
Y18-779-TA

INVITATION FOR BIDS

FOR

**ORANGE COUNTY UTILITIES
NWRP RAPID INFILTRATION BASINS (RIBS)
SIDE SLOPE LINERS REPLACEMENT PROJECT**

**PART H
TECHNICAL SPECIFICATIONS**

Bid Submittal

**PART H
Volume II**

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TECHNICAL SPECIFICATIONS
ORANGE COUNTY
NWRF RAPID INFILTRATION BASINS (RIBS)
SIDE SLOPE LINERS REPLACEMENT PROJECT

CPH Project No. O28528
OCU File No. 84948

June 2018

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OF THE CONTRACT PROVIDED BY ORANGE COUNTY
PURCHASING

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SECTION 01001
GENERAL WORK REQUIREMENTS

PART 1 - GENERAL

1.01 NOTICES

- A. All notices or other papers required to be delivered by the Contractor to the County shall be delivered to the office of the Engineering Division, Orange County Utilities Department, 9150 Curry Ford Road, Orlando, FL 32825.
- B. A Construction Assistance Request (C.A.R) will be required for all contact with existing operation personnel i.e.: tie-in, spare parts, training, etc. A 7-day notice is required for all C.A.R.'s.

1.02 WORK TO BE DONE

- A. The Contractor shall furnish all labor, materials, equipment, tools, services, and incidentals to complete all work required by these specifications and as shown on the Drawings, at a rate of progress which will ensure completion of the Work within the Contract Time stipulated.
- B. The Contractor shall perform the Work complete, in place, and ready for continuous service, and shall include repairs, testing, permits, clean up, replacements, and restoration required as a result of damages caused during this construction.
- C. The Contractor shall comply with all City, County, State, Federal, and other codes, which are applicable to the proposed Work.
- D. All newly constructed Work shall be carefully protected from injury in any way. No wheeling, walking, or placing of heavy loads on it shall be allowed and all portions damaged shall be reconstructed by the Contractor at his own expense.
- E. All contact, request, coordination with all County personnel including but not limited to the NWRP Operation Staff for any reason shall be initiated through Owner's Resident Project Representative (R.P.R.) in writing by the Contractor processing a Construction Assistance Request (C.A.R.). Contractor will not have contact with any County personnel without processing of a C.A.R. through the County's R.P.R.
- F. Scope of Work: See Section 01010 "Summary of Work" and the Bid Schedule for details.

1.03 DRAWINGS AND PROJECT MANUAL

- A. The Work shall be performed in accordance with the Drawings and Specifications prepared by the County/Professional. All work and materials shall conform to the Orange County Utilities Standards and Construction Specifications Manual, latest edition

or as indicated in these Specifications or Drawings.

- B. The Contractor shall verify all dimensions, quantities and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications or other data received from the County/Professional, and shall notify same, in writing, of all errors, omissions, conflicts and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory Work, faulty construction or improper operation resulting there from, nor from rectifying such conditions at his own expense.
- C. All schedules are given for the convenience of the County and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quantity of materials and equipment included in the Work to be done under this Contract.
- D. Intent:
 - 1. All Work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified either in the Drawings or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described.
 - 2. Items of material, equipment, machinery, and the like may be specified on the Drawings and not in the Specifications. Such items shall be provided by the Contractor in accordance with the specification on the Drawings.
 - 3. The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.
- E. Refer to the Contract for the order of precedence of items and documents.

1.04 PROTECTION AND RESTORATION

- A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every means of protection necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or the Contractor shall make good the damage in other manner acceptable to the County/Professional.
- B. Protection of Trees and Shrubs
 - 1. Protect with boxes or other barricades.
 - 2. Do not place excavated material so as to injure trees or shrubs.
 - 3. Install pipelines in short tunnels between and under root systems.

4. Support trees to prevent root disturbance during nearby excavation.

C. Tree and Limb Removal

1. Tree limbs, which interfere with equipment operation and are approved for pruning, shall be neatly trimmed and the tree cut coated with tree paint.
2. The County may order the Contractor, for the convenience of the County, to remove trees along the line or trench excavation. The Contractor shall obtain any permits required for removal of trees. Ordered tree removal shall be paid for under the appropriate Contract Items.

D. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by the Contractor with new stock of similar size and age, at the proper season and at the sole expense of the Contractor.

E. Lawn Areas: All lawn areas disturbed by construction shall be replaced with like kind to a condition similar or equal to that existing before construction. Where sod is to be removed, it shall be carefully removed, and the same re-sodded, or the area where sod has been removed shall be restored with new sod in the manner described in the applicable section.

F. Where fencing, walls, shrubbery, grass strips or area must be removed or damaged incident to the construction operation, the Contractor shall, after completion of the work, replace or restore to the original condition.

G. The cost of all labor, materials, equipment, and work for restoration shall be deemed included in the appropriate Contract Item or items, or if no specific item is provided therefore, as part of the overhead cost of the Work, and no additional payment will be made therefore.

1.05 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including, but not limited to, encroachment on adjacent lands, flooding of adjacent lands, or excessive noise.

B. Sound levels measured by the County/Professional shall not exceed 45 dBA from 8 p.m. to 8 a.m. or 55 dBA 8 a.m. to 8 p.m. This sound level shall be measured at the exterior of the nearest exterior wall of the nearest residence. Levels at the equipment shall not exceed 85 dBA at any time. Sound levels in excess of these values are sufficient cause to have the Work halted until equipment can be quieted to these levels. Work stoppage by the County/Professional for excessive noise shall not relieve the Contractor of the other portions of this specification including, but not limited to, completion dates and bid amounts.

C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.06 CONTRACTOR'S PAYMENTS TO COUNTY FOR OVERTIME WORK

A. **County Inspector Work Hours: Normal work hours for the County's inspector(s)**

are defined as any 8-hour period between the hours of 7:00 a.m. and 7:00 p.m. on the weekdays of Monday through Friday. Any County Inspector(s) work beyond the aforementioned normal work hours shall be requested in writing 48-hours in advance. All overtime, any County holidays or weekend work compensation for the County's Inspector(s) to work beyond the normal working hours are considered overtime compensation and shall be paid for by the Contractor. The overtime pay rate will be \$51.00 per hour or the most current rate as listed in the County Fee Directory prepared by the Office of Management and Budget, in section "Orange County Utilities Engineering & Construction", under the heading of "Inspection Fee other than Normal Working Hours". The Contractor agrees that the County shall deduct charges for work outside normal work hours and for overtime pay from payments due the Contractor.

1.07 MAINTENANCE OF SERVICE

- A. Unless noted otherwise on the plans, the operation of the existing water, reclaimed water or wastewater facility on each of the respective locations shall remain in service until the transfer of service has been completed. The Contractor shall, prior to interrupting any utility service (water, sewer, etc.) for the purpose of making cuts to the existing lines or for any other purposes, contact the County and make arrangements for the interruption which will be satisfactory to the County.
- B. Utility lines that are damaged during construction shall be repaired by the Contractor and service restored within 4-hours of the breakage. The County retains the option of repairing any damage to utility pipes in order to expedite service to the customers. The Contractor will remain responsible for all costs associated with the repair.

1.08 TRANSFER OF SERVICE

- A. When the County has accepted a proposed facility and placed it into operation, the transfer of service is complete. The Contractor may begin the work of removing the existing or temporary facilities.

1.09 LABOR

- A. Supervision: The Contractor shall supervise and direct the Work efficiently and with his best skills and attention. The Contractor shall have a competent, English speaking superintendent or representative, who shall be on the site of the Project at all working hours, and who shall have full authority by the Contractor to direct the performance of the Work and make arrangements for all necessary materials, equipment, and labor without delay.
- B. Jurisdictional Disputes: It shall be the responsibility of the Contractor to pay all costs that may be required to perform any of the Work shown on the Drawings or specified herein to avoid any work stoppages due to jurisdictional disputes. The basis for subletting work in question, if any, shall conform to precedent agreements

and decisions on record with the Building and Construction Trades Department, AFL-CIO, dated June, 1973, including any amendments thereto.

- C. Apprenticeship: The Contractor shall comply with all of the requirements of Section 446, Florida Statutes, for all contracts in excess of \$25,000 excluding roadway, highway or bridge contracts and the Contractor agrees to insert in any subcontract under this Contract the requirements of this Article.

1.10 MATERIALS AND EQUIPMENT

A. MANUFACTURER

1. All transactions with the manufacturers or Subcontractors shall be through the Contractor, unless the Contractor and the County/Professional request that the manufacturer or Subcontractor communicate directly with the County/Professional. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.
2. All workmanship and materials shall be of the highest quality. The equipment shall be the product of manufacturers who are experienced and skilled in the field with an established record of research and development. No equipment will be considered unless the manufacturer has designed and manufactured equipment of comparable type and size and have demonstrated sufficient experience in such design and manufacture.
3. No material shall be delivered to the Site without prior approval of the County/Professional.
4. All apparatus, mechanisms, equipment, machinery, and manufactured articles for incorporation into the Project shall be the new (most current production at time of bid) and unused standard products of recognized reputable manufacturers.
5. Manufactured and fabricated products:
 - a. Design, fabricate and assemble in accord with the best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
 - c. Any two or more pieces of material or equipment of the same kind, type or classification, and being used for identical types of service, shall be made by the same manufacturer.
 - d. Products shall be suitable for service conditions as specified and as stated by manufacturer.
 - e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
 - f. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.11 MANUFACTURER'S SERVICE

- A. Where service by the manufacturer is specified to be furnished as part of the cost of the item of equipment, the Work shall be at the Contractor's expense.
- B. The services provided shall be by a qualified manufacturer's service representative to

check and verify the completed installation, place the equipment in operation, and instruct the County's operators in the operation and maintenance procedures. Such services are to be for period of time and for the number of trips specified. A working day is defined as a normal 8-hour working day on the job and does not include travel time.

- C. The services shall further demonstrate to the County/Professional's complete satisfaction that the equipment will satisfactorily perform the functions for which it has been installed.

