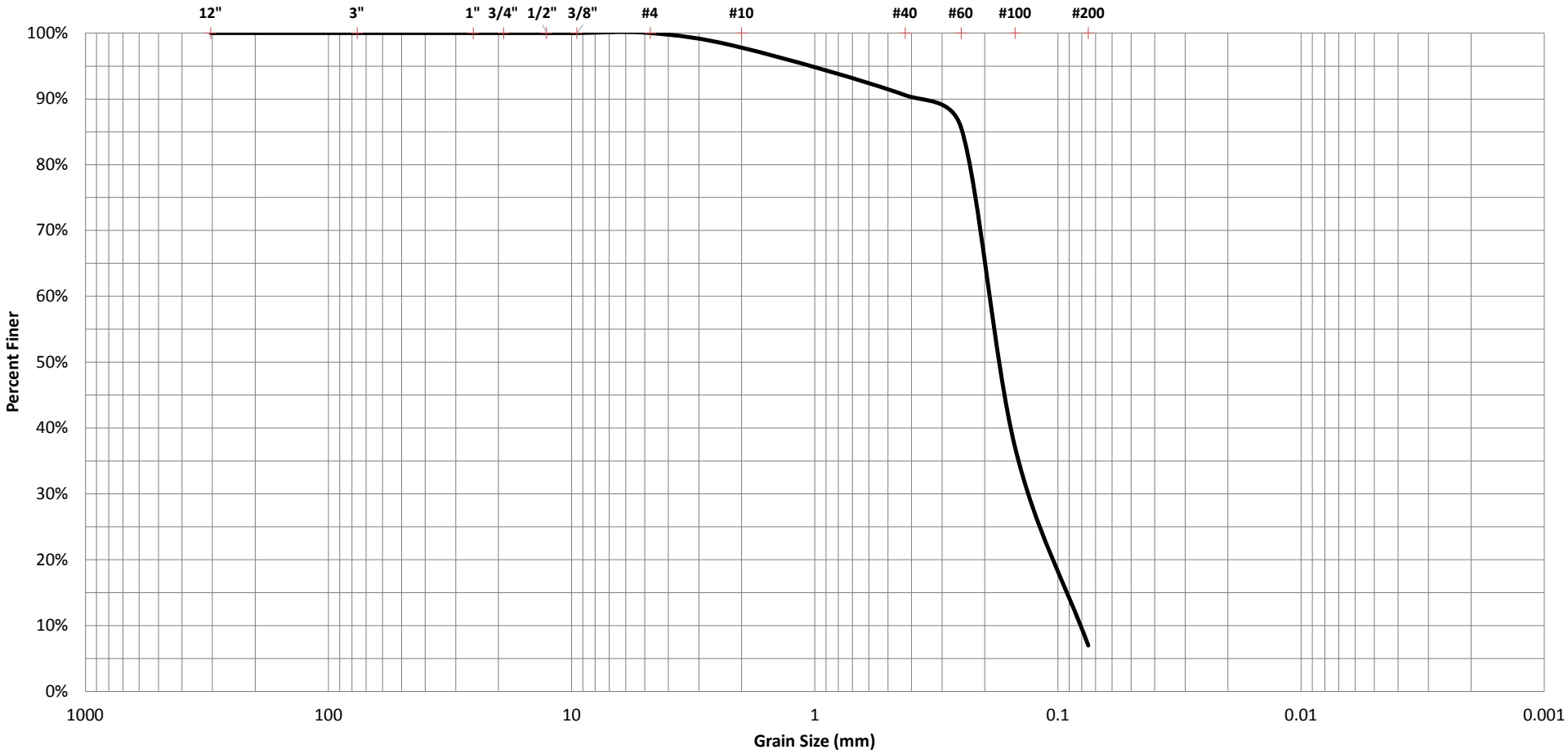
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

PROJECT NAME:	Rivertown Water Treatment Plant	**BORING NO. / SAMPLE NO.:**	B-8 (5)
CSI GEO PROJECT NUMBER:	71-19-127-02	**DEPTH (FT.) :**	8-10

W%	LL	PL	PI	DESCRIPTION / CLASSIFICATION		CSI Geo, Inc.
29	-	-	-	Brown Slightly Silty Fine SAND	SP-SM	

GRAIN SIZE DISTRIBUTION GRAPH

US STANDARD SIEVE SIZES



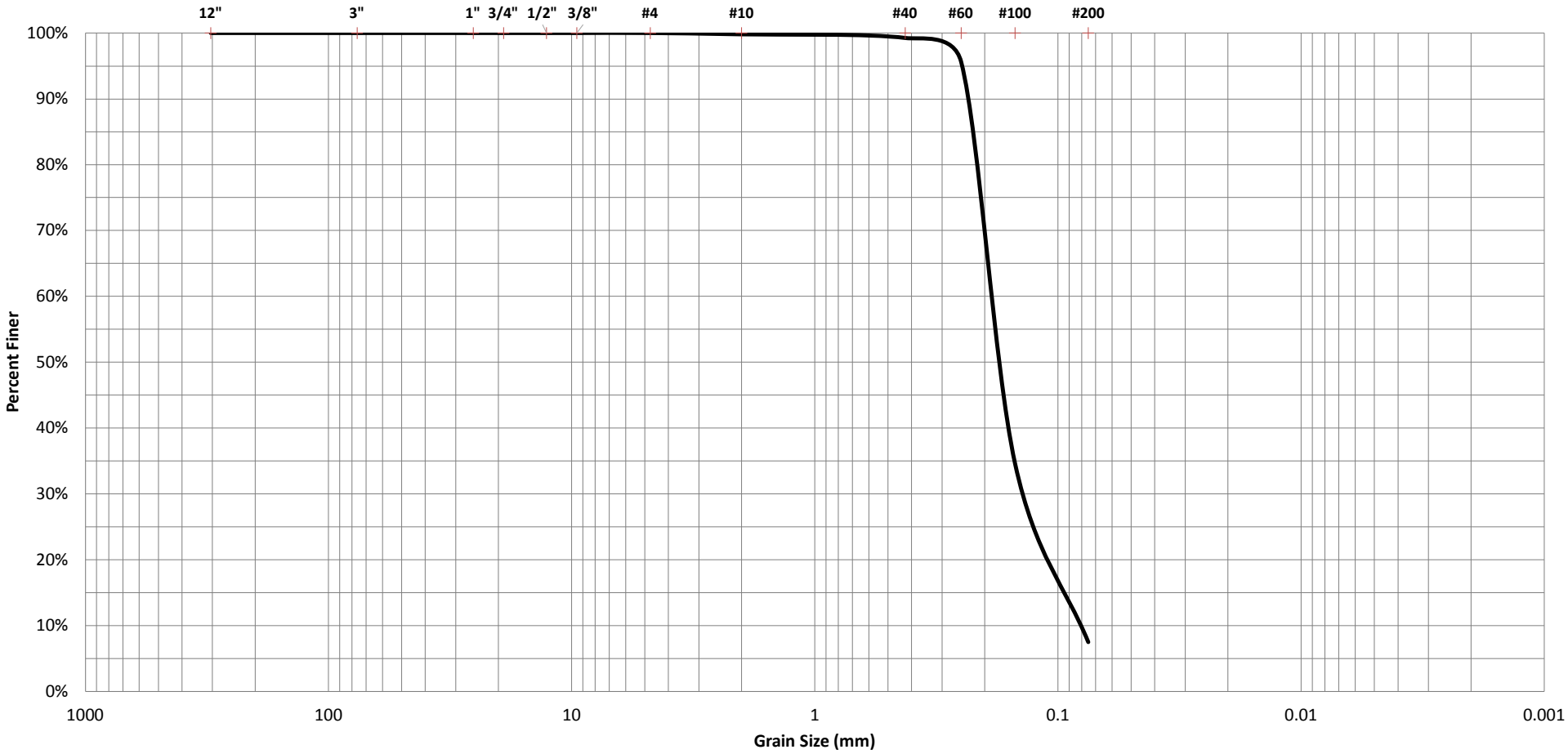
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

PROJECT NAME:	Rivertown Water Treatment Plant	**BORING NO. / SAMPLE NO.:**	B-10 (4)
CSI GEO PROJECT NUMBER:	71-19-127-02	**DEPTH (FT.) :**	6-8

W%	LL	PL	PI	DESCRIPTION / CLASSIFICATION		CSI Geo, Inc.
26	-	-	-	Dark Brown Slightly Organic Slightly Silty Fine SAND with few shell fragments	SP-SM	

GRAIN SIZE DISTRIBUTION GRAPH

US STANDARD SIEVE SIZES



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

PROJECT NAME:	Rivertown	**BORING NO. / SAMPLE NO.:**	B-15 (6)
CSI GEO PROJECT NUMBER:	71-19-127-02	**DEPTH (FT.) :**	13.5-15

W%	LL	PL	PI	DESCRIPTION / CLASSIFICATION		CSI Geo, Inc.
27	-	-	-	Gray Slightly Silty Fine Sand	SP-SM	

Appendix C – General Information

- Key to Soil Classification
- Field and Laboratory Test Procedures

Key to Soil Classification

KEY TO SOIL CLASSIFICATION

Correlation of Penetration Resistance with Relative Density and Consistency

Granular Materials

Relative Density	Auto Hammer SPT N-Value (Blows/foot)
Very Loose	Less than 3
Loose	3 – 8
Medium Dense	8 - 24
Dense	24 - 40
Very Dense	Greater than 40

Silts and Clays

Consistency	Auto Hammer SPT N-Value (Blows/foot)
Very Soft	Less than 1
Soft	1 – 3
Firm	3 - 6
Stiff	6 - 12
Very Stiff	12 - 24
Hard	Greater than 24

Particle Size Identification (Unified Soil Classification System)

Boulders:	Diameter exceeds 8 inches
Cobbles:	3 to 8 inches diameter
Gravel:	Coarse - 3/4 to 3 inches in diameter
	Fine - 4.76 mm to 3/4 inch in diameter
Sand:	Coarse - 2.0 mm to 4.76 mm in diameter
	Medium - 0.42 mm to 2.0 mm in diameter
	Fine - 0.074 mm to 0.42 mm in diameter

Modifiers

These modifiers provide our estimate of the amount of fines (silt or clay size particles) in soil samples.

Approximate Fines Content	Modifiers
5% Fines 12%	Slightly silty or slightly clayey
12% Fines 30%	Silty or clayey
30% Fines 50%	Very silty or very clayey

These modifiers provide our estimate of shell, rock fragments, or roots in the soil sample.

Approximate Content, By Weight	Modifiers
< 5%	Trace
5% to 10%	Few
15% to 25%	Little
30% to 45%	Some
50% to 100%	Mostly

These modifiers provide our estimate of organic content in the soil sample.

Organic Content	Modifiers
1% to 3%	Trace
3% to 5%	Slightly Organic
5% to 20%	Organic
20% to 75%	Highly Organic (Muck)
> 75%	Peat

Field and Laboratory Test Procedures

FIELD AND LABORATORY TEST PROCEDURES

FIELD TEST PROCEDURES

Standard Penetration Test (SPT) Borings – The soil penetration test borings were made in general accordance with ASTM D-1586, "Penetration Test and Split-Barrel Sampling of Soils". The borings were advanced by continuous driving the split spoon sampler to a depth of 10 feet below the existing ground surface. Below 10 feet and until boring termination depths, split spoon sampling was performed at a spacing of 5 feet. Bentonite drilling fluid was used below the ground water level to stabilize the sides and to flush the cuttings. At the sampling intervals, the drilling tools were removed and soil samples were obtained with a standard 1.4 inch I.D., 2.0 inch O.D., split-tube sampler. The sampler was first seated six inches and then driven an additional foot with blows of a 140 pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Penetration Resistance". The penetration resistance, when properly interpreted, is an index to the soil strength and density. Representative portions of the soil samples, obtained from the sampler, were containerized and transported to our laboratory. The samples were then examined by a geotechnical engineer to confirm the field classifications.

Auger Borings – The auger borings were advanced by the use of a truck mounted auger drill rig. The soils encountered were identified in the field from the cuttings brought to the surface by the augering process. Representative soil samples were placed in glass jars and transported to our laboratory where they were examined by a geotechnical engineer to confirm field classifications.

LABORATORY TEST PROCEDURES

Natural Moisture Content – The water content is the ratio, expressed as a percentage, of the weight of water in a given mass of soil to the weight of the solid particles. This test was conducted in the general accordance with ASTM D2216.

Percent Fine Content – To determine the percentage of soils finer than No. 200 sieve, the dried samples were washed over a 200 mesh sieve. The material retained on the sieve was oven dried and then weighed and compared with the unwashed dry weight in order to determine the weight of the fines. The percentage of fines in the soil sample was then determined as the percent of weight of fines in the sample to the weight of the unwashed sample. This test was conducted in accordance with ASTM D1140.

Percent Organic Content – This test is based on the percent of organics by weight of the total sample. This test was conducted in accordance with FM I - T 267.

Grain Size Distribution - The grain size tests were performed to determine the particle size and distribution of the samples tested. Each sample was dried, weighed, and washed over a No. 200 mesh sieve. The dried sample was then passed through a standard set of nested sieves to determine the grain size distribution of the soil particles coarser than the No. 200 sieve. This test was conducted in accordance with ASTM D1140.

Plasticity (Atterberg Limits) – The soil's Plastic Index (PI) is bracketed by the Liquid Limit (LL) and Plastic Limit (PL). The LL is the moisture content at which the soil flows as a heavy viscous fluid and is determined in general accordance with FM 1-T 089. The PL is the moisture content at which the soil begins to crumble when rolled into a small thread and is also determined in general accordance with ASTM D4318. The water-plasticity ratio is computed from the above test data. This ratio is an expression comparing the relative natural state of soil with its liquid and plastic consolidation characteristics.

APPENDIX 2
Test Holes Report

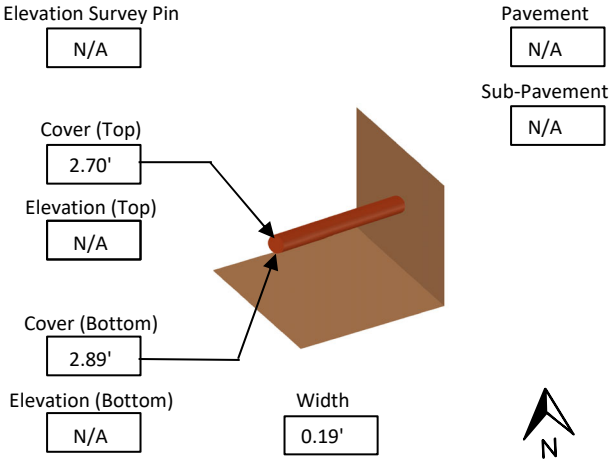
FR Aleman & Associates, Inc.
6196 Lake Gray Boulevard, Suite 101
Jacksonville, FL 32244
904.779.5972

Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	1
# of Holes	1
Date	1/20/2020
Time	N/A

Project Name: JEA Rivertown WTP

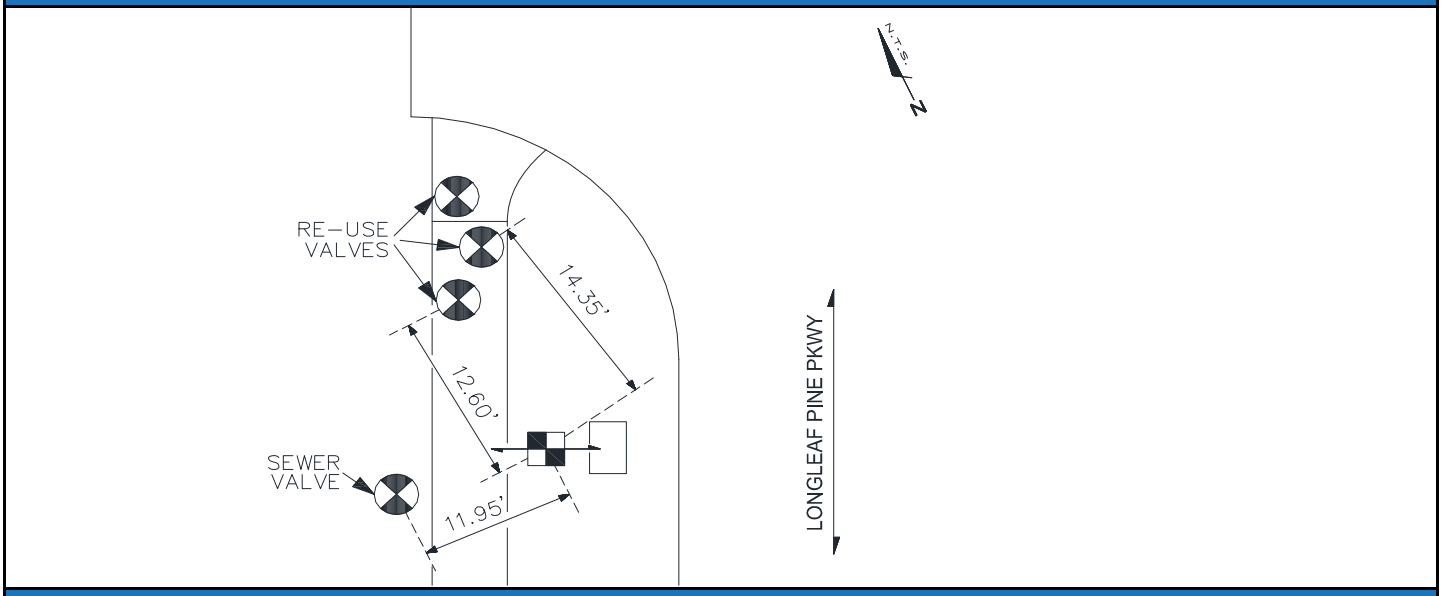
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	UNITI-FIBER	**Requested Locate**	TELEPHONE FOC	**Located Utility**	TELEPHONE FOC
Pavement Type	N/A	**Pavement Condition**	N/A	**Soil Condition**	SOFT DRY
Material as Found	PVC	**Size Expected**	2"	**Size Found**	2"
Utility Condition	GOOD	**Ribbon Installed**	ORANGE	**Utility Direction**	NW/SE
Proposed	NEW UTILITIES	**Installed**	HUB	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-1, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