1.12 INSPECTION AND TESTING

A. General

1. All materials and equipment furnished by the Contractor shall be subject to the inspection, review and acceptance of the County and meet the requirements as outlined in the Orange County Utilities Standards and Construction Specifications Manual. If in the testing of any material or equipment it is ascertained by the County/Professional that the material or equipment does not comply with the Contract, the Contractor shall be notified thereof, and the Contractor will be directed to refrain from delivering said material or equipment, or to remove it promptly from the Site or from the Work and not accepted by the County shall be replaced with acceptable material, without cost to the County.
2. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEE, except as may otherwise be stated herein.
3. The Contractor shall give notice in writing to the County sufficiently in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, the County shall arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials; or the County will notify the Contractor that the inspection will be made at a point other than the point of manufacture; or the County will notify the Contractor that inspection will be waived.
4. When inspection is waived or when the County/Professional so requires, the Contractor shall furnish to the County authoritative evidence in the form of Certificates of Manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents. These certificates shall be notarized and shall include five (5) copies of the results of physical tests and chemical analysis, where necessary, that have been made directly on the product or on similar products of the manufacturer.
5. The Contractor must comply with these provisions before shipping any material. Such inspections by the County shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

B. Cost

1. County shall employ and pay for the services of an independent testing laboratory to perform testing indicated on the Contract Documents, or at the County's discretion to ensure conformity with the Contract Documents.
2. The cost of field leakage and pressure tests and shop tests of materials and equipment specifically called for in the Contract Documents shall be borne by the Contractor. Such costs shall be deemed to be included in the Contract price.
3. The Contractor shall notify the County laboratory a minimum of 48-hours in advance of operations for scheduling of tests. When tests or inspections cannot be performed after such notice, the Contractor shall reimburse County for expenses incurred.
4. The Contractor shall pay for all work required to uncover, remove, replace, retest, etc., any work not tested due to the Contractor's failure to provide the 48-hours advance notice or due to failed tests. The Contractor shall also provide compensation for the County/Professional's personnel for required re-testing due to failed or rescheduled testing.

C. Shop Testing

1. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function or special requirements are specified shall be tested in the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. No such equipment shall be shipped to the worksite until the County/Professional notifies the Contractor, in writing, that the results of such tests are acceptable.
2. The manufacturing company shall provide five (5) copies of the manufacturer's actual shop test data and interpreted results signed by a responsible official of the manufacturing company and notarized, showing conformity with the Contract Documents as a prerequisite for the acceptance of any equipment. The cost of shop tests (excluding cost of County's representative) and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor and shall be included in the Contract price.

D. Field Testing:

1. The County shall employ and pay for services of an independent testing laboratory to perform testing specifically indicated in the Contract Documents. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the Work of the Contract. The Contractor shall provide compensation for retesting of all failed tests.
2. The County may at any time during the progress of the Work, request additional testing beyond that which is specified in the Contract. This testing will be at the County's expense. Contractor shall:
 - a. Cooperate with laboratory personnel, provide access to the Project.
 - b. Secure and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.
 - c. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes, which require control by the testing laboratory.

- E. Demonstration Tests: Upon completion of the Work and prior to final payment, all equipment and piping installed under this Contract shall be subjected to acceptance or demonstration tests as specified or required to provide compliance with the Contract

Documents. The Contractor shall furnish all labor, fuel, energy, water and all other equipment necessary for the demonstration tests at no additional cost to the County.

- F. Final Inspection: Prior to preparation of the final payment application, a final inspection will be performed by the County to determine if the Work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents. See also Section 01700 "Project Closeout."
- G. Inspection by existing utility owners: The Contractor shall pay for all inspections during the progress of the work required and provided by the owner of all existing public utilities paralleling or crossing the Work, as shown on the Drawings. All such inspection fees shall be deemed included in the appropriate Contract Item or items, or if no specific item is provided therefore, as part of the overhead cost of the Work, and no additional payment will be made therefore.
- H. Inspection by Other Agencies: The Florida Department of Transportation, the Florida Department of Environmental Protection, and other authorized governmental agencies shall have free access to the site for inspecting materials and work, and the Contractor shall afford them all necessary facilities and assistance for doing so. Any instructions to the Contractor resulting from these inspections shall be given through the County. These rights of inspections shall not be construed to create any contractual relationship between the Contractor and these agencies.

1.13 PROJECT SITE AND ACCESS

A. RIGHT-OF-WAY AND EASEMENTS

1. The use of public streets and alleys shall be such as to provide a minimum of inconvenience to the public and to other traffic. Any earth or other excavated material shall be removed by the Contractor and the streets cleaned to the satisfaction of the County.
2. The Contractor shall not enter or occupy private land outside of easements, except by written permission of the property owner.
3. At the time of the Pre-Construction meetings, the Contractor shall become fully acquainted with the status of all easements. Should easements not be acquired by the County in specific areas of the Work, the Contractor shall sequence and schedule his work therein so as not to interfere with the progress of work in other areas of the Project. Any rescheduling of work due to easement acquisitions shall be performed by the Contractor at no additional cost to the County. The County agrees that it will make every effort to acquire all remaining easements with all speed and diligence possible so as to allow the completion of the Work within the Contract time.

B. ACCESS

1. Neither the material excavated nor the materials or equipment used in the construction of the Work shall be so placed as to prevent free access to all fire hydrants, valves or manholes.
2. Access to businesses located adjacent to the project site must be maintained at all times. Contractor may prearrange the closing of business access with the business

Owner. Such prearranged access closing shall not exceed two (2) hours. Property drainage and grading shall be restored and all construction debris removed within 48-hours of backfilling trench.

3. Contractor agrees that representatives of the County and any governmental agents will have access to the Work wherever it is in preparation or progress and that the Contractor shall provide facilities for such access and inspection.

1.14 UTILITIES

A. UTILITY CONSTRUCTION

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto, whether owned or controlled by governmental bodies or privately owned by individuals, firms or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage or water. Other public or private property, which may be affected by the Work, shall be deemed included hereunder.
2. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required.
3. The length of open trench will be controlled by the particular surrounding conditions, but shall always be confined to the limits described by the County. If any excavation becomes a hazard, or if it excessively restricts traffic at any point, the County may require special construction procedures. As a minimum, the Contractor shall conform to the following restoration procedures:
 - a. Interim Restoration: All excavations shall be backfilled and compacted as specified by the end of each working day. For excavations within existing paved areas; limerock base or soil cement base (match existing) shall be spread and compacted to provide a relatively smooth surface free of loose aggregate material. At the end of each workweek, the S-I asphaltic surface course shall be completed and opened to traffic. Contractor shall coordinate his construction activity including density tests and inspections to allow sufficient time to achieve this requirement. All driveway cuts shall be backfilled, compacted, and limerock base spread and compacted immediately after installation. Contractor shall coordinate with the individual property owners prior to removing the driveway section. Any utility crossing an existing roadway, parking lot or other paved area shall be patched by the end of the working day.
 - b. All pipe and fittings shall be neatly stored in a location, which will cause the least disturbance to the public. All debris shall be removed and properly disposed of by the end of each working day.
 - c. Final Restoration Overlay: After completing all installations, and after testing of the pipe (but no sooner than 30-days after applying the S-I asphaltic surface), final restoration shall be performed. In no event shall final restoration begin after substantial completion. Final restoration shall provide an S-III asphaltic overlay as specified in an uninterrupted continuous operation until completion. Any

additional restoration required after testing shall be repaired in a timely manner at no additional cost to the County.

- d. Maintenance of all restored facilities shall be the Contractor's responsibility. This maintenance shall be performed on an on-going basis during the course of construction. The Contractor's Progress Schedule shall reflect the above restoration requirements.
- e. Additional Restoration for Work in Business or Commercial Districts: The Contractor shall restore all private property, damaged by construction, to its original condition. Access to businesses located adjacent to the project site must be maintained at all times. Contractor may prearrange the closing of business accesses with the business owner. Such prearranged access closing shall not exceed two (2) hours. Property drainage and grading shall be restored within 24-hours of backfilling trench.

B. EXISTING UTILITIES

1. The locations of all existing underground piping, structures and other facilities are shown based on information received from the respective owner. The locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping, conduit and cables to be encountered. It is the Contractor's responsibility to verify all existing underground piping, structures and other facilities.
2. The Contractor shall, at all times, employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage or destruction of existing utility installations and structures; and shall, at all times in the performance of the Work, avoid unnecessary interference with, or interruption of, utility services; and shall cooperate fully with the owners thereof to that end.
3. When existing facilities are found to be in conflict with the Work, the County reserves the right to modify alignments to avoid interference with existing facilities.
4. All utilities, which do not interfere with the work, shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the County. Any existing facilities, which require operation to facilitate repairs, shall be operated only by the owner of the respective utility.
5. It is the responsibility of the Contractor to ensure that all utility and/or poles, the stability of which may be endangered by the proximity of excavation, be temporarily stayed and/or shored in position while work proceeds in the vicinity of the pole and that the utility or other companies concerned be given reasonable advance notice of any such excavation.

C. NOTICES

1. All governmental utility departments and other owners of public utilities, which may be affected by the Work, will be informed in writing by the Contractor two (2) weeks after the execution of the Contract or Contracts covering the Work. Such notice will be sent out in general, and directed to the attention of the governmental utility departments and other owners of public utilities for such installations and structures as may be affected by the Work.
2. The Contractor shall comply with Florida Statute 553.851 regarding protection of

- underground gas pipelines. Evidence of notification to the gas pipeline owner shall be furnished to the County within two (2) weeks after the execution of the Contract.
3. It shall be the Contractor's responsibility to contact utility companies at least 72-hours in advance of breaking ground in any area or on any unit of the work so maintenance personnel can locate and protect facilities, if required by the utility company.
 4. The Contractor shall give a minimum five (5) working day notice to utility personnel prior to interrupting a utility service (water, sewer, etc.).