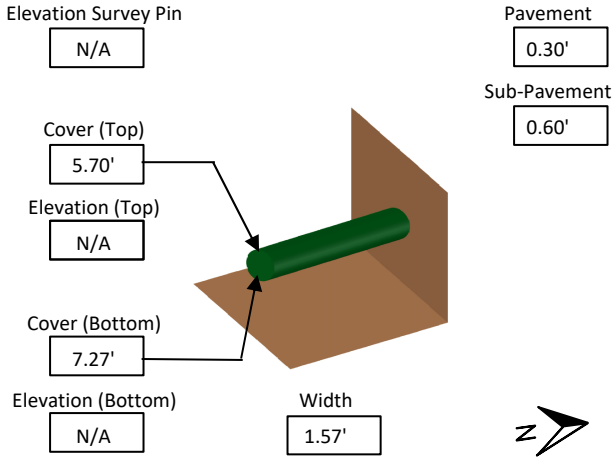
FR Aleman & Associates, Inc.
6196 Lake Gray Boulevard, Suite 101
Jacksonville, FL 32244
904.779.5972

Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	2
# of Holes	1
Date	1/20/2020
Time	N/A

Project Name: JEA Rivertown WTP

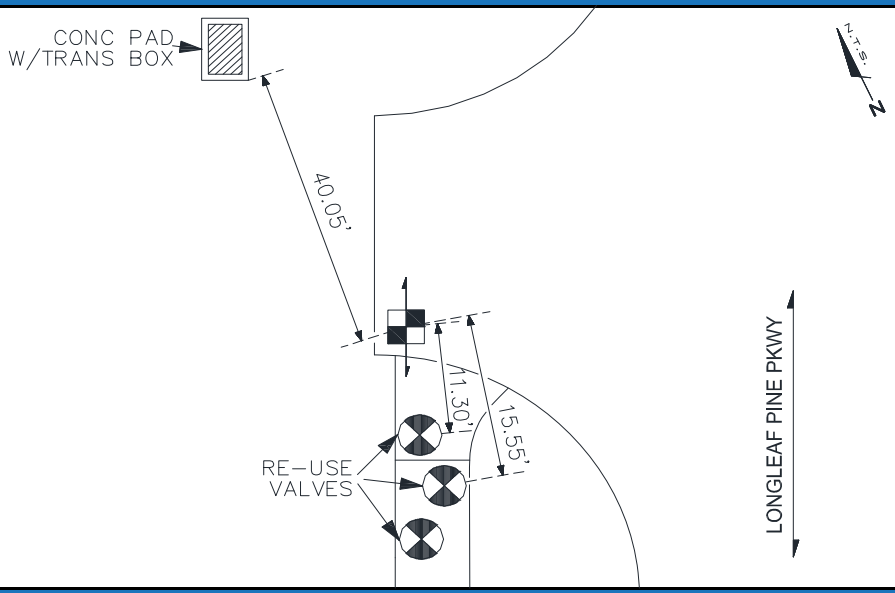
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	JEA WATER & SEWER	**Requested Locate**	FORCE MAIN	**Located Utility**	FORCE MAIN
Pavement Type	ASPHALT	**Pavement Condition**	FAIR	**Soil Condition**	SOFT DRY
Material as Found	PVC	**Size Expected**	16"	**Size Found**	16"
Utility Condition	GOOD	**Ribbon Installed**	GREEN	**Utility Direction**	NE/SW
Proposed	NEW UTILITIES	**Installed**	PK	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-1, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

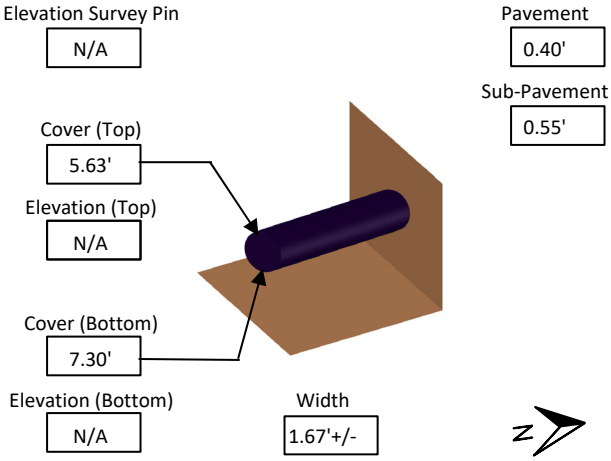
FR Aleman & Associates, Inc.
6196 Lake Gray Boulevard, Suite 101
Jacksonville, FL 32244
904.779.5972

Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	3
# of Holes	1
Date	1/20/2020
Time	N/A

Project Name: JEA Rivertown WTP

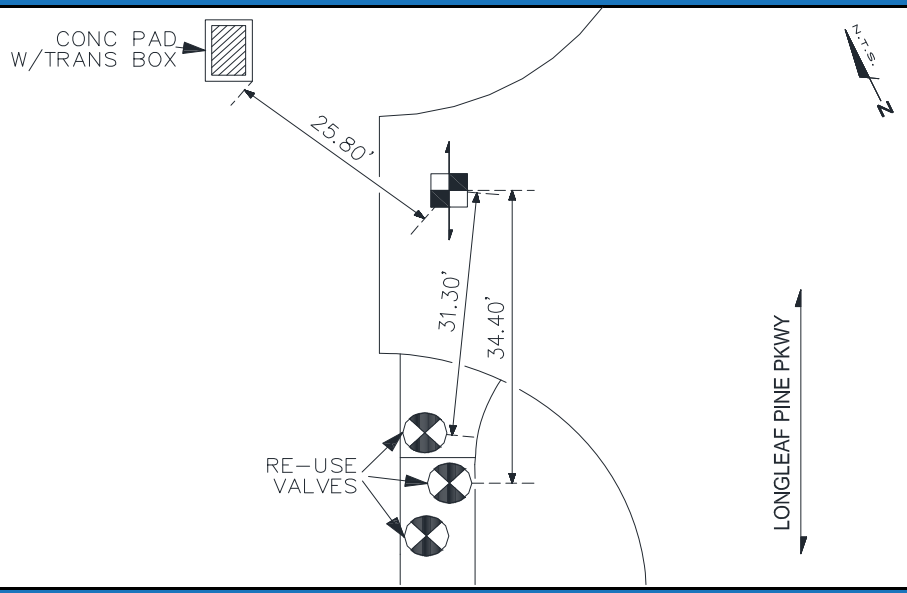
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	JEA WATER & SEWER	**Requested Locate**	RE-CLAIM	**Located Utility**	RE-CLAIM
Pavement Type	ASPHALT	**Pavement Condition**	GOOD	**Soil Condition**	SOFT DRY
Material as Found	PVC	**Size Expected**	20"	**Size Found**	20"
Utility Condition	GOOD	**Ribbon Installed**	PURPLE	**Utility Direction**	NE/SW
Proposed	NEW UTILITIES	**Installed**	PK	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-1, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

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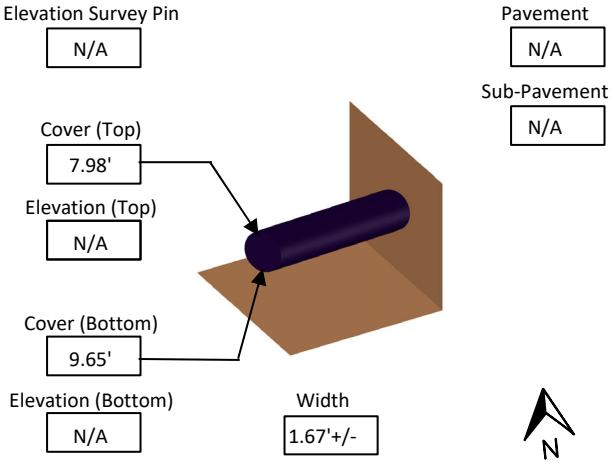
Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	4
# of Holes	1
Date	1/20/2020
Time	N/A

Project Name: JEA Rivertown WTP

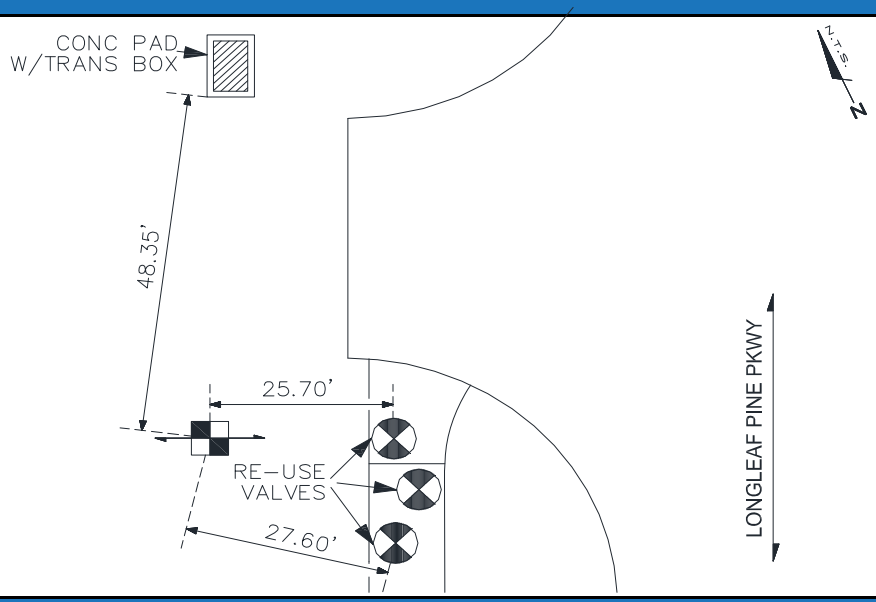
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	JEA WATER & SEWER	**Requested Locate**	RE-CLAIM	**Located Utility**	RE-CLAIM
Pavement Type	N/A	**Pavement Condition**	N/A	**Soil Condition**	SOFT MOIST
Material as Found	PVC	**Size Expected**	20"	**Size Found**	20"
Utility Condition	GOOD	**Ribbon Installed**	PURPLE	**Utility Direction**	NW/SE
Proposed	NEW UTILITIES	**Installed**	HUB	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-1, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

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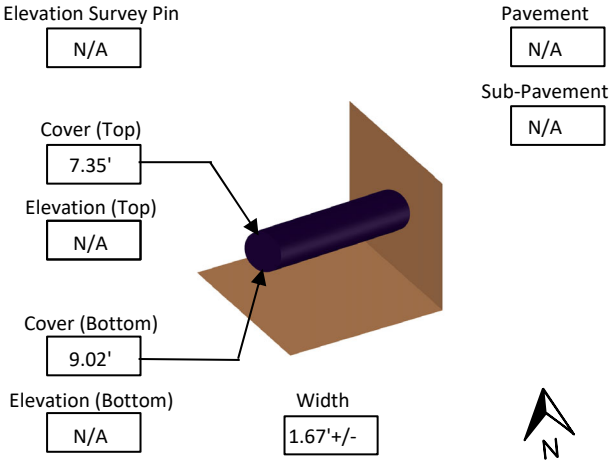
Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	5
# of Holes	1
Date	1/20/2020
Time	N/A

Project Name: JEA Rivertown WTP

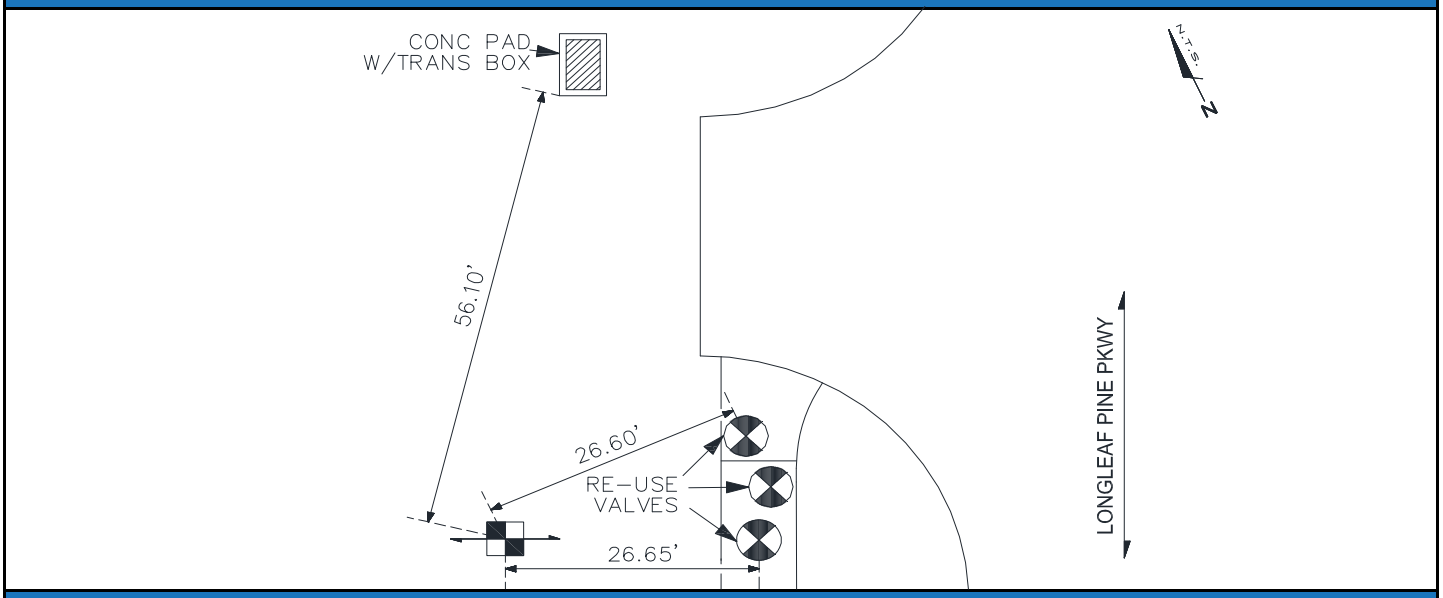
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	JEA WATER & SEWER	**Requested Locate**	RE-CLAIM	**Located Utility**	RE-CLAIM
Pavement Type	N/A	**Pavement Condition**	N/A	**Soil Condition**	SOFT MOIST
Material as Found	PVC	**Size Expected**	20"	**Size Found**	20"
Utility Condition	GOOD	**Ribbon Installed**	PURPLE	**Utility Direction**	NW/SE
Proposed	NEW UTILITIES	**Installed**	HUB	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-1, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

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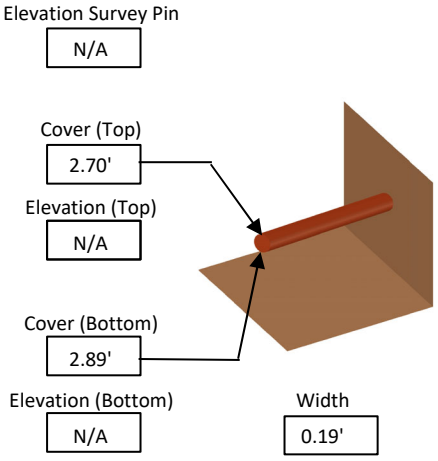
Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	6
# of Holes	1
Date	1/20/2020
Time	N/A

Project Name: JEA Rivertown WTP

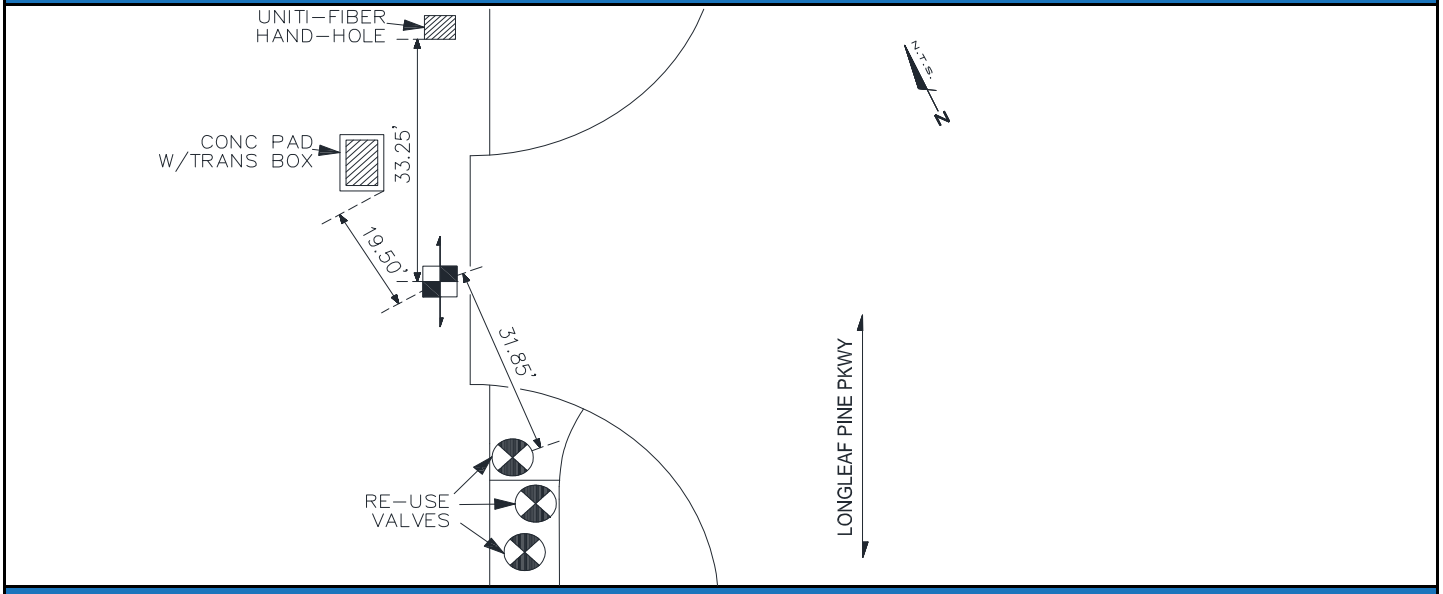
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	UNITI-FIBER	**Requested Locate**	FOC	**Located Utility**	FOC
Pavement Type	ROCK	**Pavement Condition**	N/A	**Soil Condition**	SOFT DIRT
Material as Found	PVC	**Size Expected**	2"	**Size Found**	2"
Utility Condition	GOOD	**Ribbon Installed**	ORANGE	**Utility Direction**	NE/SW
Proposed	NEW UTILITIES	**Installed**	PIN	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-1, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