D. EXPLORATORY EXCAVATIONS

1. Exploratory excavations shall be conducted by the Contractor for the purpose of locating underground pipelines or structures in advance of the construction. Test pits shall be excavated in areas of potential conflicts between existing and proposed facilities and at piping connections to existing facilities a minimum of 48-hours or 1,000-feet in advance of work. If there is a potential conflict, the Contractor shall notify the County/Professional immediately. Information on the obstruction to be furnished by the Contractor shall include: Location, Elevation, Utility Type, Material and Size. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the County.

E. UTILITY CROSSINGS

1. It is intended that wherever existing utilities must be crossed, deflection of the pipe within specified limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated on the Drawings. However, when in the opinion of the County this procedure is not feasible, the County may direct the use of fittings for a utility crossing or conflict transition as detailed on the Drawings.

F. RELOCATIONS

1. Relocations shown on the Drawings: Public utility installations or structures, including but not limited to poles, signs, fences, piping, conduits and drains that interfere with the positioning of the work which are shown on the Drawings to be removed, relocated, replaced or rebuilt by the Contractor shall be considered as part of the general cost of doing the Work and shall be included in the prices bid for the various contract items. No separate payment shall be made therefore.
2. Relocations not shown on the Drawings
 - a. Where public utility installations or structures are encountered during the course of the work, and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the County, removal, relocation, replacement or rebuilding is necessary to complete the Work, such work shall be accomplished by the utility having jurisdiction, or such work may be ordered, in writing by the County, for the Contractor to accomplish.
 - b. If such work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required.
 - c. If such work is accomplished by the Contractor, it will be paid for as a Change Order.
3. All existing castings, including valve boxes, junction boxes, manholes, hand holes,

- pull boxes, inlets and similar structures in the areas of construction that are to remain in service and in areas of trench restoration and pavement replacement, shall be adjusted by the Contractor to bring them flush with the surface of the finished work.
4. All existing utility systems which conflict with the construction of the work herein, which can be temporarily removed and replaced, shall be accomplished at the expense of the Contractor. Work shall be done by the utility unless the utility approves in writing that the Work may be done by the Contractor.

1.15 RELATED CONSTRUCTION REQUIREMENTS

A. PUBLIC INFORMATION OFFICER

1. The Contractor shall provide community interaction and coordination through a designated Public Information Officer (PIO). The PIO will provide resolution to complaints and problems from community members affected by the construction for the entire project duration. The PIO will manage a 24-hour hotline phone number for citizens to call. The PIO will field these calls, provide answers to questions, research issues with the project team or appropriate agencies and follow up each complaint in a timely manner. The PIO will maintain a daily diary of call and/or interactions with the community, as well as a complaint log chronicling all issues and proposed resolutions.
2. The PIO shall attend the project progress meetings and provide the project team with a report of public issues since the last progress meeting. The PIO will also disseminate roadway closures, sewer hookups, temporary and permanent restoration and other relevant construction information to the community, as well as, when appropriate, to the media, emergency services personnel and other interested agencies.
3. The designated PIO shall have previous experience in providing similar services on Orange County Utilities, Orange County Public Works or FDOT construction projects. The PIO shall be fluent in English and Spanish and shall visit the construction site, meeting locations and affected resident's homes as required.

B. TRAFFIC MAINTENANCE

1. Refer to Section 01570 – Maintenance of Traffic

C. BARRIER AND LIGHTS

1. The Contractor shall exercise extreme care in the conduct of the Work to protect health and safety of the workmen and the public. The Contractor shall provide all protective measures and devices necessary, in conformance with applicable local, state and federal regulations. Protective measures shall include but are not limited to barricades, warning lights/flashers and safety ropes.
2. All equipment and vehicles operating within 10-feet of the roadway shall have flashing strobe lights attached.

D. DEWATERING AND FLOTATION

1. The Contractor, with his own equipment, shall do all pumping necessary to dewater any part of the work area during construction operations to insure dry working conditions. The Contractor shall take the necessary steps to protect on-site and off-

site structures. Damage to any structures due to dewatering shall be repaired or the structures replaced at the Contractor's expense.

2. The Contractor shall be completely responsible for any tanks, wetwells or similar structures that may become buoyant during the construction and modification operations due to the ground water or floods and before the structure is put into operation. The proposed final structures have been designed to account for buoyancy; however the Contractor may employ methods, means and techniques during construction which may affect the buoyancy of structures. The Contractor shall take the necessary steps to protect structures. Damage to any structures due to floating or flooding shall be repaired or the structures replaced at the Contractor's expense.
3. Contractor shall be responsible for any required permits for the discharge of ground water.

E. DUST AND EROSION CONTROL

1. The Contractor shall prevent dust nuisance from his operations or from traffic.
2. Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.
3. Temporary erosion controls include, but are not limited to, grassing, mulching, netting, watering and reseeding on-site surfaces and soil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the County, FDEP and any other agency having jurisdiction.
4. Temporary sedimentation controls include, but are not limited to; silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the County, FDEP and any other agency having jurisdiction.
5. The construction of temporary erosion and sedimentation control facilities shall be in accordance with the technical provision of section 104 "Prevention, Control, and Abatement of Erosion and Water Pollution" of the FDOT Standard Specifications for Road and Bridge Construction, latest edition.

F. LINES AND GRADES

1. All Work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings, or as given by the County/Professional.
2. When the location of the Work is dimensioned on the Drawings, it shall be installed in that location; when the location of the Work is shown on a scaled drawing, without dimensions, the Work shall be installed in the scaled location unless the County approves an alternate location for the piping. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve the Contractor from laying and jointing different or additional items where required. The County/Professional may require detailed pipe laying drawings and schedules for project control.
3. The Contractor shall, at his own expense, establish all working or construction lines and grades as required from the project control points set by the County, and shall be solely responsible for the accuracy thereof.
4. Water main and forcemain shall be installed to provide long uniform gradient or slope

- to pipe to minimize air pockets and air release valves. The stationing shown on the Drawings for air and vacuum release valve assemblies are approximate and the Contractor shall field adjust these locations to locate these valves at the highest point in the pipeline installed. All locations must be accepted by the County.
5. To insure a uniform gradient for gravity pipe and pressure pipe, all lines shall be installed using the following control techniques as a minimum:
 - a. Gravity lines; continuous control, using laser beam technology.
 - b. Pressure lines; control stakes set at 50-foot intervals using surveyors' level instrument.

G. TEMPORARY CONSTRUCTION

1. Temporary fences: If, during the course of the Work, it is necessary to remove or disturb any fencing, the Contractor shall at his own expense, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced.
2. Responsibility for Temporary Structures: In accepting the Contract, the Contractor assumes full responsibility for the sufficiency and safety of all temporary structures or work and for any damage which may result from their failure or their improper construction, maintenance or operation.

H. DAILY REPORTS

1. The Contractor shall submit to the County's Representative daily reports of construction activities including non-work days. The reports shall be complete in detail and shall include the following information:
 - a. Days from Notice to Proceed; Days remaining to substantial and final completion.
 - b. Weather information
 - c. Work activities with reference to the Critical Path Method (CPM) schedule activity numbers (including manpower, equipment and daily production quantities for each individual activity).
 - d. Major deliveries
 - e. Visitors to site
 - f. Test records
 - g. New problems, and
 - h. Other pertinent information
2. A similar report shall be submitted for/by each Subcontractor.
3. The report(s) shall be submitted to the County Representative within 2 days of the respective report date. Each report shall be signed by the Contractor's Superintendent or Project Manager. Pay request will not be processed unless daily reports are current.
4. If a report is incomplete, in error, or contains misinformation, a copy of the report shall be returned by the County Representative to the Contractor's Superintendent or Project Manager with corrections noted. When chronic errors or omissions occur, the Contractor shall correct the procedures by which the reports are produced.

I. CLEANING

1. During Construction
 - a. During construction of the Work, the Contractor shall, at all times, keep the Site free from material, debris and rubbish as practicable and shall remove the same

from any portion of the Site if, in the opinion of the County, such material, debris, or rubbish constitutes a nuisance or is objectionable.

- b. Provide on-site containers for the collection of waste materials, debris and rubbish and remove such from the Site periodically by disposal at a legal disposal area away from the Site.
 - c. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished. Use cleaning materials which will not create hazards to health or property and which will not damage surfaces. Use only those cleaning materials and methods recommended by the manufacturer of the surface material. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.
 - d. The Contractor shall remove from the site all surplus materials and temporary structures when no longer necessary to the Work at the direction of the County.
2. Final Cleaning
- a. At the conclusion of the Work, all equipment, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and the Contractor shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances. Employ skilled workmen for final cleaning. Thoroughly clean all installed equipment and materials to a bright, clean, polished and new appearing condition. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
 - b. The Work shall be left in a condition as shown on the Drawings and the remainder of the site shall be restored to a condition equal or better than what existed before the Work.
 - c. Prior to final completion, or County occupancy, Contractor shall conduct an inspection of interior and exterior surfaces, and all work areas to verify that the entire Work is clean. The County will determine if the final cleaning is acceptable.

1.16 CONSTRUCTION NOT PERMITTED

A. USE OF EXPLOSIVES

1. No blasting shall be done except as approved by the County and the governmental agency or political subdivision having jurisdiction.

1.17 SITE ADMINISTRATION

- A. Contractor shall be responsible for all areas of the Site used by it and by all Subcontractors in the performance of the Work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to Owner or others. Contractor shall have the right to exclude from the Site all persons who have no purpose related to the Work or its inspection, and may require all persons on the Site (except Owner's employees) to observe the same regulations as Contractor requires of its employees.

- B. Access to the Site during construction will be limited to Contractor's and/or Subcontractor's employees, agents, and vendors (hereinafter "Representatives") for the sole purpose of performing the Work. Contractor/Subcontractor Representative's identity and business purpose will be subject to verification by Owner's security representative. Access to the Site will be limited to the main gate unless specific alternate arrangements are made with the Owner. Contractor will supply list, and periodically update it, which will contain the names of all personnel with driver licenses numbers and license plate numbers of all vehicles that will be on-site during construction.
- C. Owner reserves the right to direct Contractor to permanently remove any subcontractor or subcontracted employee from the site for breach of security, policy, unsafe working practice, unprofessional behavior, or failure to comply with access restrictions.