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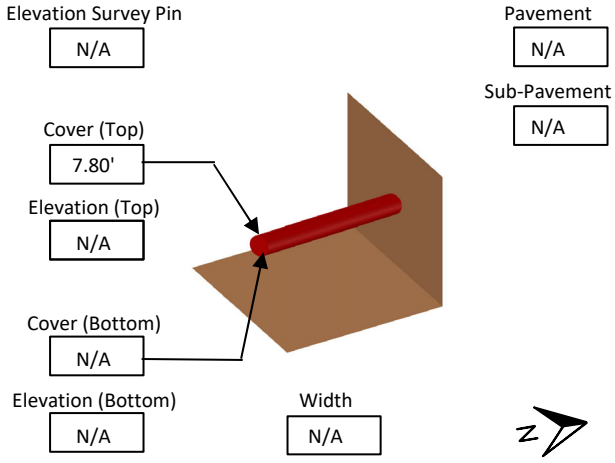
Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	7
# of Holes	1
Date	1/20/2020
Time	N/A

Project Name: JEA Rivertown WTP

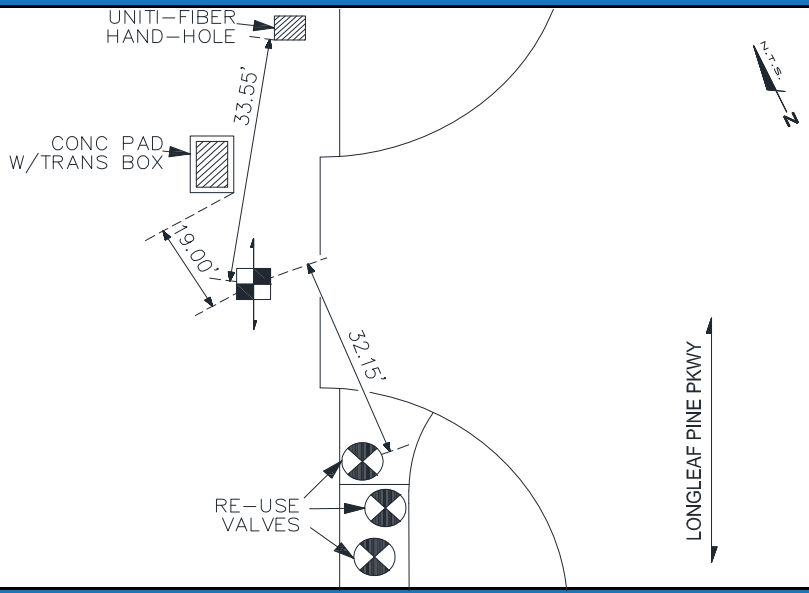
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	FPL	**Requested Locate**	ELECTRIC	**Located Utility**	ELECTRIC
Pavement Type	ROCK	**Pavement Condition**	N/A	**Soil Condition**	SOFT WET ROCK
Material as Found	UNKNOWN	**Size Expected**	N/A	**Size Found**	N/A
Utility Condition	N/A	**Ribbon Installed**	RED	**Utility Direction**	NE/SW
Proposed	NEW UTILITIES	**Installed**	PIN	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes: Dug hole to a depth of 7.80', unable to identify size and material due to depth of utility. Checked with USIC locator to find size expected and prints show N/A on size and material.

Find test hole location in sheet no. C-1, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

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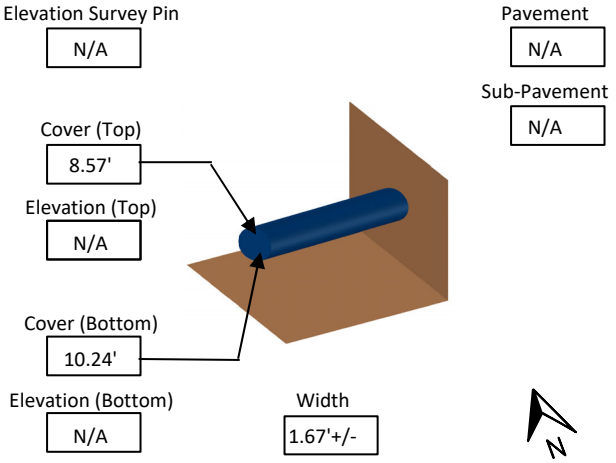
Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	8
# of Holes	1
Date	1/21/2020
Time	N/A

Project Name: JEA Rivertown WTP

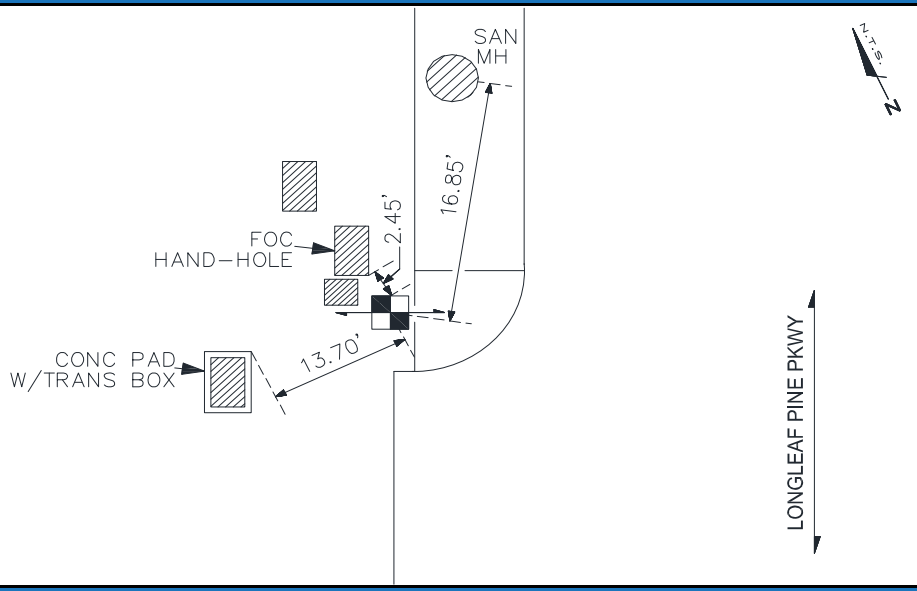
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	JEA WATER & SEWER	**Requested Locate**	WATER	**Located Utility**	WATER
Pavement Type	N/A	**Pavement Condition**	N/A	**Soil Condition**	SOFT DRY
Material as Found	PVC	**Size Expected**	20"	**Size Found**	20"
Utility Condition	GOOD	**Ribbon Installed**	BLUE	**Utility Direction**	NW/SE
Proposed	NEW UTILITIES	**Installed**	HUB	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-1, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

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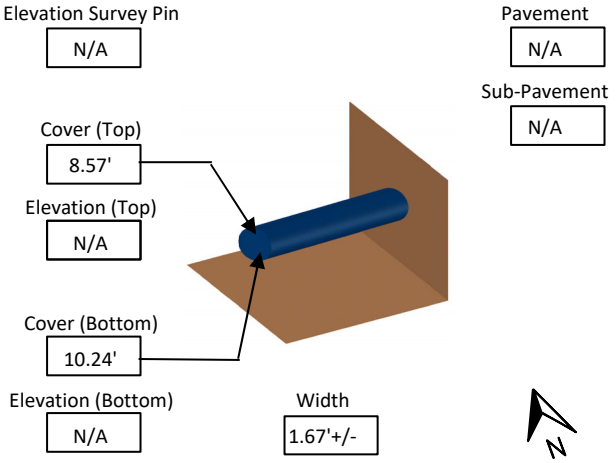
Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	9
# of Holes	1
Date	1/21/2020
Time	N/A

Project Name: JEA Rivertown WTP

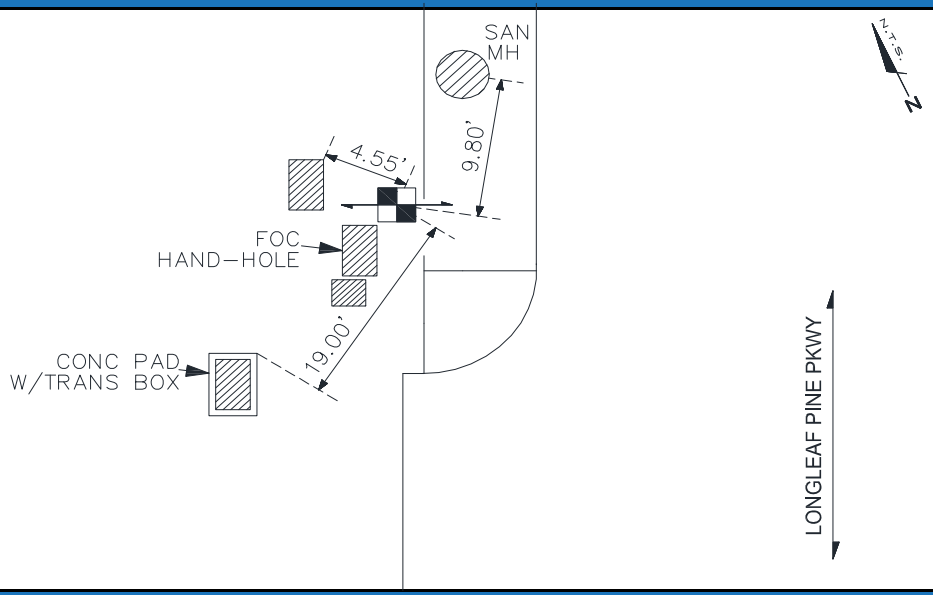
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	JEA WATER & SEWER	**Requested Locate**	WATER	**Located Utility**	WATER
Pavement Type	N/A	**Pavement Condition**	N/A	**Soil Condition**	SOFT MOIST
Material as Found	PVC	**Size Expected**	20"	**Size Found**	20"
Utility Condition	GOOD	**Ribbon Installed**	BLUE	**Utility Direction**	NW/SE
Proposed	NEW UTILITIES	**Installed**	HUB	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-1, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

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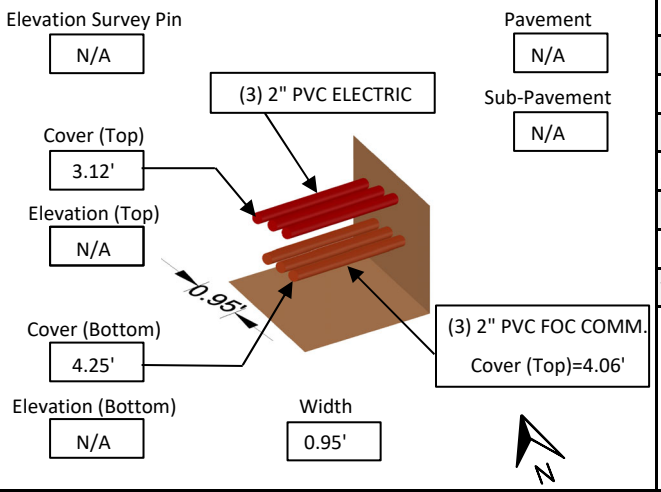
Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	10
# of Holes	1
Date	1/21/2020
Time	N/A

Project Name: JEA Rivertown WTP

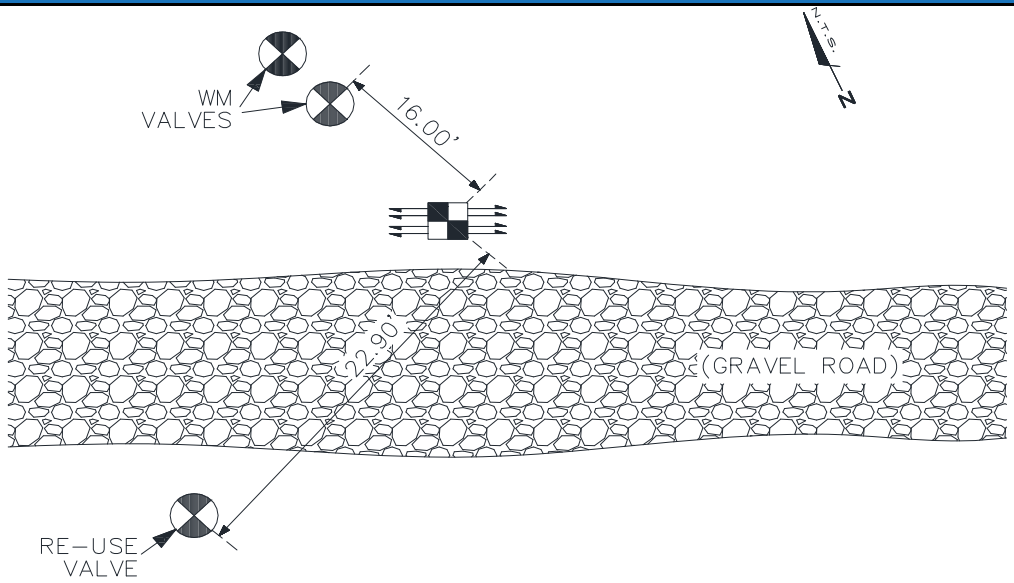
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	FPL & AT&T	**Requested Locate**	ELECTRIC & FOC	**Located Utility**	ELECTRIC & FOC
Pavement Type	N/A	**Pavement Condition**	N/A	**Soil Condition**	HARD DRY
Material as Found	PVC	**Size Expected**	2"	**Size Found**	(6) 2"
Utility Condition	GOOD	**Ribbon Installed**	RED	**Utility Direction**	NW/SE
Proposed	NEW UTILITIES	**Installed**	HUB	**At**	EDGE OF UTILITY - S



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-5, Rivertown Water Treatment Plan Project, Yard Piping Plan II, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

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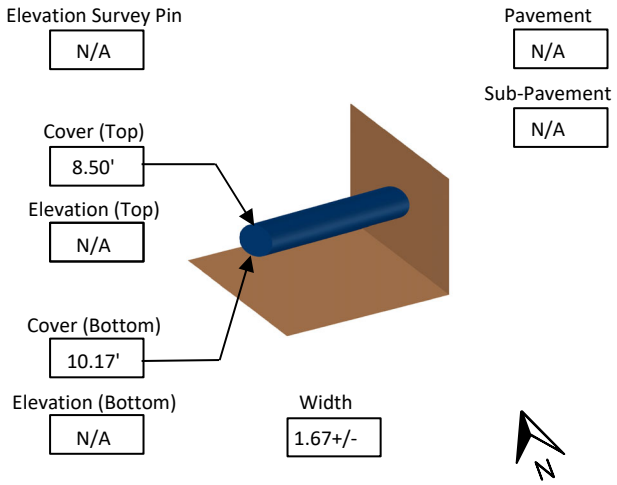
Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	11
# of Holes	1
Date	1/21/2020
Time	N/A

Project Name: JEA Rivertown WTP

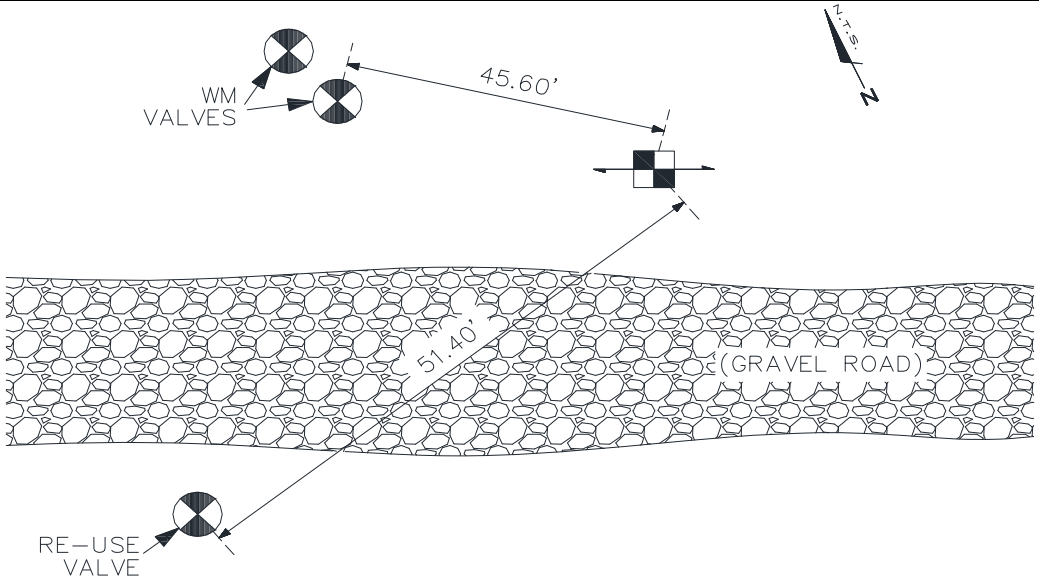
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	JEA WATER & SEWER	**Requested Locate**	WATER	**Located Utility**	WATER
Pavement Type	N/A	**Pavement Condition**	N/A	**Soil Condition**	SOFT DRY
Material as Found	PVC	**Size Expected**	20"	**Size Found**	20"
Utility Condition	GOOD	**Ribbon Installed**	BLUE	**Utility Direction**	NW/SE
Proposed	NEW UTILITIES	**Installed**	HUB	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-5, Rivertown Water Treatment Plan Project, Yard Piping Plan II, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

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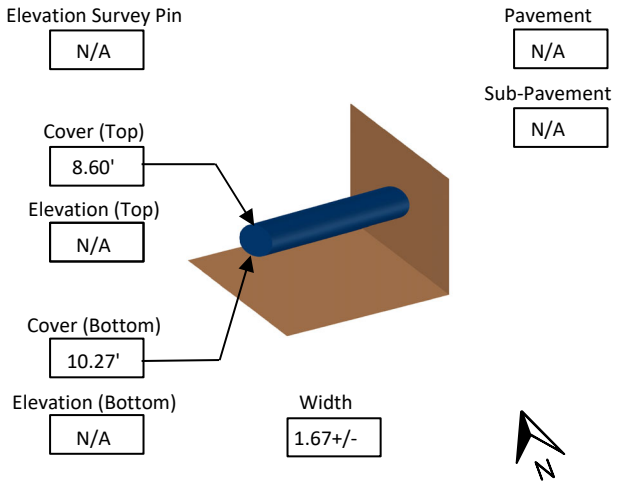
Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	12
# of Holes	1
Date	1/21/2020
Time	N/A

Project Name: JEA Rivertown WTP

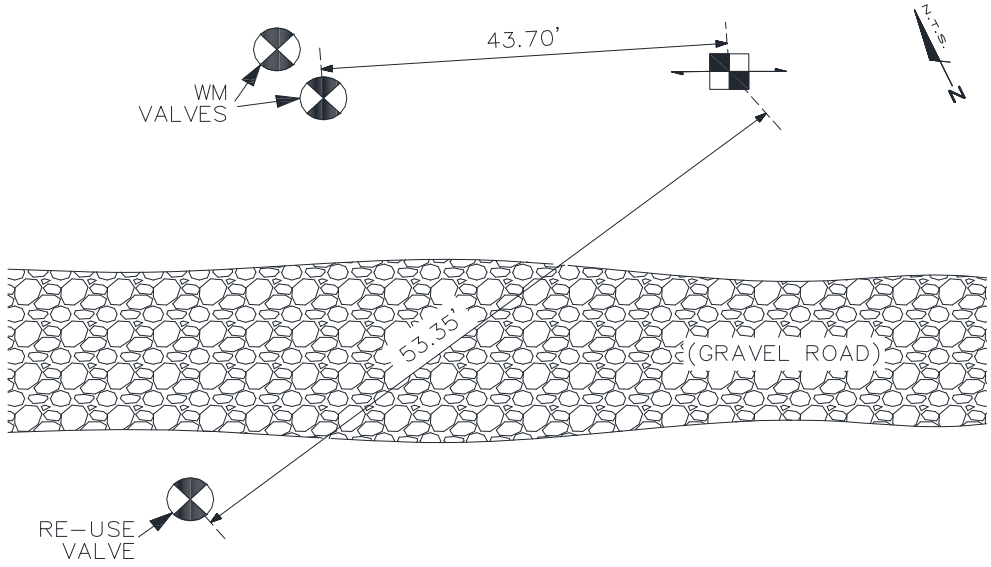
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	JEA WATER & SEWER	**Requested Locate**	WATER	**Located Utility**	WATER
Pavement Type	N/A	**Pavement Condition**	N/A	**Soil Condition**	SOFT DRY
Material as Found	PVC	**Size Expected**	20"	**Size Found**	20"
Utility Condition	GOOD	**Ribbon Installed**	BLUE	**Utility Direction**	NW/SE
Proposed	NEW UTILITIES	**Installed**	HUB	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-5, Rivertown Water Treatment Plan Project, Yard Piping Plan II, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

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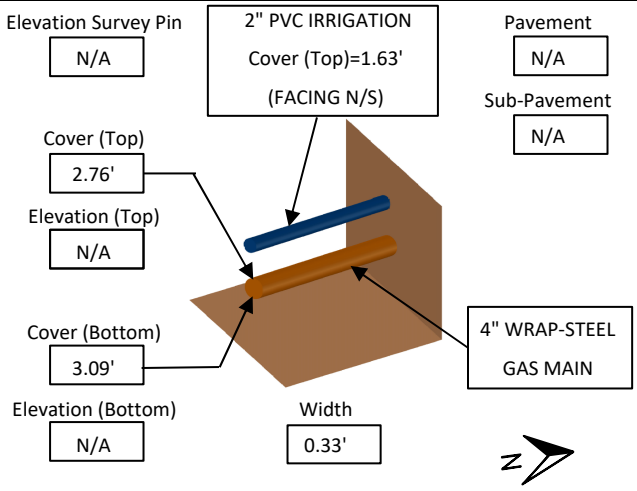
Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	13
# of Holes	1
Date	1/22/2020
Time	N/A

Project Name: JEA Rivertown WTP

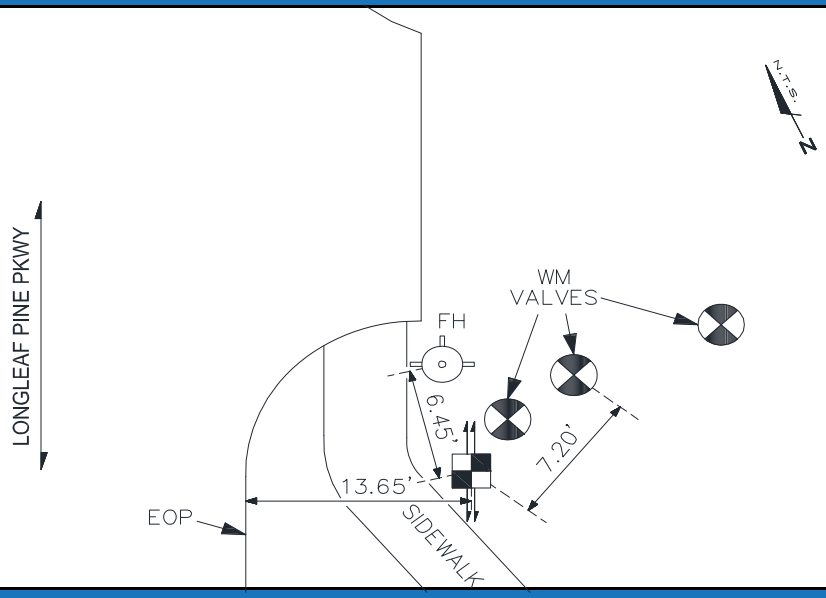
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	TECO PEOPLES GAS	**Requested Locate**	GAS	**Located Utility**	GAS & IRRIGATION
Pavement Type	N/A	**Pavement Condition**	N/A	**Soil Condition**	SOFT DRY
Material as Found	WRAP-STEEL & PVC	**Size Expected**	4"	**Size Found**	(1) 4" & (1) 2"
Utility Condition	GOOD	**Ribbon Installed**	YELLOW	**Utility Direction**	NE/SW
Proposed	NEW UTILITIES	**Installed**	HUB	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	13.65' RT
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-4, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

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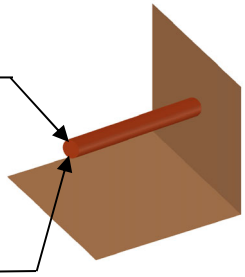
Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	14
# of Holes	1
Date	1/22/2020
Time	N/A

Project Name: JEA Rivertown WTP

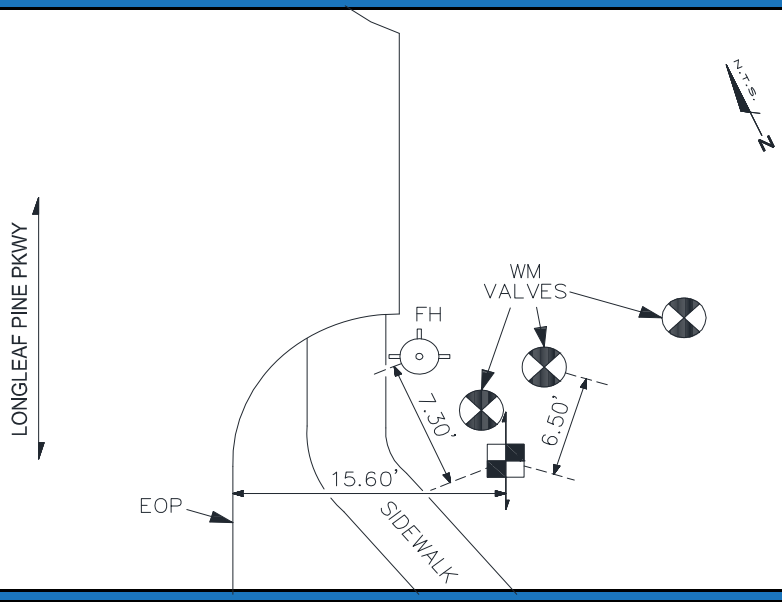
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	AT&T	**Requested Locate**	TELEPHONE BT	**Located Utility**	TELEPHONE BT
Pavement Type	N/A	**Pavement Condition**	N/A	**Soil Condition**	SOFT DRY
Material as Found	DB CABLE	**Size Expected**	0.5"	**Size Found**	0.5"
Utility Condition	GOOD	**Ribbon Installed**	ORANGE	**Utility Direction**	NE/SW
Proposed	NEW UTILITIES	**Installed**	HUB	**At**	CROWN OF UTILITY

Elevation Survey Pin: N/A
Pavement: N/A
Sub-Pavement: N/A
Cover (Top): 2.35'
Elevation (Top): N/A
Cover (Bottom): 2.39'
Elevation (Bottom): N/A
Width: 0.04'



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	15.60' RT
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:
Find test hole location in sheet no. C-4, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

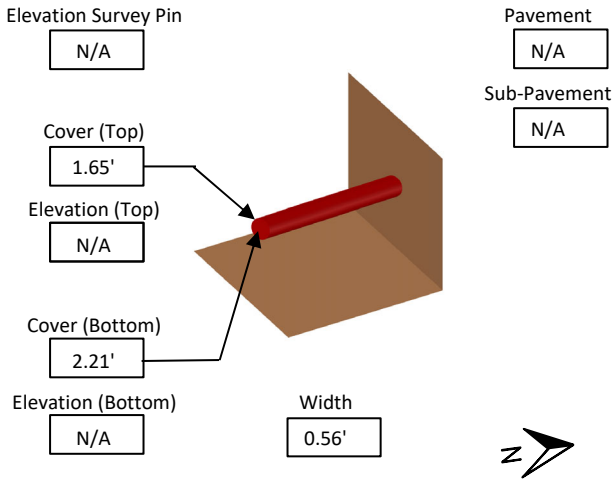
FR Aleman & Associates, Inc.
6196 Lake Gray Boulevard, Suite 101
Jacksonville, FL 32244
904.779.5972

Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	15
# of Holes	1
Date	1/22/2020
Time	N/A

Project Name: JEA Rivertown WTP

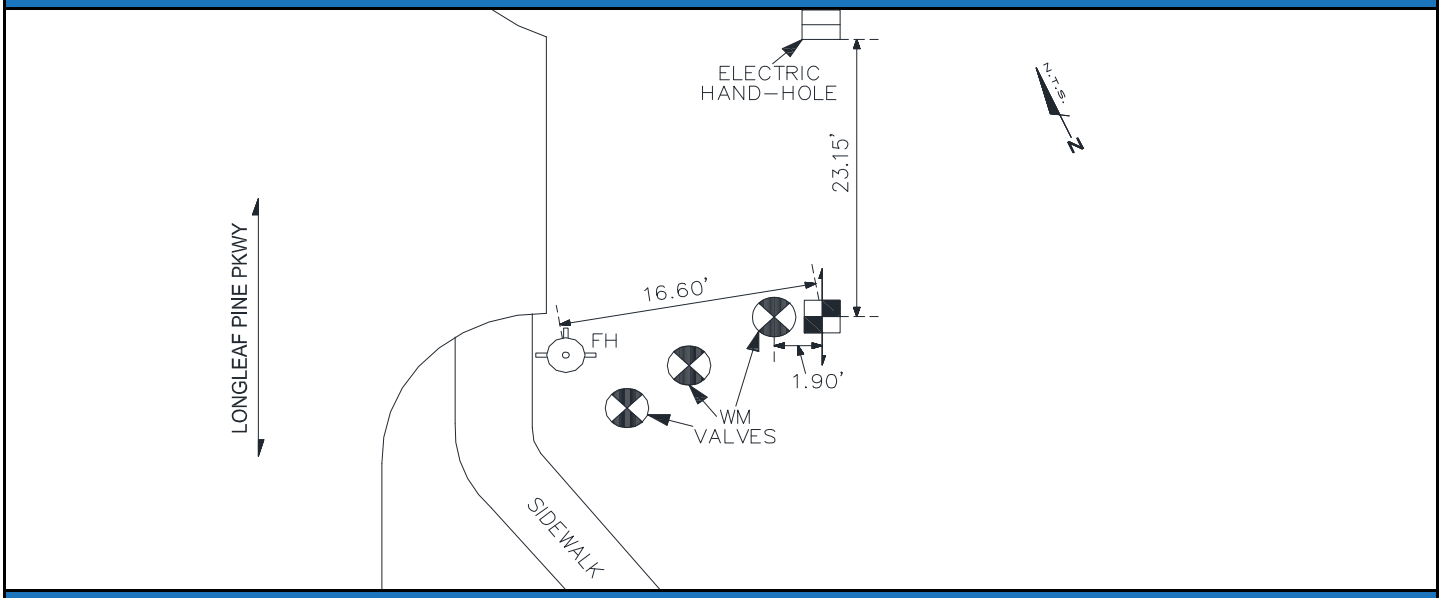
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	FPL	**Requested Locate**	ELECTRIC	**Located Utility**	ELECTRIC
Pavement Type	N/A	**Pavement Condition**	N/A	**Soil Condition**	SOFT DRY
Material as Found	HDPE	**Size Expected**	6"	**Size Found**	6"
Utility Condition	GOOD	**Ribbon Installed**	RED	**Utility Direction**	NE/SW
Proposed	NEW UTILITIES	**Installed**	HUB	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-4, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

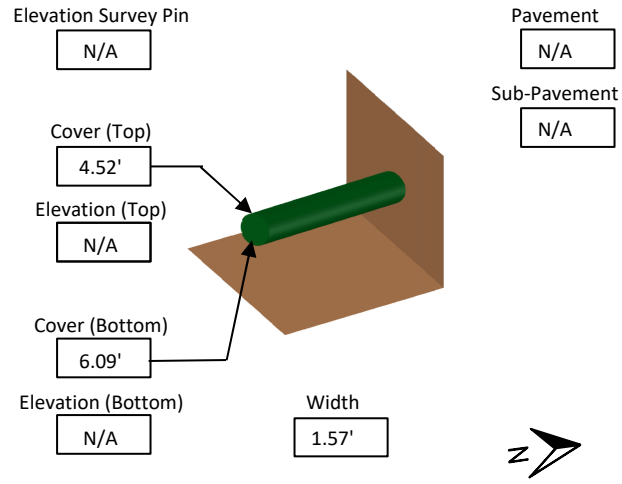
FR Aleman & Associates, Inc.
6196 Lake Gray Boulevard, Suite 101
Jacksonville, FL 32244
904.779.5972

Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	16
# of Holes	1
Date	1/22/2020
Time	N/A

Project Name: JEA Rivertown WTP

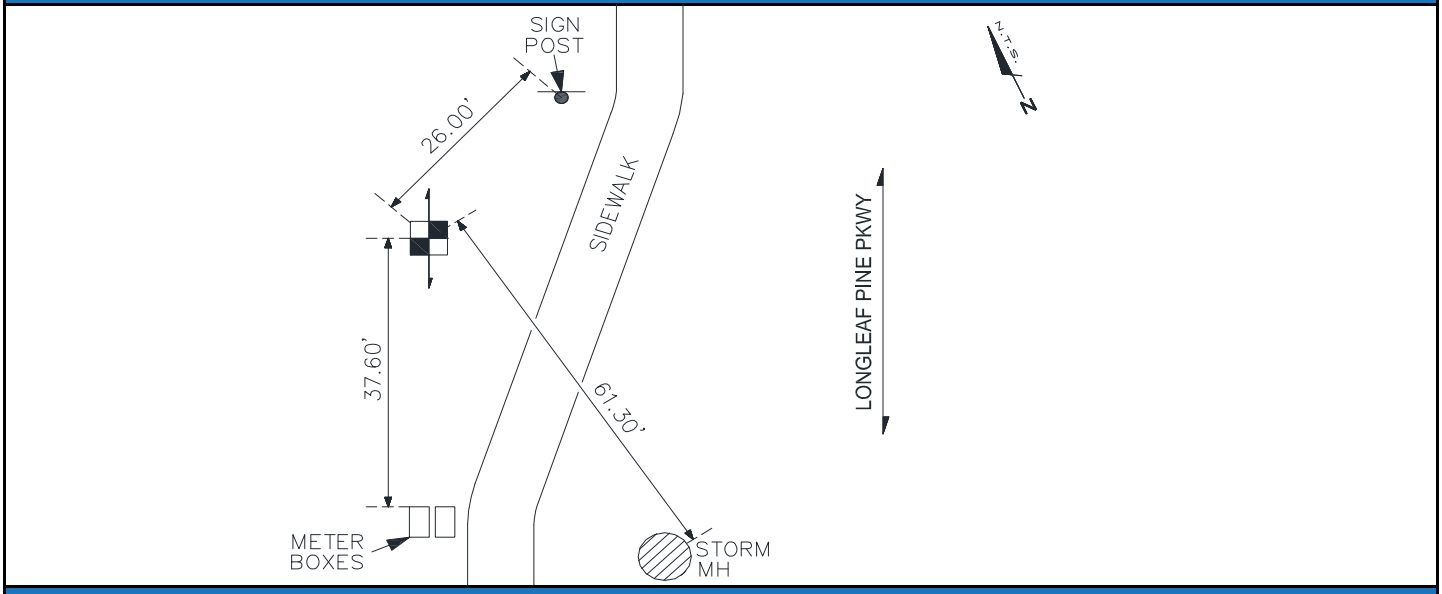
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	JEA WATER & SEWER	**Requested Locate**	FORCE MAIN	**Located Utility**	FORCE MAIN
Pavement Type	N/A	**Pavement Condition**	N/A	**Soil Condition**	SOFT DRY
Material as Found	PVC	**Size Expected**	16"	**Size Found**	16"
Utility Condition	GOOD	**Ribbon Installed**	GREEN	**Utility Direction**	NE/SW
Proposed	NEW UTILITIES	**Installed**	HUB	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	N/A
Horizontal Datum	N/A
Vertical Datum	N/A