1.18 METHOD OF PAYMENT

- A. Contractor agrees that the County shall deduct charges for the County's RPR's work outside normal work hours and for overtime pay from payments due the Contractor.

1.19 COMMUNICATION WITH OWNER

- A. All communication with Owner personnel for any purpose shall be administered solely through the County R.P.R. Any other communication with the Owner personnel that is not initiated through the County R.P.R. will be null and void.

1.20 SECURITY

- A. Contractor shall be responsible for protection of the Site, and all Work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons. Contractor shall comply with Orange County's security requirements to protect the site.
- B. The Owner is implementing special security measures to protect the public wastewater system and the Contractor shall provide the same level of security. The Contractor shall provide the following security measures:
 - 1. Contractor will supply list of all personnel that will be on site each morning to Owner's R.P.R.
 - 2. All personnel, employees and or subcontractors and suppliers that pass through the security perimeter shall wear Contractor issued photo identification badges.
 - 3. Contractor will supply list with names, driver license, and license plate numbers of all personnel.
 - 4. Contractor shall perform background checks to identify any historical crimes dealing with terrorism, sabotage, or other government related illegal activities for all personnel passing through the security perimeter.
 - 5. All project deliveries shall be inspected prior to entering the security perimeter of the Facility in order to verify contents. All delivery personnel and delivery vehicles shall be under supervision while within the security perimeter of the Facility in lieu of issuance of photo identification badges. The Contractor shall maintain staff to accept

all deliverables to the Site; the Owner will not be responsible for receipt of any deliverables.

6. If access other than the main gate entrance is utilized, a full time guard shall be provided at the construction gate during contractor working hours. All arrangements for alternative access shall be pre-arranged with the Owner. All alternative access must be secured and locked when not in use.

C. No Claim shall be made against Owner by reason of any act of an employee or trespasser, and Contractor shall make good all damage to Owner's property resulting from Contractor's failure to provide security measures as specified.

1.21 CONSTRUCTION ADMINISTRATION REQUEST (CAR) FORM

A. The Contractor is responsible to submit a CAR to the Owner's Representative for any interaction requiring the involvement of the Owner's Operation Staff for the site, including but not limited to the following examples; existing valve actuation, process interruptions, equipment operation interruption, power interruption, flow diversions, training. The Contractor will not have contact with the Operations Staff without Owner's Representatives' knowledge. The Owner's Representative reserves the right to direct the Contractor to provide a CAR at his discretion. Unless otherwise noted by the Owner's Representative, a CAR shall be submitted a minimum of seven (7) calendar days in advance of the intended operation noted within the CAR. Unless otherwise noted within the Contract Documents, for all activities affecting treatment process operation, a CAR shall be submitted a minimum of thirty (30) days in advance of the scheduled activity. Unless otherwise noted within the Contract Documents, the schedule for performing work which will require shutting down a unit process must be coordinated with the Owner by CAR submittal a minimum of sixty (60) days in advance of the scheduled activity.

1.22 SMOKING POLICY – SMOKE FREE CAMPUS

A. In order to protect the public health, safety, and welfare of citizens and employees, smoking tobacco, or any other substance, is prohibited in County owned or operated facilities and vehicles. Contractor's personnel will not be permitted to smoke tobacco products on County property, including County parking lots, break areas, and worksites. Smoking means the lighting of any cigarette, cigar, or pipe, regardless of its composition. This requirement shall be enforced from the beginning of construction and violators will be removed from the property.

1.23 OPERATOR TRAINING

A. A minimum of two (2) days of training shall be provided for each piece of equipment supplied, including all electrical installation, instruments and testing equipment. The Contractor shall video and audio record each training session. The Contractor shall provide the County with a flash drive compiling all of the training sessions on the project. The flash drive shall be able to be indexed per respective piece of equipment. The flash drive shall be accompanied by an electronic compilation (.PDF format) of all the handout

materials provided to Operators during those training sessions. At a minimum of seven (7) days in anticipation of scheduling a training session, the Contractor is responsible to submit a CAR Form to the County RPR. The purpose of the submittal of the CAR Form is to request if the Contractor may conduct a training session with the Operations Staff on an anticipated date. The CAR is to be accompanied by the training agenda and all handouts to be provided. The County reserves the right to reject the date submitted in instances where Operations staff is unable to accommodate that date because of a scheduling conflict. From the training materials submitted, the County reserves the right to request additional training and those materials provided shall be based upon the Manufacturer's recommendations and the Manufacturer's Operations and Maintenance manuals.

1.24 SPARE PARTS

- A. Spare parts for certain equipment provided under Divisions 11: Equipment; 13: Special Construction; 15: Mechanical; and 16: Electrical have been specified in the pertinent sections of the Specifications. The Contractor shall collect and store all spare parts so required in an area to be designated by the Engineer. In addition, the Contractor shall furnish to the Engineer an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier, and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivered cost. Contractor shall package in large plastic military grade containers with all information needed labeled on outside of container such as equipment item, manufacturer, specification, facility, etc.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

This project consists of replacing the aging and failing Rapid Infiltration Basin (RIB) liners at the Northwest Water Reclamation Facility. Fifteen (15) of the total eighteen (18) existing RIBs on-site shall be replaced per the design drawings.

- A. The Work generally includes but is not limited to the following:
1. Excavation, backfill and compaction
 2. Removal of unsuitable soils & installing fill dirt
 3. Re-grading of RIB side slopes, and pond bottoms
 4. Install new HDPE liners
 5. Replacement of all disturbed access roads along top of RIBs
 6. Testing of installed systems
 7. Restoration, sodding, and site clean-up

The Work also includes replacing components of the existing flow meters. The existing flow meter assembly will be retrofitted from the existing McCrometer Standard Mechanical Reading System to the McCrometer FlowConnect Automatic Meter Digital Reading System. Serial interface between FlowConnect and digital register will allow FlowConnect to read totalizer and rate value directly. All electrical components shall be grounded to fluid column and pipe. Meters must use software platform AddVantage Pro, where daily readings from FlowConnect may be viewed by the Owner.

Bid alternate will consider an additive alternate to completely replace the existing ten flow meters with a new McCrometer FlowConnect Automatic Meter Digital Reading System meter, or approved equal, if needed based on the age and condition of the existing flow meters.

- B. All materials, equipment, skills, tools, and labor which is reasonably and properly inferable and necessary for the proper completion of the Work and in compliance with the requirements stated or implied by these Specifications or Drawings shall be furnished and installed by the Contractor without additional compensation, whether specifically indicated in the Contract Documents or not. Materials used to complete the Work shall be listed in the List of Approved Products – Appendix D of the Manual of Standards and Specifications for Wastewater and Water Main Construction, which is provided in Appendix D of this document.
- C. The Contractor shall perform the work complete, in place, and ready for continuous service, and shall include repairs, testing, permits, clean up, replacements, and restoration required as a result of disruptions caused during this construction.

1.02 CONTRACTOR'S USE OF PREMISES

- A. The Contractor shall assume full responsibility for the protection and safekeeping of products and materials at the job site. If additional storage or work areas are required, they shall be obtained by the Contractor at no additional cost to the Owner.
- B. The Contractor shall protect existing underground piping located throughout the site from excavation activities and heavy machinery. This piping is not shown on the Drawings, however, the facility's record drawings showing these pipes will be provided by the County upon request.

1.03 SEQUENCE OF WORK

- A. The Contractor recognizes this wastewater treatment facility an active facility and relies on the RIB system for effluent disposal. Only a specific number or RIBs may be out-of-service at any point during the project. Contractor's Bid shall assume only two (2) RIB(s) may be out-of-service at any point during construction.
- B. The Contractor shall submit a Sequence of Construction Plan for approval to the Owner prior to the pre-construction meeting. This Plan shall include the sequence of RIBs that will be out-of-service and length of construction time for each RIB.
- C. The Contractor shall establish his work sequence based on the use of crews to facilitate completion of construction and testing within the specified Contract Time.
- D. Upon completion of the Work on all RIBs, Contractor may request substantial completion for the entire Project. Requests for partial substantial completions will not be accepted.

1.04 PUBLIC UTILITY INSTALLATIONS AND STRUCTURES

- A. Some of the utility contacts are listed on the plans for the Contractor's convenience.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01021
SOILS REPORT AND OTHER INFORMATION

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Identification of reports of existing conditions.

Bidder's/Contractor's responsibilities for investigating and working with existing conditions.

1.02 LAND IN-ADDITION TO THE SITE

- A. Contractor is responsible for obtaining any lands, areas, properties, facilities and easements, in addition to those furnished by the County, that the Contractor considers necessary for temporary facilities, storage, disposal of spoil or waste material or other purposes the Contractor determines necessary to complete the Work. Contractor shall provide written documentation from owner to use such land or facilities. The County/ Professional and the Geotech do not assume any responsibility for existing conditions at such lands, areas, properties, facilities and /or easements obtained by the Contractor.

1.03 UNDERGROUND UTILITIES

- A. Information or data about physical conditions of Underground Utilities, which have been used in the preparation of the Contract Documents, is shown or indicated in the Drawings and technical specifications. Such information and data is based on information and data obtained from record documents or furnished to the County by the owners of those Underground Utilities or by others.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 EXISTING GROUND SURFACE AND UNDERGROUND CONDITIONS; GENERALLY

- A. Where existing ground conditions are shown on the plans hereto attached, the elevations are believed to be reasonably correct but are not guaranteed to be absolutely so, and, together with any schedule of quantities, are presented only as an approximation. The Contractor shall satisfy itself, however, by actual examination of the site of the Work, as to the existing elevations and the amount of work required under the Contract.
- B. Where test pits and borings have been dug, the results supplied to the County/ Professional by the soils Engineer may be given on the plans or are on file in the County/Professional's office and available for review . The County does not guarantee

the accuracy or correctness of this information. If the Contractor desires any additional information relating to the soils investigation, contact the County/Professional to obtain such information. County does not guarantee the accuracy or correctness of any such information supplied to the Contractor.

- C. If, upon notice of a differing subsurface or latent physical condition from the Contractor, the County determines there was no unforeseen condition and unnecessary tests and investigations were conducted solely at the Contractor's request, any unnecessary expenses may be deducted from the Final Payment for the Contract. No increase in Contract Amount or Contract Time will be made if the differing site conditions were known or could have been discovered by the types of examinations that the Contractor, as Bidder, was responsible for. Claims based on groundwater table conditions will not be considered unforeseen subsurface conditions and will not be allowed. Any information indicated in the Contract Documents as to the groundwater table conditions has been provided for general information purposes only and is not intended to represent that the same conditions will exist during the execution of the Work. Further, no increase in Contract Amount or Contract Time will be made for costs incurred prior to the Contractor's written notice as required by the Contract Documents. The County will be allowed at least 10-days to investigate any alleged differing site conditions and to take appropriate action, before the Contractor is entitled to any adjustment in Contract Amount or Contract Time for Delay.

3.02 UNDERGROUND UTILITIES:

- A. The Contractor will be responsible for the safety and protection of, and providing for the repair of any damage done to the Work and existing surface and subsurface structures. The Contractor will be responsible for any damages and injury resulting from the failure to excavate in a careful and prudent manner.
- B. Contractor shall have full responsibility for locating all underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, stormwater, other liquids or chemicals, or traffic or other control systems, shown or indicated in the Contract Documents, in advance of construction, coordinating the Work with the actual locations found and making note of the actual locations on the record Drawings. Contractor shall exercise extreme caution when locating underground facilities to minimize the risk of damage from Contractor's activities. The Contractor will immediately notify the County and the owner of any Underground Utilities that are inaccurately identified or located on the Drawings.
- C. The Contractor will be responsible for any delay and all costs relating to the obligations set forth in this Section, except as provided by allowances specific to Underground Utilities.
- D. The Contractor will promptly notify the County, in writing, whenever the Contractor discovers that actual physical conditions of Underground Utilities differ materially from

those indicated by the Contract Documents or Authorized Technical Data provided with the Contract Documents. Further, the Contractor promptly will notify the County, in writing, whenever the Contractor encounters Underground Utilities not shown or indicated in/through the Contract Documents, and which could not reasonably have been foreseen.

- E. The County and Contractor will follow the provisions of the General Conditions with respect to any conclusions reached by the County after the County compares the actual underground utility conditions with those included in the information provided to the Contractor.

3.03 ENVIRONMENTAL PROCEDURES FOR HAZARDOUS MATERIALS

- A. The Contractor will not, at any time, cause or permit any Hazardous Materials to be brought upon, stored, manufactured, blended, handled, or used in, on, or about the Project or the Site for any purpose except as lawful and necessary and in accordance with the Contract Documents. The Contractor will not cause or permit Hazardous Materials to be brought on Site unless they have been specifically pre-identified by the Contractor, and approved in writing in advance by the County.
- B. The Contractor will defend, save, indemnify and hold harmless the County, their agents and employees from and against all liabilities, claims, damages, losses and expenses including attorneys' fees, which arise at any time during or after completion of the Work as a result of or in connection with:
 - 1. The Contractor's breach of any prohibition or requirement set forth in this Section or,
 - 2. Any Hazardous Materials discharged, released, deposited or introduced in the soil or surface or groundwater in, on, under, or about the Work, the Site or other properties as a result of the activities of the Contractor, the Subcontractors and their respective agents and employees in connection with the Work.
- C. This Contractor's indemnity obligation includes without limitation, costs incurred in connection with any investigation of site conditions or any cleanup, remediation, removal, or restoration required by the County or any federal, State, or local Public Agency because of:
 - 1. The occurrence of any Hazardous Materials present in the soil or surface or groundwater in, on, under, or about the Work or the Site;
 - 2. The diminution in value of the Work or the Site;
 - 3. Damages for the loss or restriction on use of the Work or of any amenity of the Work or the Property; and/or
 - 4. Amounts paid in settlement of claims, penalties, attorneys' fees, court costs, consultant and laboratory fees and experts' fees.
- D. The Contractor will immediately notify the County in writing of any significant release of Hazardous Materials at the Project or the Site, specifying the nature and quantity of the release, the location of the release, and the measures taken to contain and clean up the release and ensure that future releases do not occur.

- E. The Contractor agrees that insulation and any other construction materials containing asbestos or urea formaldehyde will not be used on the Work, and that all Sub-agreements will prohibit the use of construction materials (including, but not limited to, insulation) containing asbestos or urea formaldehyde.

3.04 DIFFERING HAZARDOUS MATERIAL CONDITIONS:

- A. If the Contractor unexpectedly encounters material reasonably believed to be Hazardous Material, the Contractor will immediately stop all affected Work, give written notice to the County and take appropriate health and safety precautions. Unless the Contract Documents require otherwise, the Contractor will conduct an investigation. If upon due investigation, the Contractor determines the material a Hazardous Material that may present a danger to persons or the surroundings, the Contractor will recommend a solution to the County. In any such case, the affected Work will be considered to have been under a suspension of Work.
- B. If the Hazardous Material is not required Work under the Drawings and/or Specifications, the County will proceed to have the Hazardous Material removed or rendered harmless through a Change Order or by means of another contract or as the County otherwise deems expedient. Alternatively, the County will terminate the affected Work or Contract for the County's convenience.
- C. If the County did not elect termination, once the Hazardous Material has been removed or rendered harmless, the affected Work will be resumed as directed in writing by the County. Any determination by the Florida Department of Community Health or the Department of Environmental Quality that the Hazardous Material has been removed or rendered harmless will be binding upon the County and Contractor for the purposes of resuming the affected Work.
- D. If the Contractor is responsible for the Hazardous Material, the Contractor will bear its proportionate share of the delay and costs involved in cleaning up the Site and removing and rendering it harmless to the satisfaction of the County and all Political Subdivisions with jurisdiction. The Contractor will be solely responsible if the Hazardous Material was brought to the Site by the Contractor, or results in whole or in part from any violation by the Contractor of any applicable Laws.
- E. If the Contractor is responsible, but fails to take appropriate action, and the County acts accordingly, the Contractor will defend, save, indemnify and hold harmless the County from and against all claims arising from the County's exercise of appropriate action.
- F. If the Contractor is not responsible, the County will issue a Change Order with the necessary changes. The Change Order will adjust Contract Amount and/or Contract Time as made necessary by the changes and resulting unreasonable delay under the circumstances attributable to the County /Professional.

3.05 INCIDENTS WITH ARCHAEOLOGICAL FEATURES:

- A. The Contractor will immediately notify in writing, the County and all Federal, State and local agencies with jurisdiction of any Archaeological Feature deposits encountered or unearthed. The Contractor will protect such Archaeological Features in a proper and satisfactory manner. No further disturbance of the Archaeological Features will take place until work is allowed to resume in the affected areas.
- B. If the County concludes that the Contract Documents require changes because of Archaeological Feature deposits encountered, the County will issue a Change Order with the necessary changes in the Work. The Change Order also will adjust Contract Amount and/or Contract Time as made necessary by those changes and by any resulting unreasonable delay under the circumstances attributable to the County/Professional.

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SECTION 01027
APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.01 REQUIREMENT

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
- B. Prior to submitting a monthly payment application, the Contractor's progressive As-Built Drawings, As-Built Asset Attribute Data, Gravity Main, and Pipe Deflection Tables for the period covered by the monthly payment application shall be submitted and accepted by the County.

1.02 FORMAT

- A. Format and Content: Use the accepted Schedule of Values.
 - 1. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
 - a. Generic name
 - b. Related specification section
 - c. Name of subcontractor
 - d. Name of manufacturer or fabricator
 - e. Name of supplier
 - f. Dollar value
 - 2. Round amounts off to the nearest whole dollar. The total shall equal the Contract Amount.

1.03 PREPARATION OF APPLICATION

- A. Each Application for Payment shall be consistent with previous applications for payments as certified and paid for by the County.
- B. Payment Application Times: As stated in the General Conditions, Payment Applications shall be submitted monthly on a day of the month established by the County at the Pre-Construction Conference.
- C. Application Preparation: Contractor shall complete every entry on the Pay Application form. The form shall be executed by a person authorized to sign legal documents on behalf of the Contractor and the signature notarized. Incomplete applications will be returned without action. The following procedure shall be followed by the Contractor:
 - 1. Submit applications typed on forms provided by the County.
 - 2. Use data on Bid Form and approved Schedule of Values. Provide dollar value in each column for each line item for portion of Work performed and for stored products.