Notes: No comments

Find test hole location in sheet no. C-3, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

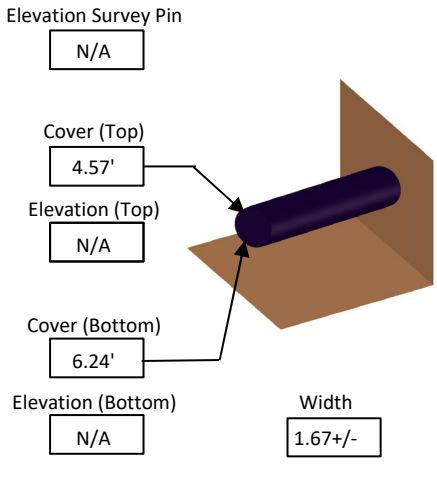
FR Aleman & Associates, Inc.
6196 Lake Gray Boulevard, Suite 101
Jacksonville, FL 32244
904.779.5972

Vacuum Test Hole Report

FRA Job #	3247
Work Order	1
Test Hole #	17
# of Holes	1
Date	1/22/2020
Time	N/A

Project Name: JEA Rivertown WTP

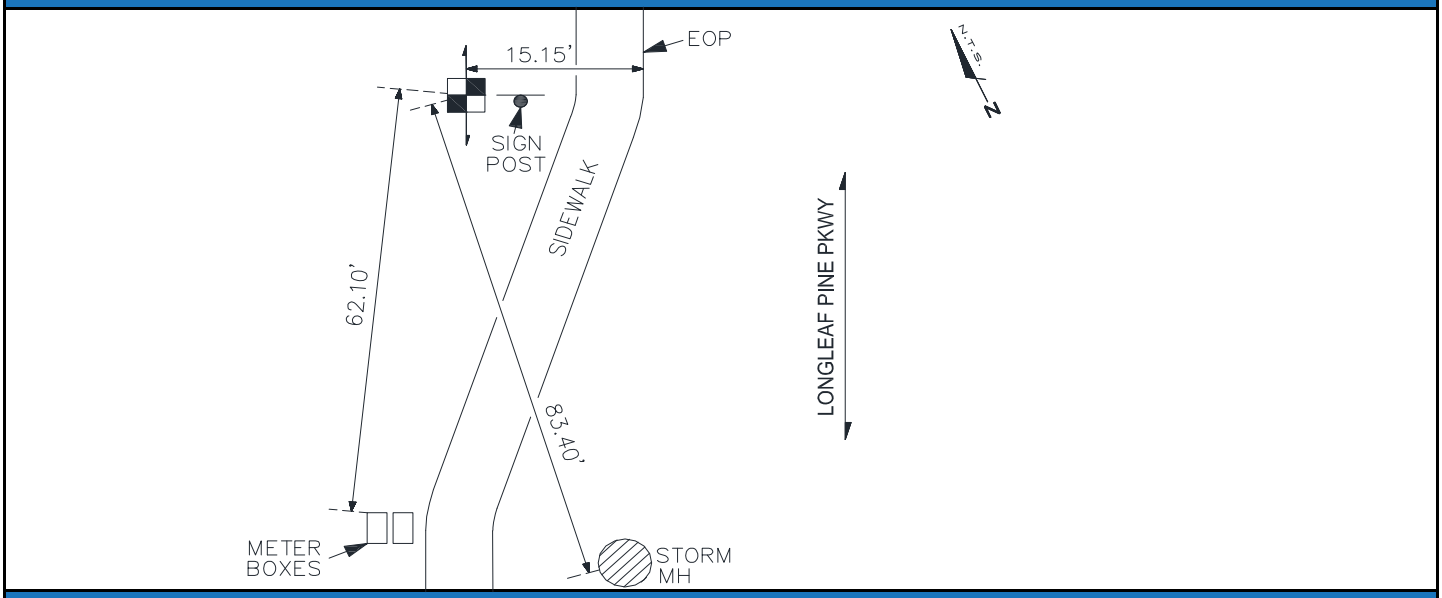
Work Order	JEA Rivertown WTP				
Owner	JEA		**Client**	R.E. Holland & Associates, Inc.	
Contract #	N/A		**FPID**	N/A	
Utility Owner	JEA WATER & SEWER	**Requested Locate**	RE-CLAIM WM	**Located Utility**	RE-CLAIM WM
Pavement Type	N/A	**Pavement Condition**	N/A	**Soil Condition**	SOFT DRY
Material as Found	PVC	**Size Expected**	20"	**Size Found**	20"
Utility Condition	GOOD	**Ribbon Installed**	PURPLE	**Utility Direction**	NE/SW
Proposed	NEW UTILITIES	**Installed**	HUB	**At**	CROWN OF UTILITY



Survey Pin Located	FR Aleman
Measurement Type	US Feet
Northing	N/A
Easting	N/A
Station	N/A
Offset	15.15' LT
Horizontal Datum	N/A
Vertical Datum	N/A

Notes:

Find test hole location in sheet no. C-3, Rivertown WTP RAW Water Main Proposed Plan and Profile, provided by client.



FRA Project Manager	Dennis S.	**Form**	Chris R.	**QA/QC Field**	Dailys T.
Assistant	Aaron M.	**CAD**	Dailys T.	**QA/QC Office**	Chris R.
Cover	DeShawn R.			**QA/QC PM**	Dennis S.
Latitude	N/A	**Longitude**	N/A		

Soft Dig Location Map January 3, 2020

JEA Rivertown WTP, Wells No. 2 and 3 and Raw Water Pipeline

1" = 20'
10 0 20

SEE NEXT PAGE FOR TEST HOLES IN THIS AREA

TH # 10

TH # 11

TH # 12

POINT OF BEGINNING
ORB 2759, PG 1538
"JEA RE-USE WATER TRACT"

POINT OF BEGINNING
ORB 2759, PG 1538
"ACCESS, UTILITY & DRAINAGE EASEMENT"

TEST HOLE POSSIBLE ELECTRIC SEE NOTE 1

TEST HOLE WATER MAIN

TEST HOLE FIBER OPTIC SEE NOTE 1

TEST HOLE POSSIBLE WATER SEE NOTE 1

20" RW-DI FROM WELLS NO. 2 AND NO. 3

20" WM-DI TO DISTRIBUTION SYSTEM

EXISTING GRAVEL ROAD

EXISTING 2" CONDUIT (FO)

WATER VALVE COVER ELEV.: 30.79 NUT ELEV.: 28.46

WATER VALVE COVER ELEV.: 31.05 NUT ELEV.: 29.05

UNDERGROUND WATER LINE

194.04' (M) 194.04' (R) 98.72' (R)

326.48' (R)

S54°49'39"E

S67°30'30"E

S27°19'12"W 60.50' (R) S27°48'13"W

N54°17'15"W 448.74' (R)

133.25' (R)

RECLAIM WATER VALVE COVER ELEV.: 32.23 NUT ELEV.: 30.94

56.73' (R) 56.53' (M)

(MEASURED)
N39°09'47"W CH=26.40'
R=25.00' L=27.81'
T=15.54' Δ=63°44'45"
(RECORD)
N38°49'30"W CH=26.26'
R=25.00' L=27.65'

SANITARY ARV MANHOLE N. RIM ELEV.: 33.19

UNDERGROUND AT&T VAULT

UNDERGROUND COMCAST VAULT

8' X 7.3' CONC. TRANSFORMER PAD

RECLAIM WATER VALVE COVER ELEV.: 33.44 NUT ELEV.: 31.50

RECLAIM WATER VALVE COVER ELEV.: 33.42 NUT ELEV.: 31.19

RECLAIM WATER VALVE COVER ELEV.: 33.44 NUT ELEV.: 30.83

(2) IRRIGATION CONTROL VALVE

FORCE MAIN VALVE COVER ELEV.: 33.53 NUT ELEV.: 30.83

WATER VALVE COVER ELEV.: 33.86 NUT ELEV.: 31.92

WATER VALVE COVER ELEV.: 33.90 NUT ELEV.: 32.90

WATER VALVE COVER ELEV.: 33.82 NUT ELEV.: 33.52

EXISTING WATERMAINS (SEE NOTE 1)

LONGLEAF PINE PARKWAY
(COUNTY ROAD 244 130' RIGHT OF WAY)

MTL POST GAS LINE MARKER

UNDERGROUND WATER MAIN

UNDERGROUND TELECOM LINE

UNDERGROUND ELECTRIC LINE

TELEPHONE MARKER

WATERLINE MARKER

NAIL & DISK FOUND

TOP GRATE ELEV.:33.00
FULL OF WATER
SIZE/TYPE UNK NE INV.:25.01
SIZE/TYPE UNK SW INV.:25.01
SIZE/TYPE 36"RCP W INV.:24.97

MATCH LINE SEE SHEET C-4 FOR CONTINUATION

NOTES
1. EXACT LOCATION OF UTILITIES IS UNKNOWN AND IS TO BE DETERMINED IN THE FIELD FOLLOWING ADDITIONAL UTILITY LOCATES

NOTES:

1. EXISTING WATER MAIN PICKED UP BY SURVEY CREW. EXACT LOCATION TO BE DETERMINED FOLLOWING ADDITIONAL INVESTIGATION.
2. BYPASS VALVE TO REMAIN NORMALLY CLOSED, EXCEPT WHEN BYPASSING THE GROUND STORAGE TANK (GST).
3. ALL UNDERGROUND PIPING SHALL HAVE RESTRAINED JOINTS. ALL ABOVE GROUND PIPING SHALL HAVE FLANGED JOINTS.

DATE:
DAVID J PRAH
PE NO. 43393

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: C. CERRETA
DRAWN BY: C. SCOTT
SHEET CHK'D BY: B. WILLIAMS
CROSS CHK'D BY: D. PRAH
APPROVED BY: I. POLEMATIDIS
DATE: DECEMBER 2019

CDM Smith
4651 Salisbury Road, Suite 420
Jacksonville, FL 32256
Tel: (904) 731-7109
FL COA No. EB-0000020

JEA

RIVERTOWN WATER TREATMENT PLANT PROJECT

YARD PIPING PLAN II

PROJECT NO. 6103-237938
FILE NAME: C005YPPL.DWG

SHEET NO.
C-5

30% SUBMITTAL - NOT FOR CONSTRUCTION

TH # 4

TH # 5

TH # 7

TH # 6

TH # 9

TH # 1

TH # 3

TH # 8

TH # 2

B1 – 40' DEEP SPT IN WTP ENTRANCE ROAD
B4 – 15' SPT IN WTP ENTRANCE ROAD

N: 2076478.0780
E: 461245.5145
BORING B4

ENTRANCE

N: 2076404.6212
E: 461218.6403
TEST HOLE
20" RECLAIMED

N: 2076429.2452
E: 461246.8292
TEST HOLE
CHECK, UNSURE

N: 2076409.7392
E: 461222.2470
TEST HOLE
20" RECLAIMED

N: 2076444.0943
E: 461258.9592
TEST HOLE
FIBER OPTIC

N: 2076451.1329
E: 461276.4630
TEST HOLE
20" WATER

560 LF OF 18" HDPE (DR11) RAW WATER MAIN BY HDD

TOP GRATE ELEV.:32.11
18"RCP SE INV.:29.56
BOTTOM ELEV.:29.46

N: 2076459.9642
E: 461280.0430
TEST HOLE
20" WATER

N: 2076378.8919
E: 461240.2126
TEST HOLE
FIBER OPTIC

N: 2076410.3284
E: 461250.0106
TEST HOLE
16" FORCEMAIN

N: 2076417.7330
E: 461262.4532
TEST HOLE
20" RECLAIMED

REFERENCE DRAWING C-4
FOR 14" HDPE (DR11)
RAW WATER MAIN

HDD DRILL PIT IN TURN LANE OF LONGLEAF PARKWAY

LONGLEAF PINE PARKWAY
(COUNTY ROAD 244 130' RIGHT OF WAY)

PARKWAY
RIGHT OF WAY)

UNDERGROUND FORCE MAIN

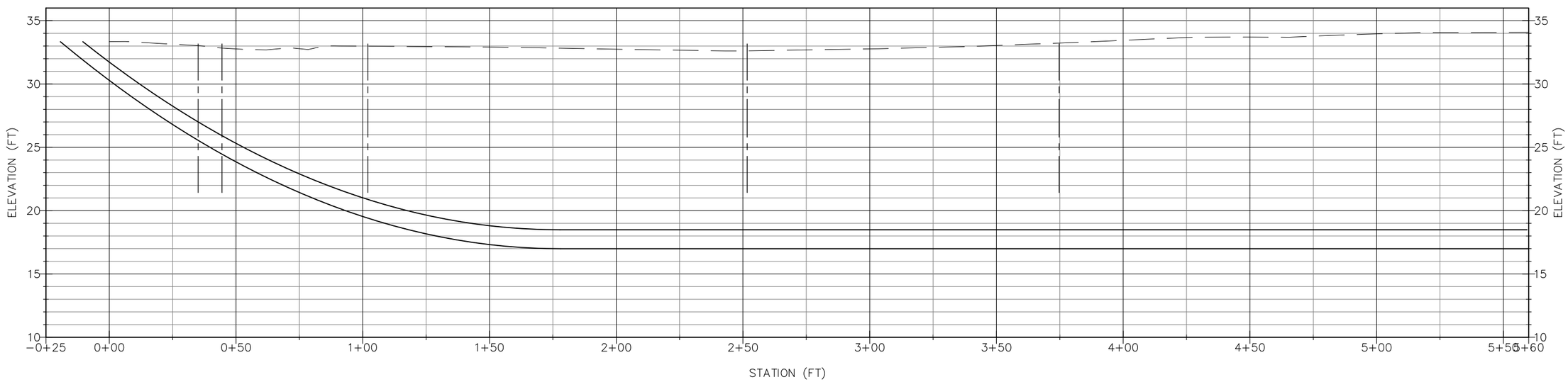
FM 12

MATCHLINE

TOP GRATE ELEV.:33.47
FULL OF WATER
SIZE/TYPE UNK E INV.:19.05

0 20 40

MAIN RUN PROFILE
FROM –0+25.00 TO 5+60.00



FOUR WATERS ENGINEERING
324 6th AVE N, JACKSONVILLE BEACH, FLORIDA 32250
904-414-2400 C.O.A.# 31101 WWW.4WENG.COM

REVISIONS

NO.	BY	DATE
1.		

DESIGN ENGINEER: Angela B. Bryan P.E.
FLORIDA REGISTRATION NO. 56370

DESIGNED: ABB
DRAWN BY: SLD 11-2019
CHECKED BY: ABB
DATE: 11-2019

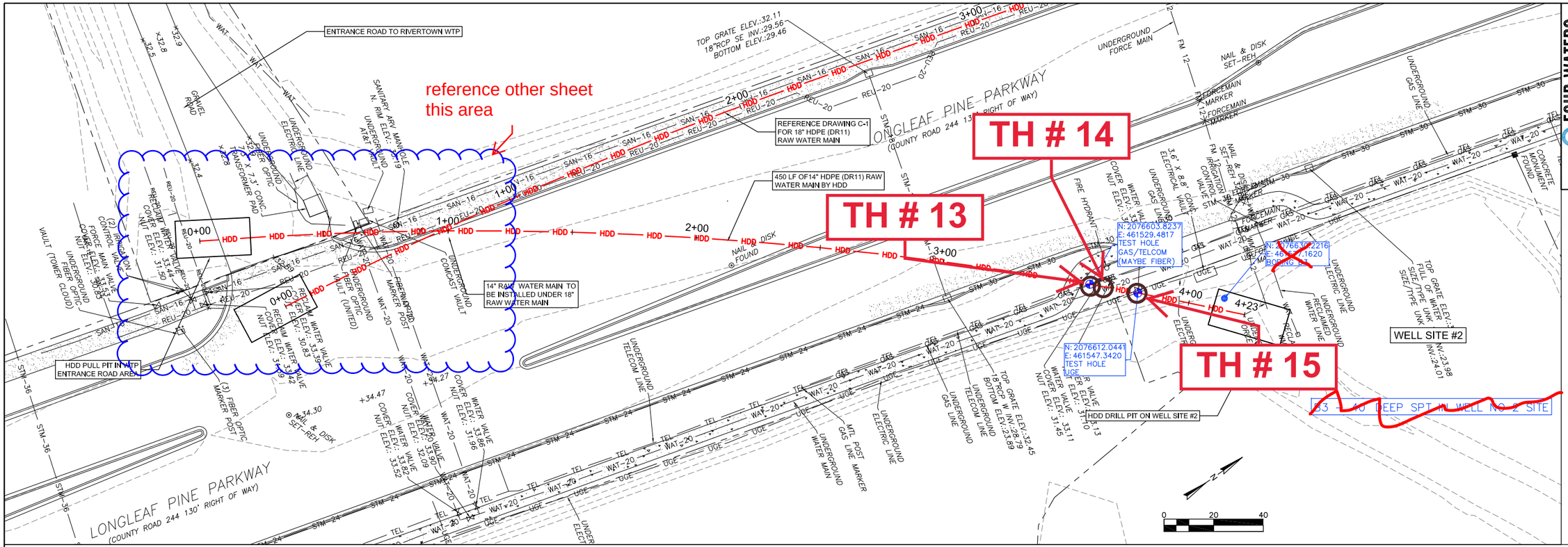
JEA Building Community.sm

RIVERTOWN WTP
RAW WATER MAIN
PROPOSED PLAN AND PROFILE

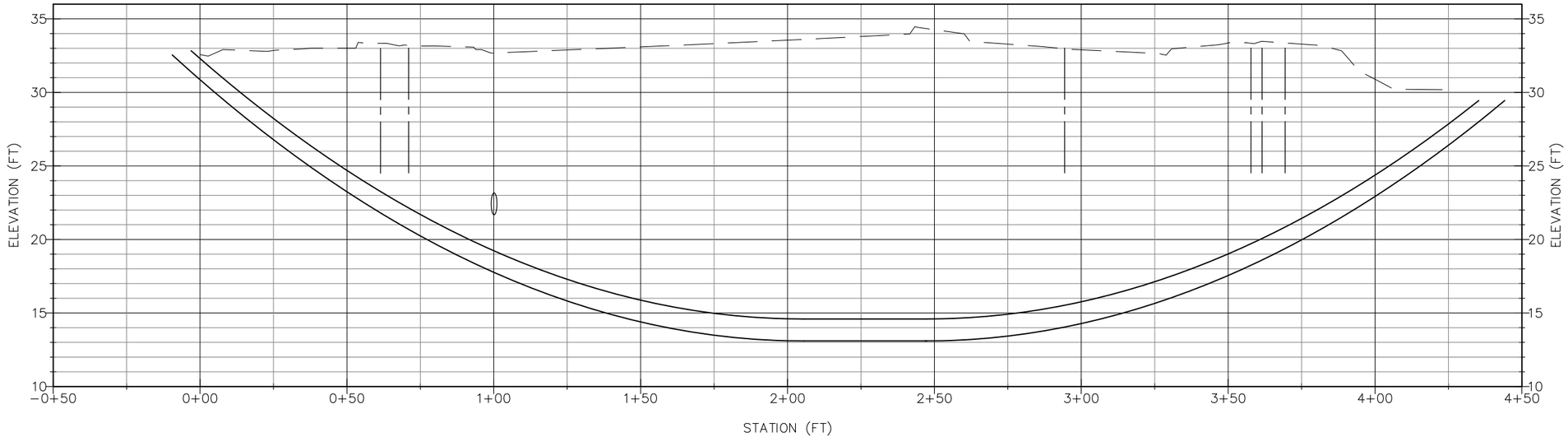
PROJ. NO. 19-1019
DATE: NOV-2019
SCALE: AS SHOWN

NO. SHEETS
SHEET NO.
DRAWING NO. C-1

R:\19-1019 RIVERTOWN\X\CDS\4W RIVERTOWN BORINGS.dwg Current Layout Tab = PP-1 Mon Nov 25, 2019 - 15:17



SECOND RUN PROFILE
FROM −0+50.00 TO 4+50.00



FOUR WATERS ENGINEERING
324 6th AVE N, JACKSONVILLE BEACH, FLORIDA 32250
904-414-2400 C.O.A.# 31101 WWW.4WENG.COM

NO.	BY	DATE	REVISIONS

DESIGN ENGINEER: Angela B. Bryan P.E.
FLORIDA REGISTRATION NO. 56370

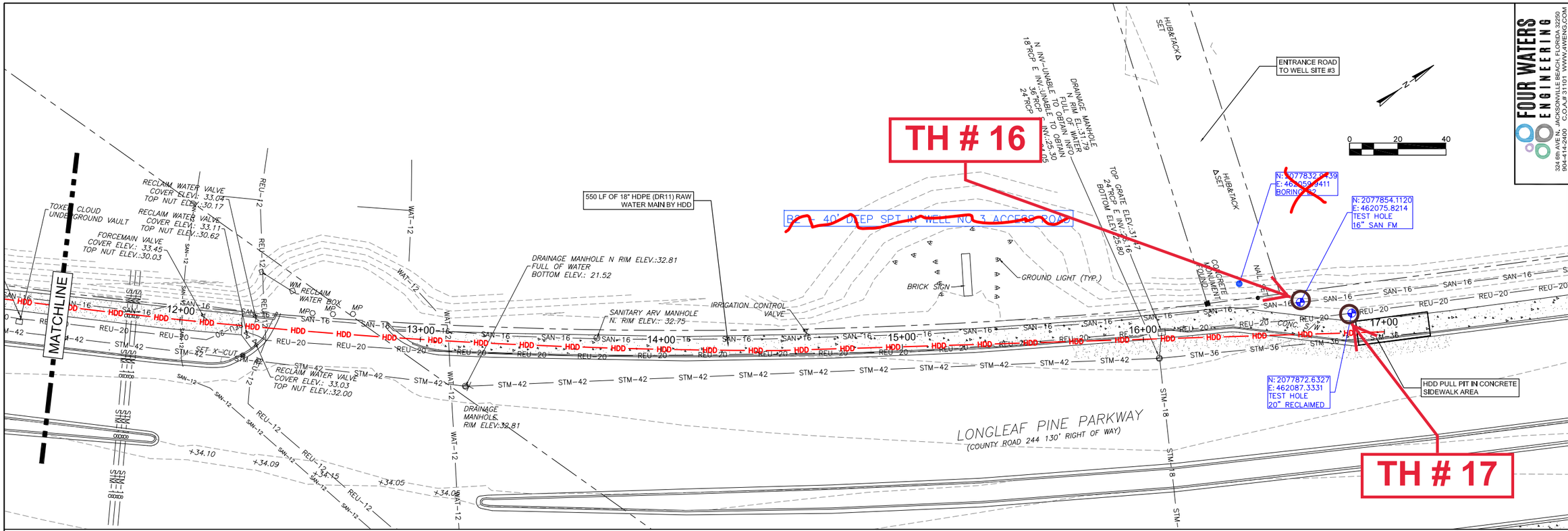
DESIGNED:	ABB	
DRAWN BY:	SLD	
DATE:	11-2019	
CHECKED BY:	ABB	
DATE:	11-2019	

JEA Building Community sm

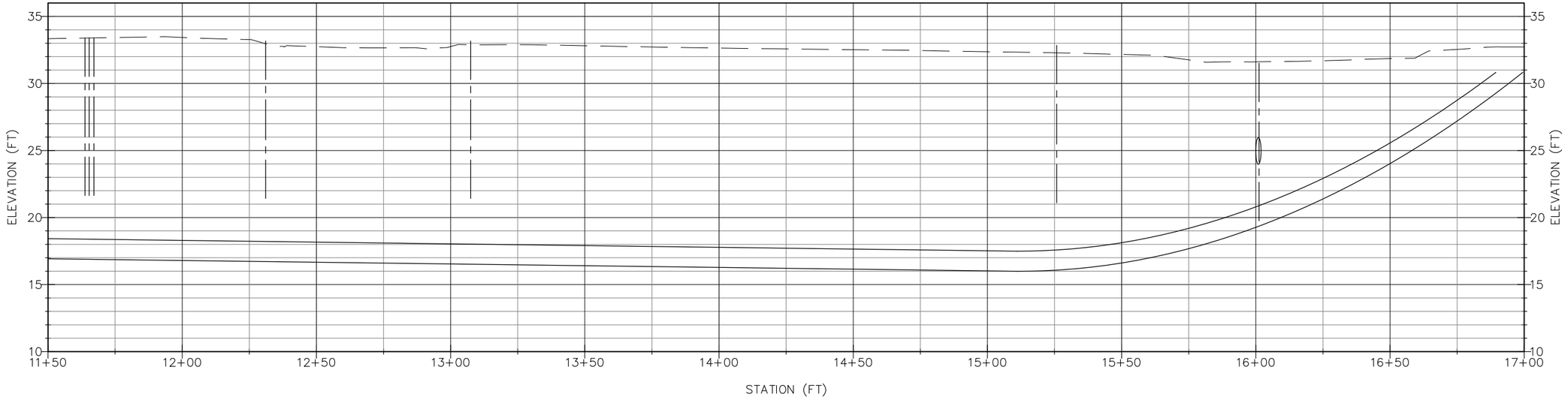
RIVERTOWN WTP
RAW WATER MAIN
PROPOSED PLAN AND PROFILE

NO. SHEETS	
SHEET NO.	
DRAWING NO.	C-4
PROJ. NO.	19-1019
DATE:	NOV-2019
SCALE:	AS SHOWN

R:\19-1019 RIVERTOWN\X\CDS\4W RIVERTOWN BORINGS.dwg Current Layout Tab = PP-4 Mon Nov 25, 2019 - 15:18



MAIN RUN PROFILE
FROM 11+50.00 TO 17+00.00



FOUR WATERS ENGINEERING
324 6th AVE N, JACKSONVILLE BEACH, FLORIDA 32250
904-414-2400 C.O.A.# 31101 WWW.4WENG.COM

NO.	BY	DATE	REVISIONS
1.	X	X	X

DESIGN ENGINEER: Angela B. Bryan P.E.
FLORIDA REGISTRATION NO. 56370

DESIGNER:	ABB	
DRAWN BY:	SLD	
DATE:	11-2019	
CHECKED BY:	ABB	
DATE:	11-2019	

JEA Building Community sm

RIVERTOWN WTP
RAW WATER MAIN
PROPOSED PLAN AND PROFILE

PROJ. NO.	19-1019
DATE:	NOV-2019
SCALE:	AS SHOWN
NO. SHEETS	
SHEET NO.	
DRAWING NO.	C-3

R:\19-1019 RIVERTOWN\X\CDS\4W RIVERTOWN BORINGS.dwg Current Layout Tab = PP-3 Mon Nov 25, 2019 - 15:17

APPENDIX 3
Preliminary Wetlands and Listed Species Report

Environmental Resource Solutions
A Division of SES Energy Services LLC

15 November 2019

Mr. Yanni Polematidis
CDM Smith
4651 Salisbury Road, Suite 20
Jacksonville, Florida 32256

RE: JEA Rivertown Parcels
Preliminary Wetlands and Listed Species Report
ERS Job No. 19138

Dear Mr. Polematidis:

On 7 November 2019, Environmental Resource Solutions (ERS) performed a wetlands and wildlife assessment for three JEA sites near the Rivertown development along Longleaf Pine Parkway. The purpose of the assessment was to delineate all on-site jurisdictional wetlands, document all on-site habitats, and conduct a preliminary listed species survey. The three parcels are located alongside Longleaf Pine Parkway near Bartram Trail High School in northern St. Johns County (Exhibit 1).

Parcel 1 is approximately 1.98 acres in size and is located on the east side of Longleaf Pine Parkway on the south side of a stormwater pond. It consists of upland and wetland pine plantation.

Parcel 2 is approximately 4.65 acres in size and is located on the west side of Longleaf Pine Parkway. It is mostly cleared and is the site of a cell phone tower.

Parcel 3 is approximately 1.25 acres in size and is located on the west side of Longleaf Pine Parkway north of Parcel 2. It consists of pine plantation and forested wetlands.

Mapped soil types according to the *Soil Survey of St. Johns County, Florida* (U.S. Department of Agriculture – Natural Resources Conservation Service) are depicted on Exhibit 2. Jurisdictional wetland boundaries within the site were flagged during the field inspection. On-site habitats were identified and classified in accordance with the *Florida Land Use, Cover, and Forms Classification System* (FLUCFCS; Florida Department of Transportation, 1999). Approximate wetland lines and on-site habitats are depicted on Exhibit 3.

Prior to the initiation of field work, documented listed species occurrences within the project vicinity were obtained from the Florida Natural Areas Inventory (FNAI), U.S. Fish and Wildlife Service (FWS), and Florida Fish and Wildlife Conservation Commission (FWC) (Exhibits 4 and 5). During the assessment, the site was evaluated in the field for the occurrence of listed species and their habitat.

HABITATS

Parcel 1

Parcel 1 consists of pine plantation. The majority of the site is upland Coniferous Plantations (FLUCFCS 441). Dominant species include planted slash pine (*Pinus elliottii*), gallberry (*Ilex glabra*), saw palmetto (*Serenoa repens*), and bracken fern (*Pteridium aquilinum*). Wetlands occur on the site and consist generally of Hydric Coniferous Plantations (FLUCFCS 441H). Dominant species in the wetlands include slash pine, myrtle holly (*Ilex cassine* var. *myrtifolia*), gallberry, large sweet gallberry (*Ilex coriacea*), Virginia chain fern (*Woodwardia virginica*), cinnamon fern (*Osmundastrum cinnamomeum*), and sugarcane plumegrass (*Saccharum giganteum*).

Parcel 2

Parcel 2 is mostly cleared with a secondary growth of saplings, shrubs, and herbaceous vegetation. A cell tower is present in one corner of the site. On-site habitats are classified as Disturbed Land (FLUCFCS 740) and Transmission Towers (FLUCFCS 821). Dominant species include dogfennel (*Eupatorium capillifolium*), Bahia grass (*Paspalum notatum*), saw blackberry (*Rubus pensilvanicus*), sapling slash pine, broomgrass (*Andropogon virginicus*), and similar opportunistic species. Forested wetlands occur near the southern and western boundaries of the parcel. Wetland boundaries near the site were flagged, but depending on the exact location of the boundaries, wetlands may not extend into the parcel.

Parcel 3

The western end of Parcel 3 is a forested wetland that is classified as Wetland Forested Mixed (FLUCFCS 630). It is dominated by slash pine, bald cypress (*Taxodium distichum*), red maple (*Acer rubrum*), sawgrass (*Cladium jamaicense*), cinnamon fern, royal fern (*Osmunda regalis*), and caric sedge (*Carex* sp.). A second wetland crosses the site further to the east. It consists of Hydric Coniferous Plantations (FLUCFCS 441H), and is dominated by slash pine, cinnamon fern, royal fern, and gallberry. Uplands on the parcel consist of upland Coniferous Plantations (FLUCFCS 441), and are dominated by slash pine, gallberry, saw palmetto, and bracken fern.

Wetlands

Wetland lines depicted on Exhibit 3 are approximate and are subject to change pending agency verification and survey. All wetlands that occur on all three parcels are jurisdictional to the Florida Department of Environmental Protection (FDEP) and the U.S. Army Corps of Engineers. If impacts are planned, permits from both of these agencies and wetland mitigation would be necessary. Wetland quality scores were estimated using the Uniform Mitigation Assessment Method (UMAM). The mixed forested wetland in Parcel 3 is a moderate quality system that is estimated to score a 0.7 out of 1.0. The hydric planted pine wetlands in Parcels 1 and 3 are lower in quality, and are estimated to score a 0.6 out of 1.0. If impacts are proposed to these systems, the approximate amount of mitigation credits required can be determined by multiplying the estimated quality score (0.7 for mixed forest or 0.6 for hydric planted pine) by the acreage of wetland

affected. The parcels are located in the N. St. Johns River & N. Coastal Basin. Mitigation credits in this basin are currently selling for approximately $70,000. Therefore, estimated mitigation costs can be calculated by multiplying the estimated credits required by the estimated cost per credit.

Significant Natural Communities

The following habitat types have been identified and designated by St. Johns County (SJC) as Significant Natural Communities: Beach Dune, Coastal Grasslands / Coastal Strand, Xeric Hammock, Maritime Hammock, Sandhill, and Scrub. The three subject sites are located in a pine flatwoods landscape and do not contain coastal or xeric habitats. No habitats classified by SJC as Significant Natural Communities occur within the three JEA parcels.

Preliminary Listed Species Survey

This report addresses federally-listed wildlife species, candidates for federal listing, and state-listed wildlife species as regulated by the U.S. Fish and Wildlife Service (FWS) and the Florida Fish and Wildlife Conservation Commission (FWC). Unless otherwise noted, all are collectively referred to as "listed species" in this report. A complete list of all listed species that may occur in St. Johns County was compiled using available FWS online sources and the Florida Natural Areas Inventory (FNAI). In addition, GIS data from FNAI was consulted to determine if any FNAI-documented occurrences of listed species occur on the subject site. FNAI-documented occurrences within five miles of the site are depicted on Exhibit 5.

The results of these database searches were used to determine which species may occur on the parcels and which species should be the subject of the preliminary survey. On 7 November 2019, on-site assessments of representative areas of all habitats were performed to determine the presence of listed species or the probability of their occurrence. Of all the listed species that may occur in the County, the species that may occur on the subject parcels were determined based on habitat requirements. Table 1 below includes all listed wildlife species that may occur on the subject parcels.