3. List each authorized Change Order and use additional sheets if necessary, list Change Order number and dollar amount for the original item of work.
 4. Each item shall have an assigned dollar value for the current pay period and a cumulative value for the project to-date.
 5. Submit stored material log, partial waivers of claims and mechanic liens, and Consent of Surety with each application, as further explained below.
- D. Contractor shall submit a stored material log with each application for payment that identifies the type, quantity, and value of all stored material that tracks when the stored materials were installed and deducts the installed material from the stored quantity at that time. Include original invoices for all stored materials for which payment is requested.
- E. Waivers of Claims and Mechanics Lien (Waivers): With each Application for Payment the Contractor shall submit waivers of claims and mechanic liens from Subcontractors, Sub-subcontractors, and suppliers for the construction period covered by the previous application.
1. The Contractor shall submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
 2. When an application shows completion of an item, the Contractor shall submit final or full waivers.
 3. The Contractor shall submit the final Application for Payment with, if not already submitted, the final waivers from every entity involved with performance of work covered by the Application that could lawfully be entitled to a payment claim or lien.
 4. Format of Waiver Forms: The Contractor shall submit executed waivers of claims and liens on forms acceptable to the County.
 5. The County reserves the right to designate which entities involved in the Work must submit waivers.
- F. Transmittal of Pay Applications: Contractor shall submit four (4) executed copies of each Application for Payment to the County. One (1) copy shall include all waivers of lien and similar attachments.
1. The Contractor shall transmit each Pay Application package with a transmittal form that lists attachments and all appropriate information related to the application. The transmittal form shall be acceptable to the County.
 2. The Contractor shall include a certification with each application stating that all previous payments received from the County under the Contract have been applied by the Contractor to discharge, in full, all obligations of the Contractor in connection with the Work covered by prior applications for payment. The Contractor shall also certify that all materials and equipment incorporated into the Work are free and clear of all liens, claims, security interest, and encumbrances.
- G. Initial Application for Payment Submittal: Administrative actions and submittals that must precede or coincide with submittal of the initial Application for Payment include the following:
1. List of Subcontractors
 2. List of principal suppliers and fabricators
 3. Schedule of Values
 4. Contractor's Construction Progress Schedule (accepted)

5. List of Contractor's staff assignments
 6. Copies of building permits
 7. Copies of authorizations and licenses from governing authorities for performance of the Work
 8. Certificates of insurance and insurance policies
 9. Performance and Payment bonds (if required)
 10. Data needed to acquire County's insurance
- H. Monthly Application for Partial Payment Submittals: Administrative actions and submittals that must precede or coincide with submittal of Monthly Applications for Partial Payment include the following, as applicable:
1. Relevant tests
 2. Progressive As-builts Survey Drawings - one (1) paper copy and electronic copy
 3. Table 01050-2 Asset Attribute Data -one (1) paper copy and electronic copy (see Specification Section 01050 "Surveying and Field Engineering" Table 01050-2)
 4. Table 01050-3 Pipe Deflection Table - one (1) paper copy and electronic copy (see Specification Section 01050 "Surveying and Field Engineering" Table 01050-3)
 5. Table 01050-4 Gravity Main Table - one (1) paper copy and electronic copy (see Specification Section 01050 "Surveying and Field Engineering" Table 01050-4)
 6. Boundary Surveys on 8 1/2"X11" format of fee simple and permanent easements for pump stations, treatment facilities, and constructed pipe in easements
 7. An electronic copy of all survey field notes
 8. Final Release of Lien
 9. Partial Consent of Surety
 10. Site photographs
 11. Updated Progress Schedule: submit one (1) electronic copy and five (5) copies
 12. Summary of Values
 13. Pay Request
 14. On-Site Storage of materials
 15. Provide Draw Schedule
- I. Substantial Completion Application for Payment Submittal: Following issuance of the Certificate of Substantial Completion, Contractor shall submit an Application for Payment. This Application shall reflect any Certificates of Partial Substantial Completion issued previously for the County's occupancy of designated portions of the Work.
1. Administrative actions and submittals that shall precede or coincide with this application include:
 - a. Occupancy permits and similar approvals
 - b. Warranties (guarantees) and maintenance agreements
 - c. Test/adjust/balance records
 - d. Maintenance instructions
 - e. Meter readings
 - f. Start-up performance reports
 - g. Change-over information related to the County's occupancy, use, operation and maintenance
 - h. Final Cleaning

- i. Application for reduction of retainage and consent of surety
 - j. Advice on shifting insurance coverage
 - k. List of incomplete Work, recognized as exceptions to County's Certificate of Substantial Completion
- J. Final Completion Application for Payment Submittal: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
1. Prior to submitting a request for final payment or the County issuing a Certificate of Completion for the Work, the Contractor shall submit the final Record Documents to the County for approval. Retainage funds will be withheld at the County's discretion based on the quality and accuracy of the final Record Documents.
 2. Written signed statements by the Contractor
 - a. Completion of project close-out requirements
 - b. Completion of items specified for completion after Substantial Completion
 - c. Assurance that unsettled claims are settled
 - d. Assurance that work not complete and accepted is now completed
 3. Transmittal of Record Documents to the County
 4. Proof that taxes, fees, and similar obligations have been paid
 5. Removal of temporary facilities and services has been completed
 6. Removal of surplus materials, rubbish, and similar elements
 7. Prepare Application for Final Payment as required in General Conditions
 8. Copies of closed permits.

1.04 PAY APPLICATION SUBSTANTIATING DATA

- A. When the County requires substantiating data for a Pay Application, submit data justifying Pay Application line item amounts in question.
- B. Provide one (1) copy of data with a transmittal letter for each copy of Pay Application submittal. The Pay Application number, date, and line item by number and description shall be clearly stated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01050
SURVEYING AND FIELD ENGINEERING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Professional Surveyor: Provide professional surveying and mapping work required for the execution of the Contract, including verification of existing survey data, construction layout, and production of the As-Built Drawings. This Work shall be performed by a Surveyor that is licensed by the State of Florida as a Professional Surveyor and Mapper pursuant to Chapter 472, F.S.
- B. Professional Engineer: The Contractor shall provide the services of a Registered Professional Engineer currently licensed in the State of Florida for the required field engineering services as applicable to the work.

1.02 REQUIREMENTS

A. Survey Services

- 1. The Contractor shall retain the services of a registered Surveyor and Mapper licensed in the State of Florida to provide professional surveying and mapping services necessary for the construction including a control survey and an as-built survey during construction. The Surveyor will identify control points (monuments and benchmarks noted on the Drawings). The construction layout survey shall be established from the control points shown on the Construction Drawings. The control points shall be confirmed by the contractor prior to start of construction. The accuracy of any method of staking shall be the responsibility of Surveyor. All staking shall be done to provide for easy verification of the work by the County.

B. Field Engineering Services

- 1. The Engineer shall be of the discipline required for the work.
- 2. The Engineer shall be responsible for duties during Construction to include, but not limited to:
 - a. Inspections, testing, witnessing requiring a licensed Professional Engineer.
 - b. Design of temporary shoring, bridging, scaffolding or other temporary construction, formwork and protection of existing structures.
 - c. Other requirements as specified herein.
- 3. Engineering related designs and inspections shall be signed by the licensed Professional Engineer as required by the County.

1.03 SUBMITTALS

A. Provide qualifications of the Surveyor or Engineer.

- 1. A Florida Registered Professional Engineer or Registered Surveyor and Mapper, who is proposed by the Contractor to provide services for the work, shall be acceptable to the County prior to field services being performed.

2. Submit name, address and telephone number of the Surveyor and/or Engineer, as appropriate to the County for acceptance before starting survey or engineering work.
 3. Submit written acknowledgement from the Surveyor stating that he has the hardware, software and adequate scope of services in his agreement with the Contractor to fully comply with the requirements of this specification.
- B. On request, submit documentation verifying accuracy of survey work.
- C. Surveyor shall submit certified Tables 01050 – 2, 3 and 4.

PART 2 - PRODUCTS

2.01 SURVEY DOCUMENTS

- A. Survey documents shall comply with the Minimum Technical Standards of Chapter 5J-17 of the Florida Administrative Code (FAC) and Table 01050-1 Minimum Survey Accuracies, whichever are more stringent. All coordinates shall be geographically registered in the Florida State Plane Coordinate System using the contract Drawings control points for horizontal and vertical controls.
- B. The Surveyor shall not copyright any of their work related to this project.
- C. For ease of calculating pipe deflections in Table 01050-3, begin by providing a unique asset ID for each utility (water, wastewater or reclaimed water) type, numbered sequentially along the pipe run (including changes in direction) from start to finish of the pipe in Table 01050-2 (Pipe Worksheet). Then branches and services of the same utility type can be numbered. It is recommended that each utility numbering format be distinguishable from the other. This will allow organization and convenient sorting after the individual asset table worksheet tabs are combined in the spreadsheet program prior to copying and pasting to the deflection table spreadsheet. The Microsoft Excel spreadsheet template shall be provided by the County.. The numbering system shall be approved by the County before commencing with production of the spreadsheet.

**Table 01050-1
Minimum Survey Accuracies**

Type	Horizontal Accuracy (feet)	Elevation Accuracy (feet)	Location: Horizontal Center and Vertical Top, unless otherwise specified
Bench Marks	0.01	0.01	Point
Baseline Control Locational Accuracy	0.01	N/A	Point
Tract and Easement Corners	*	N/A	Survey Monuments
Pipe, at 100-foot maximum intervals	0.1	0.1	Pipe, Pipe at Valves, Pipe at Bore & Jack Casing
Pipe, (PVC) >16-inch at every pipe joint	0.1	0.1	Pipe, Pipe at Valves, Pipe at Bore & Jack Casing
Fittings, Sleeves, Tapping Saddle, Service Saddles, Cap or Plugs.	0.1	0.1	
Pipe, Restrained	0.1	0.1	Restrained Joint Limits
Connections	0.1	0.1	Pipe
Bore & Jack Casing	0.1	0.1	Top of Casing at the Casing Limits
Directional Drill	0.1	0.1	10-foot intervals during the directional drill operation or intervals not to exceed the drilling rod length
Hydrants	0.1	0.1	Operating Nut
Valves (Operating Nut)	0.1	0.1	Operating Nut
Valve (Pipe Location)	0.1	0.1	Top of Pipe at Valve location
Air Release, Blow off, and Backflow Valves	0.1	0.1	Valve Enclosure
Master Meters, Deduct Meters & Wastewater Meters	0.1	0.1	Register
Meter Box	0.1	0.1	
Clean out -	0.1	0.1	
Manhole Rim	0.1	0.1	Manhole – top of rim
Manhole Inverts	N/A	0.01	Pipe Inverts
Pump Station (Public & Private)	0.1	0.01	Wetwell top of slab and Pipe Inverts
Production Well or Monitoring Well	0.1	0.1	Well – top of casing
Grease Interceptor	0.1	0.1	
Oil / Water Separators	0.1	0.1	
Pipe, abandoned in place or removed	0.1	0.1	Limits of Abandoned or Removed Pipe
Existing Utilities and appurtenant structures**	0.1	0.1	underground feature or structure
<p>* Shall conform to the requirements of the "Chapter 5J-17, 'Minimum Technical Standards', FAC", certified by a SURVEYOR.</p> <p>** Existing utilities including but not limited to water, wastewater, reclaimed water, stormwater, fiber optic cable, electric, gas and structures within the limits of construction.</p> <p>*** Fittings rotated in X,Y,Z plane or vertical shall be shot to maintain flowline for the horizontal and vertical locations of the coordinate</p>			
<p>Note: All survey values to be reported to second decimal point (x.xx)</p>			

TABLE 01050-2
Asset Attribute Data Examples

Hydrants Worksheet

	A	C	D	E	F	G	H	I
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Manufacturer	Model #	Comments
2	FH-1	C-7	518456.40	1483743.63	49.53	Brand B	XJ7-B	
3	FH-2	C-9	518477.68	1483758.95	54.23	Brand B	XJ7-B	
4								
5								

Hydrant / Valve / Manhole / Meter / Fitting / Cleanout / Pipe / Pumpstation / Well / Property or Easement Corner / Existing OC Utility Crossing

Valves Worksheet

	A	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Valve Type	Main Type	Valve Size	Valve Manufacturer	Valve Model #	# of Turns to Close	Gear Actuator	Gear Ratio	Side Actuator	Actuator Manufacturer	Comments
2	ARV-1	C300	518060.09	1483231.33	81.72	ARV - Combination	Water Main	2	Brand H	100XT						
3	ARV-1	C303	518083.55	1483280.50	81.15	ARV - Vacuum	Force Main	4	Brand G	1000						
4	BFP-1	C303	518066.00	1483282.88	78.21	Backflow Preventer	Reclaimed Water Main	8	Brand F	2000 fgs						
5	BO-9	C405	518088.83	1483289.43	78.20	Blowoff	Water Main	2	Brand E	14 turbo						
6	BFV-1	C405	518088.11	1483295.00	81.95	Butterfly	Water Main	30	Brand D	230 vis	200	Yes	3 to 1	Yes	Brand C	
7	GV-3	C405	518132.54	1483372.75	81.23	Gate	Water Main	16	Brand C	2225846	300	Yes	3 to 1	NO		
8	LS-W1	C405	576779.36	1539706.97	64.30	Line Stop	Water Main	16	Brand B	76r44						
9	PV-22	C405	576880.60	1539718.32	64.52		Force Main	12	Brand A	Z100	200	Yes	3 to 1	Yes	Brand A	
10																
11																

General Info / Hydrant / Valve / Manhole / Meter / Fitting / Cleanout / Pipe / Pumpstation / Well / Property or Easement Corner

Manhole Worksheet

	A	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	ID Number	Plan Sheet #	Easting	Northing	Rim Elevation	Invert Elev N	Invert Elev NE	Invert Elev E	Invert Elev SE	Invert Elev S	Invert Elev SW	Invert Elev W	Invert Elev NW	Manufacturer	Comments
2	SAN-MH01	AT-2	475216.00	1501637.12	115.89							111.28		Del Zotto	
3	SAN-MH02	AT-2	474885.63	1501636.02	114.98			110.22			110.12			Del Zotto	
4	SAN-MH03	AT-2	474849.33	1501600.22	115.18		109.96			109.86				Del Zotto	
5	SAN-MH04	AT-2	474850.21	1501416.85	115.91	109.19		110.42		108.56				Del Zotto	
6	SS-1	C1.05A	478117.70	1501622.99	118.13					113.73				Del Zotto Products of Florids Inc.	Del Zotto Products of Florids Inc.
7	SS-2	C1.05A	478116.77	1501534.19	117.79	113.41				113.38				Del Zotto Products of Florids Inc.	Del Zotto Products of Florids Inc.
8	SS-3	C1.05	478111.28	1501152.49	116.45	111.98				111.94				Del Zotto Products of Florids Inc.	Del Zotto Products of Florids Inc.
9	SS-4	C1.05A	478105.19	1500781.07	115.72	110.76		110.75						Del Zotto Products of Florids Inc.	Del Zotto Products of Florids Inc.
10															
11															

General Info / Hydrant / Valve / Manhole / Meter / Fitting / Cleanout / Pipe / Pumpstation / Well / Property or Easement Corner

Meter Worksheet

	A	C	D	E	F	G	H
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Main Type	Comments
2	MM-1	C-6	576533.64	1539520.08	58.01	Water Main	
3	RWMM-1	C-6	576937.42	1539598.78	64.84	Reclaimed Water Main	
4							

Hydrant / Valve / Manhole / Meter / Fitting / Cleanout / Pipe / Pumpstation / Well / Property or Easement Corner / Existing OC Utility Crossing

Fitting Worksheet

	A	C	D	E	F	G	H	I
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Main Type	Fitting Type	Comments
2	FM-1	C-3	572399.28	1539339.13	46.27	Force Main	Bend 11 1/4"	
3	FM-2	C-3	574840.74	1539856.91	51.73	Force Main	Bend 22-1/2"	
4	RW-1	C-4	574887.22	1539849.64	51.75	Reclaimed Water Main	Cross	
5	RW-2	C-4	574904.30	1539849.56	48.98	Reclaimed Water Main	Reducer	
6	WM-1	C-5	572532.38	1539848.16	54.42	Water Main	Tapping Saddle	
7	WM-2	C-5	572631.00	1539337.10	45.27	Water Main	Tee	
8								

General Info / Hydrant / Valve / Manhole / Meter / Fitting / Cleanout / Pipe / Pumpstation / Well / Property or Easement Corner

Cleanout Worksheet

	A	C	D	E	F	G
1	ID Number	Plan Sheet #	Easting	Northing	Elevation	Comments
2	CO-1	C-6	576533.64	1539520.08	58.01	
3	CO-2	C-6	576937.42	1539598.42	64.84	Sanitary Service
4						

General Info / Hydrant / Valve / Manhole / Meter / Fitting / Cleanout / Pipe / Pumpstation / Well / Property or Easement Corner

Pipes Worksheet

Asset Attribute Table Examples												
A	C	D	E	F	G	H	I	J	K	L	M	
ID Number	Plan Sheet #	Easting	Northing	Elevation	Main Type	Type of Shot	Construction Method	Material	Pressure Class	Manufacturer	Comments	
1												
2	CSNG-1	C-4	517827.57	1482195.46	78.83	Force Main	Bore & Jack (Casing)	PVC	DR18	Brand A		
3	CSNG-2	C-4	517848.20	1482195.31	78.38	Force Main	Bore & Jack (Casing)	PVC	DR18	Brand A		
4	RW-1	C-7	517731.98	1482237.24	80.42	Reclaimed Water Main	Restraint Joint Limit	Open Cut	DIP	Class 250	Brand B	
5	RW-2	C-7	517732.85	1482338.10	80.94	Reclaimed Water Main	Restraint Joint Limit	Open Cut	DIP	Class 250	Brand B	
6	WM-1	C-9	573309.07	1539372.90	56.10	Water main	Shot on Pipe	Open Cut	PVC	DR18	Brand C	
7	WM-2	C-9	573308.75	1539375.00	54.66	Water main	Shot on Pipe	Open Cut	PVC	DR18	Brand C	
8	FMDD-1	C-4	504345.94	1488969.20	114.14	Force Main	Shot on Pipe	Directional Drill	HDPE	DR17	Brand X	
9	FMDD-2	C-4	504360.86	1488970.50	112.74	Force Main	Shot on Pipe	Directional Drill	HDPE	DR17	Brand X	
10	FMDD-3	C-4	504377.19	1488971.20	106.14	Force Main	Shot on Pipe	Directional Drill	HDPE	DR17	Brand X	
11	FM-9	C-4	504480.47	1488952.90	105.24	Force Main	Shot on Pipe	Open Cut	PVC	DR18	Brand C	
12												

Pump Station Worksheet

Asset Attribute Table Examples					
A	C	D	E	F	G
ID Number	Plan Sheet #	Easting	Northing	Elevation	Comments
1					
2	PS-1	C-40	517914.35	1482906.56	83.91
3					

Well Worksheet

Asset Attribute Table Examples						
A	C	D	E	F	G	I
ID Number	Plan Sheet #	Easting	Northing	Elevation	Well Type	Comments
1						
2					Well	
3					Monitoring Well	
4						

Easements Worksheet

Asset Attribute Table Examples							
A	C	D	E	F	G	H	
ID Number	Plan Sheet #	Easting	Northing	Elevation	Boundary Corner Type	Comments	
1							
2	Corner-1	C-8	463484.59	1511029.72	Pump Station Tract	N.W. CORNER	
3	Corner-2	C-8	463523.24	1511040.01	Pump Station Tract	N.E. CORNER	
4	Corner-3	C-8	463480.45	1511015.23	Pump Station Tract	S.W. CORNER	
5	Corner-4	C-8	463526.97	1511025.49	Pump Station Tract	S.E. CORNER	
6					Easement		
7					Property		
8							

Existing OC Utility Crossing

Asset Attribute Table Examples							
A	C	D	E	F	G	H	I
ID Number	Plan Sheet #	Easting	Northing	Existing Pipe Elevation	Proposed Crossing Elevation	Existing Main Type	Comments
1							
2							
3	CR-02	AT-1	474767.95	1500585.09	98.20	106.20	Force Main
4	CR-03	AT-1	475239.63	1500596.35	99.10	113.88	Force Main
5	CR-04	AT-1	475239.61	1500588.49	94.30	112.45	Reclaimed Water Main
6	Conf-1	C-750	463464.47	1511013.75	100.54	104.88	Water main
7	Conf-2	C-750	463163.91	1510693.49	98.32	103.57	Storm Main
8							

Grease Interceptor

Asset Attribute Table Examples							
A	C	D	E	F	G	H	
ID Number	Plan Sheet #	Easting	Northing	Elevation	Volume (Gallons)	Comments	
1							
2	GI-1	C-400	508387.30	1487203.18	89.70	1000.00	
3							
4							