Each species is given a probability of occurrence based on observed site conditions. Species with a low probability of occurrence within the project limits are defined as those species that are known to occur in the county, but preferred habitat is limited or nonexistent within the assessment parcels or the species has been extirpated. Species with a moderate probability for occurrence are those for which suitable habitat is well represented within or adjacent to the site, but no observations or positive indicators exist to verify their presence. Species are given a high probability for occurrence if their presence is suspected within the assessment site based on known ranges and existence of sufficient preferred habitat corridors, if they are known to occur adjacent to the study area, or if they have been previously observed or documented within project boundaries. Species that were observed on the site during field investigations are marked as observed.

Table 1. Listed wildlife species that may occur in St. Johns County and probability of occurrence on-site.						
Scientific Name	**Common Name**	**Federal Status**	**State Status**	**Preferred Habitat**	**Habitat Present In Project Area**	**Probability of Occurrence**
Reptiles						
*Drymarchon corais couperi**	Eastern Indigo Snake	T	FT	Linked to xeric habitats and gopher tortoise burrows, but also uses other natural habitats such as swamps and freshwater marshes as foraging habitat.	On-site uplands are marginally suitable for gopher tortoises and therefore for indigo snakes, but no gopher tortoise burrows observed.	Low.
*Gopherus polyphemus**	Gopher Tortoise	C	ST	Sandhills, scrub, dry flatwoods, dry ruderal areas.	On-site uplands are marginally suitable for gopher tortoises and no gopher tortoise burrows observed.	Low.
Birds						
*Egretta caerulea***	Little Blue Heron	N	ST	Forages in a wide variety of freshwater, brackish, and saline wetlands and waterways, including ponds and ditches. Prefers freshwater habitats. Nests in mixed colonies in flooded trees or shrubs or on islands.	Yes. The suitability of on-site wetlands for wading birds is limited due to the apparent scarcity of standing water.	Low.
*Egretta tricolor***	Tricolored Heron	N	ST	Forages in a wide variety of freshwater, brackish, and saline wetlands and waterways, including ponds and ditches. Prefers coastal habitats. Nests in mixed colonies in flooded trees or shrubs or on islands.	Yes. The suitability of on-site wetlands for wading birds is limited due to the apparent scarcity of standing water.	Low.
*Falco sparverius paulus***	Southeastern American Kestrel	N	ST	Upland pinelands (flatwoods, sandhills, pastures, and old fields). Requires open areas for foraging, and nest cavities (dead trees,	On-site uplands are marginally suitable for kestrels.	Low.

Table 1. Listed wildlife species that may occur in St. Johns County and probability of occurrence on-site.

Scientific Name	Common Name	Federal Status	State Status	Preferred Habitat	Habitat Present In Project Area	Probability of Occurrence
				nest boxes, etc.) for breeding		
Mycteria americana	Wood Stork	T	FT	Forages in a wide variety of freshwater and brackish wetlands and waterways, including ponds and ditches. Prefers waterbodies that have shallow or variable water levels to concentrate fish prey. Nests in colonies in flooded trees or on islands.	Yes. The suitability of on-site wetlands for wading birds is limited due to the apparent scarcity of standing water.	Low.
*Platalea ajaja***	Roseate Spoonbill	N	ST	Forages in a wide variety of freshwater, brackish, and saline wetlands and waterways, including ponds and ditches. Prefers coastal habitats. Nests in mixed colonies in mangroves, willow heads, or spoil islands.	Yes. The suitability of on-site wetlands for wading birds is limited due to the apparent scarcity of standing water.	Low.

Legal Status and Notes

Federally-listed Species (FWS)

C = Candidate species for which federal listing agencies have sufficient information on biological vulnerability and threats to support proposing to list the species as endangered or threatened.
CH = Critical Habitat has been designated in the county in which the project is located.
E = Endangered: species in danger of extinction throughout all or a significant portion of its range.
T = Threatened: species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
PT = Proposed threatened.
N = Not federally-listed.
* = This species is included in a FWS Recovery Plan.
Recovery plans can be found at: https://ecos.fws.gov/ecp0/pub/speciesRecovery.jsp?sort=1

State-listed Species

SAT = Listed as threatened for similarity of appearance.
SSC = Species of Special Concern.
SE = State endangered.
ST = State threatened.
FE = Federally endangered: species federally listed as being in danger of extinction throughout all or a significant portion of its range.
FT = Federally threatened: species federally listed as likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
** = FWC has developed a specific Imperiled Species Management Plan for this species.
Imperiled species management plans can be found at: http://myfwc.com/wildlifehabitats/imperiled/management-plans/

The gopher tortoise (*Gopherus polyphemus*) is listed as threatened by FWC and as a candidate species for listing by FWS. The preliminary site inspection resulted in the observation of no tortoises or their burrows on any of the three parcels. The uplands in Parcels 1 and 3 consist of mesic planted pine. This habitat is marginally suitable for tortoises. The uplands in Parcel 2 consist of a disturbed brushy clearing. This habitat could be suitable for tortoises, and tortoises often colonize such areas after they are cleared. However, the uplands around Parcel 2 consist of low elevation pine flatwoods and planted pine, and both of these habitat types are only marginally suitable for tortoises. Therefore, there are likely few tortoises in the surrounding uplands that could move into and occupy Parcel 2. This species has been given a low probability of occurrence. The preliminary observations made for this report do not constitute a complete gopher tortoise survey. If tortoises are present on the subject parcels at the time of construction, they will occur in small numbers. If work in uplands is proposed, a complete survey of all suitable habitat must be conducted within 90 days of construction, and a permit from FWC to relocate all affected tortoises must be obtained. Only after completion of the survey (within 90 days of construction) will the number of tortoises requiring relocation be precisely known. No adverse effect is anticipated for this species.

The Eastern indigo snake *(Drymarchon corais couperi)* is listed as threatened by both FWS and FWC. This species requires large tracts of land, as their territory can exceed 470 acres and encompass habitats such as sandhills, scrub, wet prairies, and ponds. It is linked to gopher tortoise burrows. No xeric habitats occur on-site and no gopher tortoise burrows were observed. Therefore, this species has a low probability of occurrence. This species is not likely to be adversely affected by the project.

The Southeastern American kestrel (*Falco sparverius paulus*) is listed as threatened by FWC. It requires open pinelands with fields and exposed perches. On-site habitats are marginally suitable for this species and it has been given a low probability of occurrence. No adverse effect is anticipated for this species.

The wood stork (*Mycteria americana*) is listed as threatened by FWS and FWC. Wood storks prefer to forage in wetlands and waterways where falling water levels concentrate food sources. In Northeast Florida, FWS considers all Suitable Foraging Habitat (SFH) within 13 miles of a documented active wood stork colony to be within the Core Foraging Area (CFA) of that colony. On-site wetlands may be SFH for wood storks but lie outside the CFA of any documented active colony (Exhibit 4). The wood stork has been given a low probability of occurrence within the site boundary due to the apparent infrequency of standing water in the wetlands. If a proposed project impacts less than 0.5 acre of wetland, then this species is not likely to be adversely affected. If more than 0.5 acre is impacted, then the species will be not likely to be adversely affected if wetland mitigation is provided by an approved mitigation bank whose service area includes the project site.

Wetlands on the site may also be suitable for state-listed wading birds such as the little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), or roseate spoonbill (*Plataea ajaja*). These three species have been given low probabilities of occurrence because standing water appears to be rare in the wetlands. A wading bird rookery was recorded approximately 10 miles northwest of the parcels in the 1990s rookery survey (Exhibit 4). Because these species are highly mobile, any individuals that may be present during construction can easily move to nearby similar suitable habitat. Therefore, no adverse effect is anticipated for these species.

The bald eagle (*Haliaeetus leucocephalus*) is no longer listed as threatened or endangered by FWC or FWS, but restrictions remain in place for work near nests. The closest documented bald eagle nest is FWC Nest ID # SJ010, approximately 2.3 miles south of the parcels, last documented as active in 2016.

Bald eagle protection is addressed in the St. Johns County Comprehensive Plan and in the County's Land Development Code (Sec. 4.01.10). The Code states that the primary zone of protection is a 750-foot radius from the nest location. The secondary zone constitutes an additional 750-foot radius from the primary zone. None of the three parcels are located in either zone. Therefore, St. Johns County regulations for this species are unlikely to affect work on any of the three parcels.

We appreciate the opportunity to assist you with this project. Please contact Jaime Northrup or me if you have any questions or require additional information.

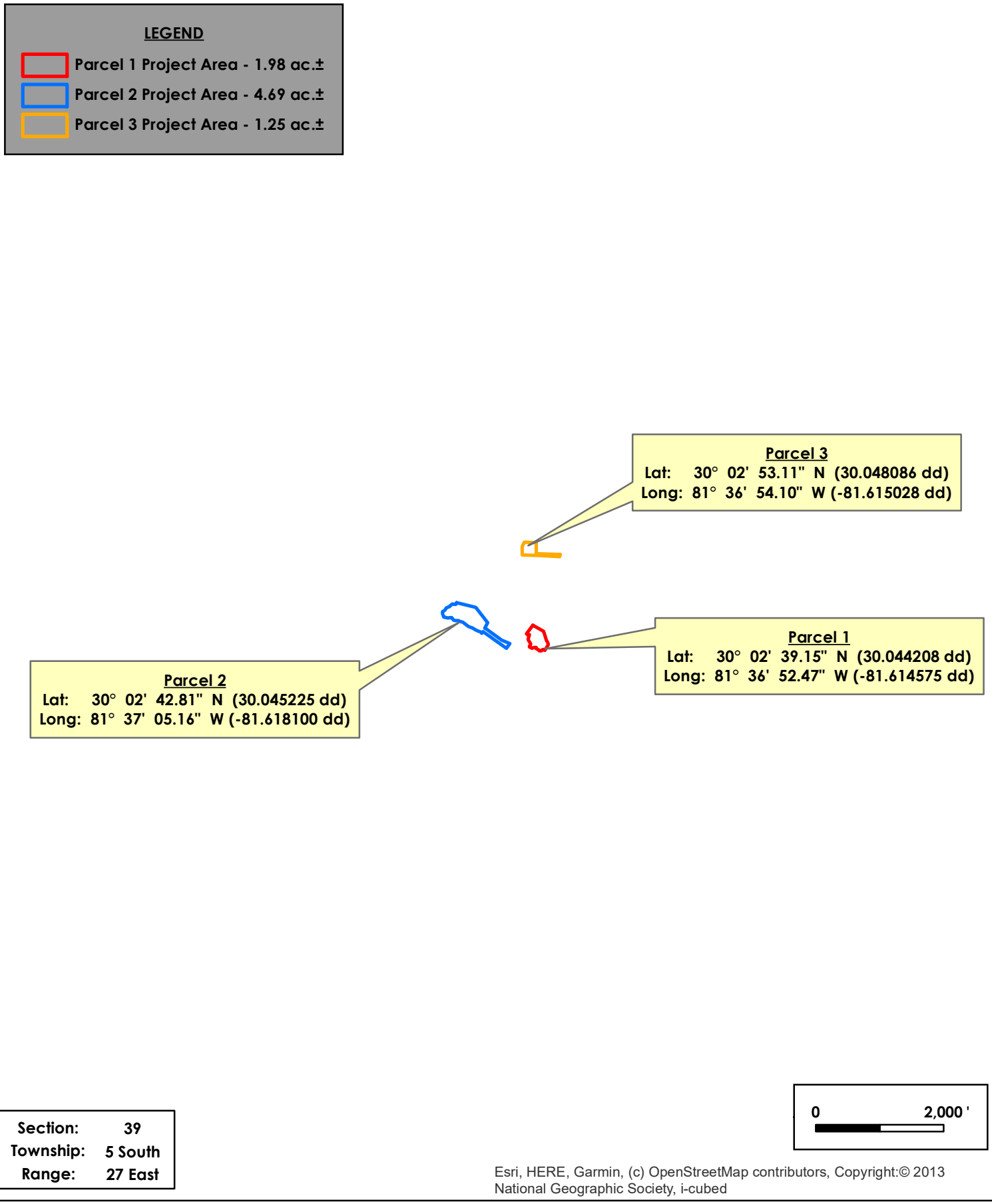
Sincerely,

ENVIRONMENTAL RESOURCE SOLUTIONS
A Division of SES Energy Services LLC

Ken Ceglady
Botanist – Senior Environmental Scientist

Attachments: Exhibits 1-5

KAC / 19138 preliminary wetlands and wildlife report 11-13-19



Section:	39
Township:	5 South
Range:	27 East

[redacted]

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JEA Rivertown
USGS Topographic Quadrangle Map

St. Johns County, Florida

By: NEE

Project No.:	19138
Exhibit No.:	1
Date:	11-13-19
Rev. Date:	

N W E S

Source: 7.5' USGS Fleming Island & Orangedale, FL Topographic Quadrangles; ArcGIS Online (USA Topo Maps)

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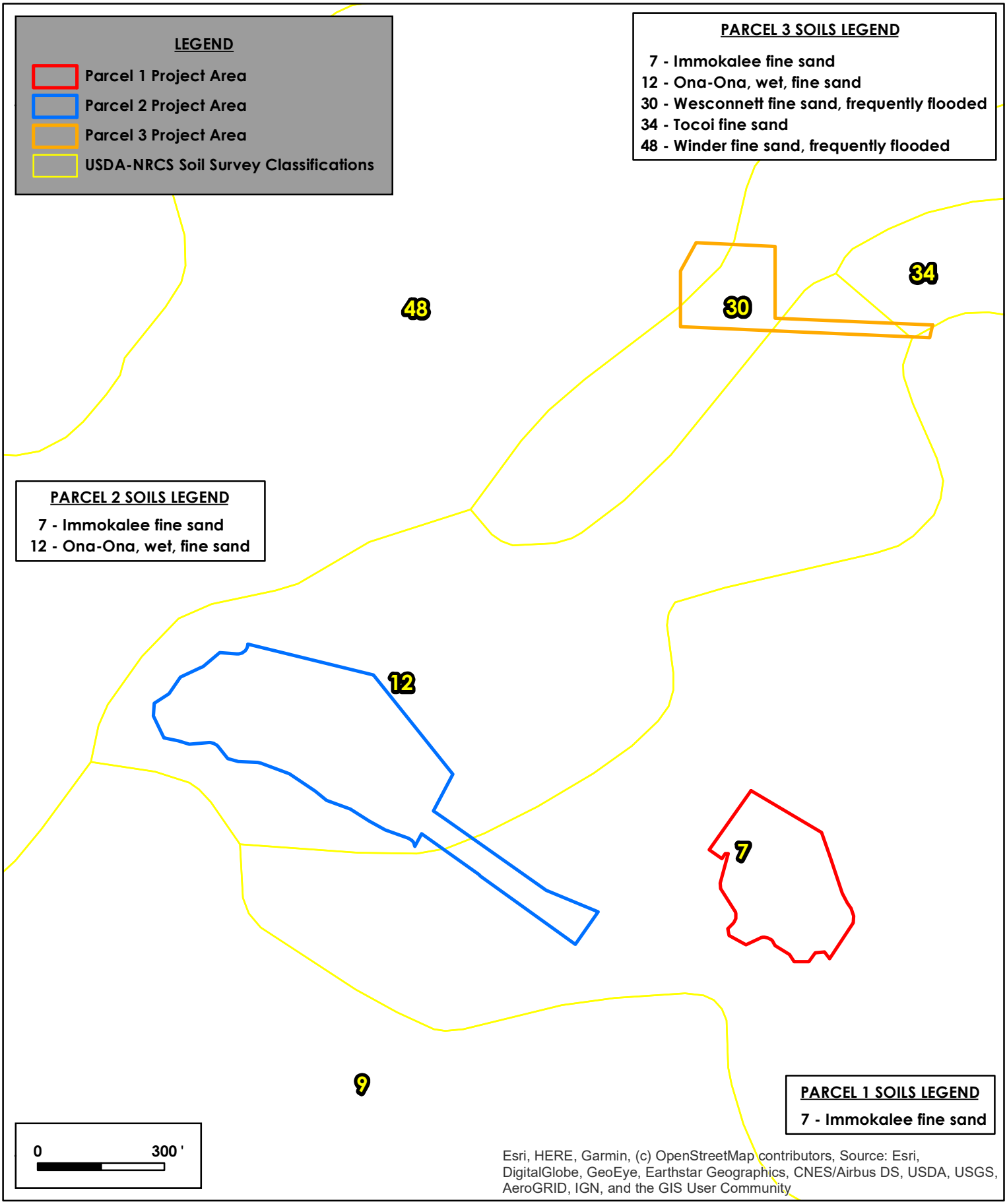

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JEA Rivertown
Soils Map

St. Johns County, Florida | By: NEE

Project No.:	19138
Exhibit No.:	2
Date:	11-13-19
Rev. Date:	

N
W E
S

Source: ArcGIS Online Imagery, USDA-NRCS soil survey classifications (data obtained from NRCS)

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LEGEND

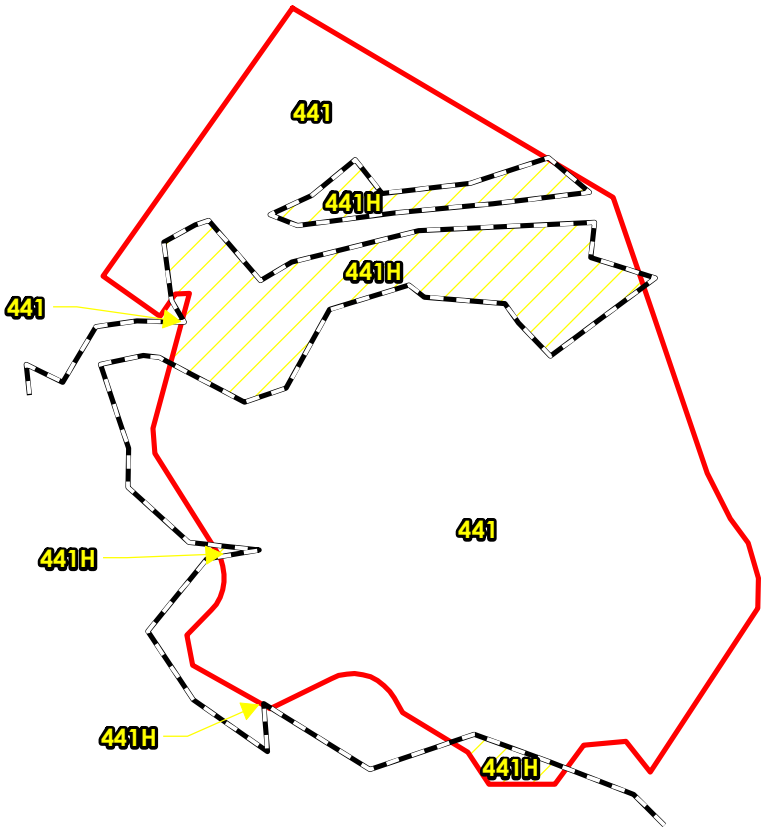
Parcel 1 Project Area - 1.98 ac.±

Approximate Wetland Line

FLUCFCS Classification Boundaries

441 - Coniferous Plantations - 1.64 ac.±

441H - Hydric Coniferous Plantations - 0.34 ac.±



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NOTE: Depicted FLUCFCS classifications and boundaries are approximate. This map is intended to be used for illustrative purposes only.

Esri, HERE, Garmin, (c) OpenStreetMap contributors, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

[redacted]

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JEA Rivertown
FLUCFCS Map A

Project No.:	19138
Exhibit No.:	3-A
Date:	11-13-19
By: NEE	Rev. Date:

N W E S

Source: ArcGIS Online Imagery and World Transportation

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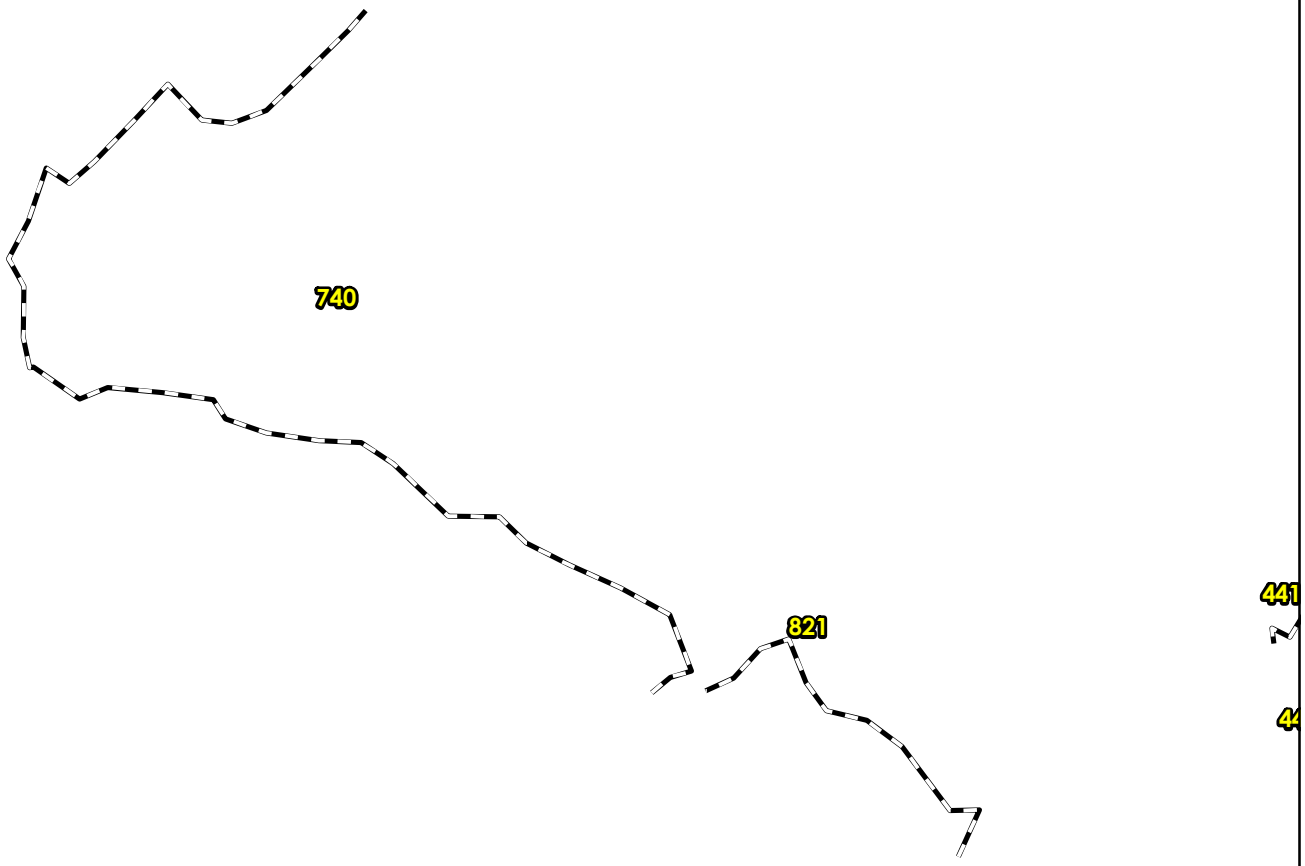
LEGEND

- Parcel 2 Project Area - 4.69 ac.±
- Approximate Wetland Line

FLUCFCS Classification Boundaries

- 740 - Disturbed Land - 4.58 ac.±
- 821 - Transmission Towers - 0.11 ac.±



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NOTE: Depicted FLUCFCS classifications and boundaries are approximate. This map is intended to be used for illustrative purposes only.

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JEA Rivertown
FLUCFCS Map B

Project No.:	19138
Exhibit No.:	3-B
Date:	11-13-19
By: NEE	Rev. Date:

N W E S

Source: ArcGIS Online Imagery and World Transportation

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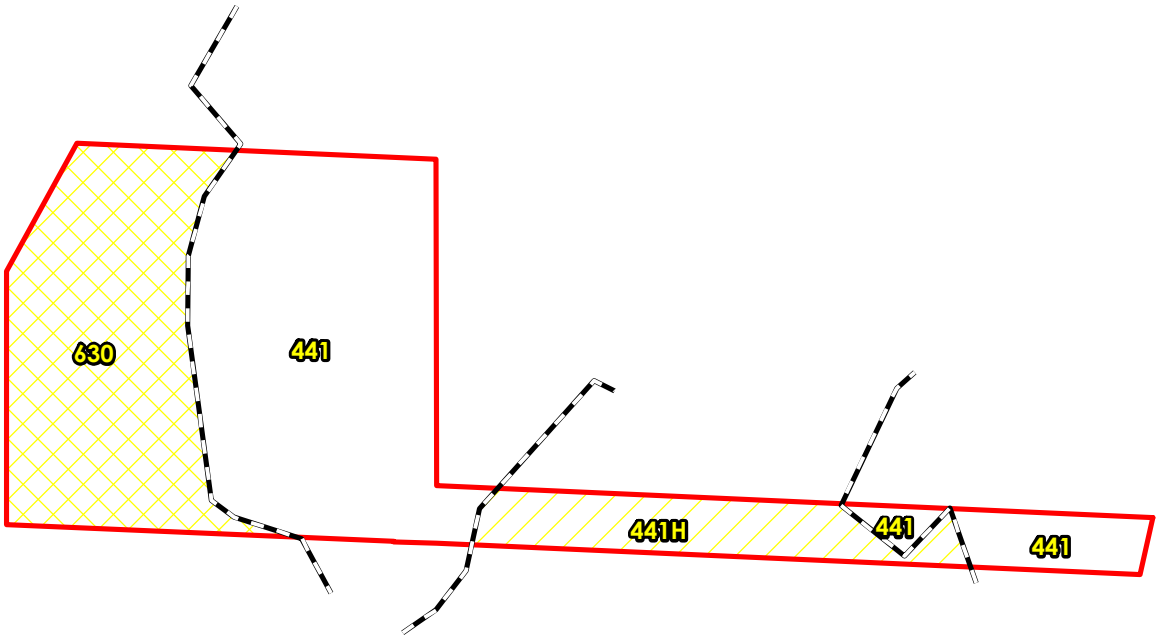
LEGEND

- Parcel 3 Project Area - 1.25 ac.±
- Approximate Wetland Line

FLUCFCS Classification Boundaries

- 441 - Coniferous Plantations - 0.65 ac.±
- 441H - Hydric Coniferous Plantations - 0.16 ac.±
- 630 - Wetland Forested Mixed - 0.44 ac.±



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NOTE: Depicted FLUCFCS classifications and boundaries are approximate. This map is intended to be used for illustrative purposes only.

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JEA Rivertown
FLUCFCS Map C

Project No.:	19138
Exhibit No.:	3-C
Date:	11-13-19
By: NEE	Rev. Date:

N W E S

Source: ArcGIS Online Imagery and World Transportation

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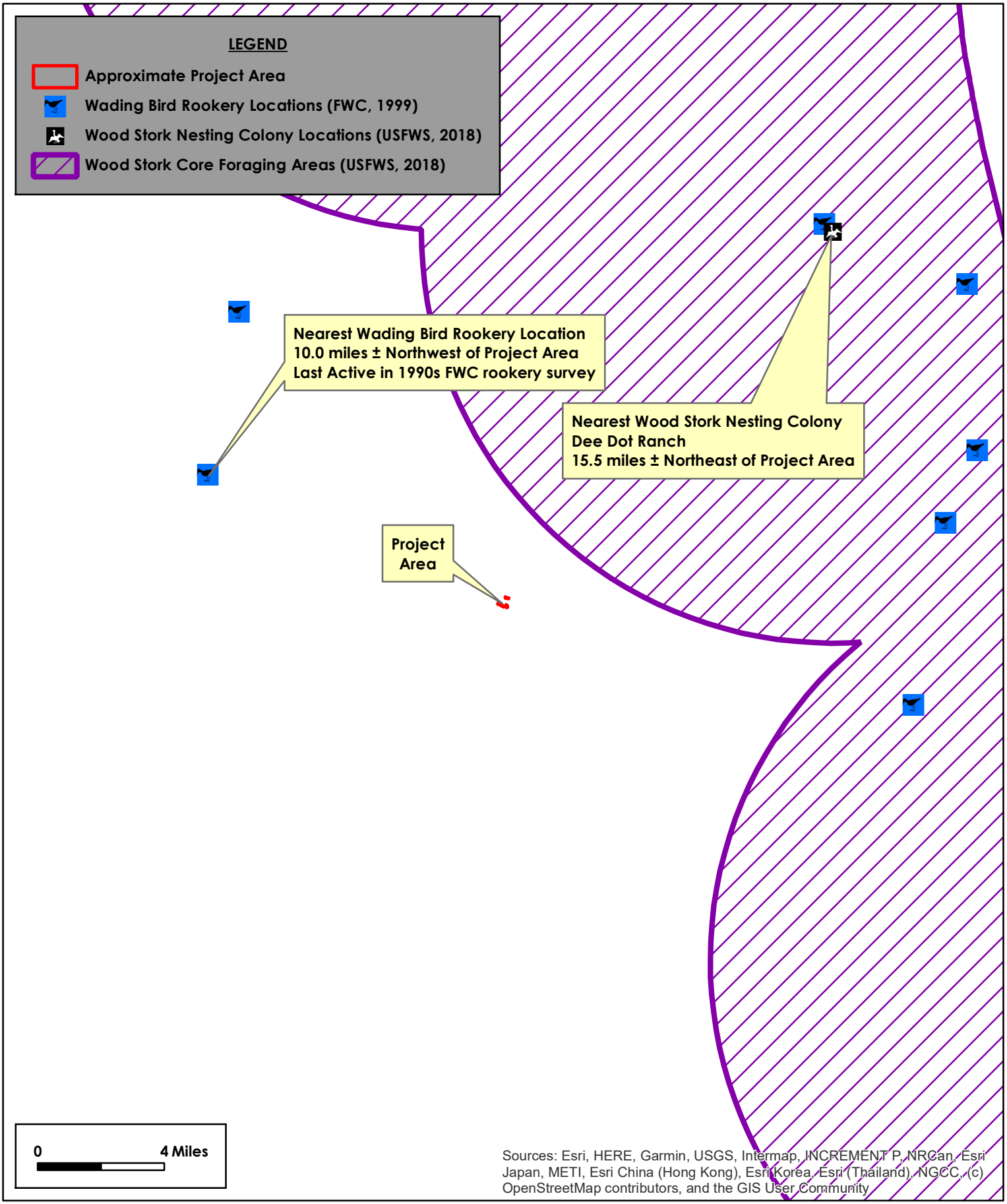

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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JEA Rivertown
Documented Occurrences of
Wading Bird Rookeries and
Wood Stork Nesting Colonies/CFA's

By: NEE

Project No.:	19138
Exhibit No.:	4
Date:	11-13-19
Rev. Date:	

N W E S

Source: USFWS, FDEP, FWC, FNAI, USGS, ArcGIS Online Data (World Street Map)

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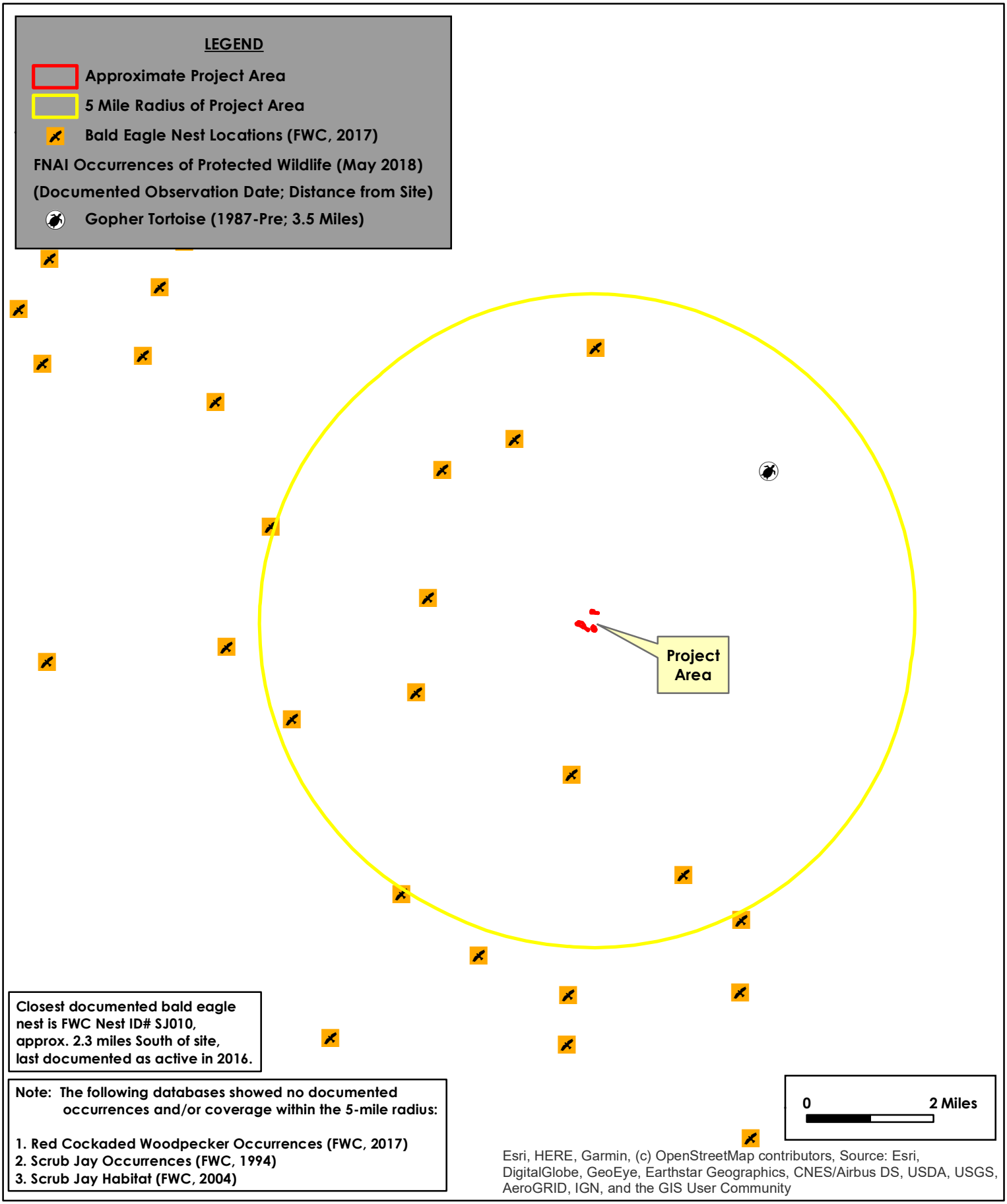

Closest documented bald eagle nest is FWC Nest ID# SJ010, approx. 2.3 miles South of site, last documented as active in 2016.

Note: The following databases showed no documented occurrences and/or coverage within the 5-mile radius:

1. Red Cockaded Woodpecker Occurrences (FWC, 2017)
2. Scrub Jay Occurrences (FWC, 1994)
3. Scrub Jay Habitat (FWC, 2004)

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JEA Rivertown
Documented Occurrences of Protected Wildlife Within 5 Miles

Project No.:	19138
Exhibit No.:	5
Date:	11-13-19
By: NEE	Rev. Date:

N W E S

Source: USFWS, FDEP, FWC, FNAI, USGS, ArcGIS Online Imagery

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DRAWINGS
(BOUND SEPARATELY)


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