**TABLE 01050-3
Pipe Deflection Data EXAMPLE**

Project Contractor: Progress Mtg Date: Contract # Dwg Sheet # Utility Type Pipe Manufacturer Pipe size & material PVC Manufacturer Deflection County Allowable Deflection 75% Allowable Angle of Offset Allowable Radius of Curvature Laying Length of Pipe	FM National Pipe 16" PVC C905 6 inches 4.5 inches 1.5 degrees 764 feet 20 feet	
--	---	--

ID	Size and Type	Northing	Easting	Elev.	Calculations Including Elevation (XYZ)							
					Distance between points AB	Distance between points BC	Distance between points AC	Total Deflection ϕ^*	Radius of Curve ^A	Average Offset Angle ^{***}	Average Offset ^{****}	
					Length AB ft	Length BC ft	Length AC ft	XYZ (w elevation) degrees	XYZ (w elevation) ft	per laying length degrees	per laying length inches	
14041	16" FM	1505131.50	468948.53	107.68	-	-	-	-	-	-	-	-
7000	16" FM	1505059.60	468932.08	108.15	73.76	38.93	112.66	5.48	1,178.35	0.97	4.07	
2128	16" FM	1505022.11	468921.60	108.55	38.93	39.61	78.54	2.29	1,961.65	0.58	2.45	
2127	16" FM	1504983.85	468911.35	108.29	39.61	38.35	77.96	1.78	2,505.50	0.46	1.92	
2126	16" FM	1504946.67	468901.96	107.81	38.35	39.13	77.42	8.79	505.16	2.27	9.51	
2125	16" FM	1504908.11	468895.31	107.48								

Data that has been inputted
 Values in yellow are over spec

*Uses law of cosines to determine angle ABC and ϕ .
 $\text{angle } ABC = \arccos((AB^2 + BC^2 - AC^2) / (2 * AB * BC))$
 $180 - \phi / 2 = \text{angle } ABC$
 Calculate the total deflection ϕ .
 to the outer point (A or C) is equal in angle to the approach from the next point along the

** Uses law of sines, using the chord length AC and radius R.
 Since $\sin((\phi / 2) * (\pi / 180)) = (\text{Chord} / 2) / R$ and length AC = Chord
 $R = AC / (2 * \sin(\phi * \pi / 360))$
 This calculation assumes an average radius over the bend between three points.

*** Adds the lengths of AB + BC / 20ft to get an approximate number of bends over the span.
 This value is divided by the total deflection angle to calculate the average bend angle of
 This assumes that the bend angle consistent across the entire length.

**** Uses average offset angle and laying length of pipe.

**TABLE 01050-4
Gravity Main Table**

Downstream		Upstream		Length (ft)	Gravity Main Diameter (inches)	Design Slope (%)	Const. Slope (%)	Allowable Minimum Constructed Slope (%)
Manhole Number	Invert Elev.	Manhole Number	Invert Elev.					
					8	0.31		0.28
					10	0.24		0.21
					12	0.20		0.17

PART 3 - EXECUTION

3.01 SURVEY FIELD WORK

- A. Locate, reference, and preserve existing horizontal and vertical control points and property corners shown on the Drawings prior to starting any construction. If the Surveyor performing the work discovers any discrepancies that will affect the Project, the Contractor must immediately report these findings to the County. All survey work shall meet the requirements as defined in Florida Administrative Code 5J-17. Reference and preserve all survey pins/monuments during Construction. If survey pins/monuments are disturbed, it is the responsibility of the Surveyor to reset the pins/monuments at the Contractor's expense. If the monuments are disturbed, any Work that is governed by these monuments shall be held in abeyance until the monuments are reestablished by the Surveyor and approved by the County. The accuracy of all the Contractor's stakes, alignments and grades is the responsibility of the Contractor. However, the County has the discretionary right to check the Contractor's stakes, alignments, and grades at any time. Copies of the Surveyor's field notes and/or electronic files for point replacement shall be provided to the County.

- B. The construction layout shall be established from the reference points shown or listed on the Drawings. The accuracy of any method of staking shall be the responsibility of the Contractor. All construction layout staking shall be done such as to provide for easy verification of the Work.

- C. The Surveyor shall locate all improvements for the project As-Built Asset Attribute Data using State Plane Coordinates as the horizontal datum and the benchmark referenced on the Drawings as the vertical datum. The County will provide electronic files of the Drawings to

be used by the Surveyor.

- D. Use survey control points to layout such work tasks including but not limited to:
 - 1. Clearing, grubbing, work limits, right-of-way lines and easements
 - 2. Locations for pipelines and all associated structures and appurtenances
- E. The Surveyor shall reference and replace any project control points, boundary corners, benchmarks, section corners, and right-of-way monuments that may be lost or destroyed, at no additional cost to the County based on the original survey control.

3.02 SURVEY DOCUMENTS DELIVERABLES

- A. All survey documents required under Section 01720 Project Record Documents, Part 2 – Products, paragraphs 2.01 and 2.02.

END OF SECTION

SECTION 01065
PERMITS AND FEES

PART 1 - GENERAL

1.01 REQUIREMENTS

A. General

1. Upon Notice to Proceed, obtain and pay for all appropriate and applicable permits and licenses as provided for in the General Conditions, except as otherwise provided herein.
2. Schedule all inspections and obtain all written approvals of the agencies required by the permits and licenses.
3. Strictly adhere to the specific requirements of the governmental unit(s) or agency(cies) having jurisdiction over the Work. Whenever there is a difference in the requirements of a jurisdictional body and the Contract Documents, the more stringent shall apply.
4. A copy of the permits obtained by the County are furnished in Appendix C "Permits Obtained by County" of these specifications.
5. Unless otherwise specified, the cost of work specified in the various sections of Division 1, will not be paid for separately but the cost therefore shall be considered incidental to and included in the bid prices of the various Contract items.

B. Building Permit (Orange County)

1. The County will pay the general building permit fee and any related impact fees or assessments to be paid to Orange County for the issuance of that permit only.
2. The Contractor shall pay all fees associated with obtaining Orange County trade permits and any and all inspection fees for the Orange County Building Department providing inspections for this project. The Contractor shall apply for and obtain the building permits from Orange County and schedule and obtain final approval from the building inspectors.
3. Information on Orange County Building Department fees is included in the Instructions to Bidders in Division 0.
4. The Contractor shall be responsible for scheduling all permit inspections and obtaining inspection approval from Orange County, as required by the building and sub-discipline construction permits.

C. Construction Dewatering Permit

The Contractor shall apply and pay for all fees associated with obtaining Florida Department of Environmental Protection District Office construction dewatering permits, if required. The Contractor shall provide all materials and equipment to comply with the permit requirements at no additional cost to the County.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01091
REFERENCE SPECIFICATIONS

PART 1 - GENERAL

1.01 GENERAL

- A. Applicable Publications: Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the Work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of or omission from said standards or requirements.

- B. Assignment of Specialists: In certain instances, specification test requires (or implies) that specific work is to be assigned to specialist or expert entities who must be engaged for the performance of the Work. Such assignments shall be recognized as special requirements over which the Contractor has no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the Work. They are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of Work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of Contract requirements remains with the Contractor.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of other requirements of the Specifications, all Work specified herein shall conform to or exceed the requirements of such referenced documents which are not in conflict with the requirements of these Specifications or applicable codes.

- B. References herein to "Building Code" shall mean the Florida Building Code. The latest edition of the code shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

- C. In case of conflict between codes, reference standards, Drawings, and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the Engineer for clarification and directions prior to ordering or providing any materials or labor. The Contractor shall bid the most stringent requirements.

D. Applicable Standard Specifications: The Contractor shall construct the Work specified herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Contractor participation in pre-construction conferences, progress meetings and specially called meetings.

1.02 MEETINGS CALLED BY THE COUNTY

- A. The Engineer will schedule and administer a pre-construction conference, periodic progress meetings and specific topic meetings throughout the progress of the Work. The Engineer will:
 - 1. Prepare and distribute a notification of the meeting to required attendees.
 - 2. Establish, prepare and distribute an agenda with the notification.
 - 3. Make physical arrangements for the meetings.
 - 4. Preside at meetings.
 - 5. Prepare and distribute minutes of meetings including significant proceedings and decisions, within 15 working days after each meeting. Minutes will be forwarded to all participants and to parties affected by decisions made at the meeting.
- B. Representatives of the Contractor, Subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
- C. The meeting location will generally be a central site, convenient for all parties, designated by the County.
- D. All meetings shall be digitally recorded with files provided to all requesting parties.

1.03 PRE-CONSTRUCTION CONFERENCE

- A. Attendance:
 - 1. County
 - 2. Contractor and superintendent
 - 3. Subcontractors as appropriate to the agenda
 - 4. Representatives of suppliers and manufacturers as appropriate to the agenda
 - 5. County MBE/WBE representative
 - 6. Other agency representatives (FDEP, EPA, City, etc.)
 - 7. Surveyor – recommended but required if Surveyor has not previously performed work for the County
 - 8. Others as requested by the County or Contractor

B. Suggested Agenda:

1. Distribution and discussion of:
 - a. List of major Subcontractors and suppliers
 - b. Construction schedules
 - c. Contact information
2. Organizational arrangement of Contractor's forces and personnel, and those of Subcontractors, material and equipment suppliers, and the County
3. Critical work sequencing
4. Major equipment deliveries
5. Project coordination
 - a. Designation of responsible personnel
 - b. Channels and procedures for communication
6. Procedures and processing of:
 - a. Field decisions
 - b. Proposal requests
 - c. Submittals
 - d. Change orders
 - e. Applications for payment/Schedule of Values
 - f. Contractor quality control
 - g. Submittal of Shop Drawings, project data and samples
7. Adequacy of distribution of Contract Documents
8. Procedures for maintaining as built and record documents
9. Use of premises:
 - a. Office, work and storage areas
 - b. County's requirements
 - c. Housekeeping
10. Temporary construction facilities
11. Temporary utilities
12. Safety and first aid procedures
13. Rules and regulations
14. Security procedures
15. Place, date and time for regular progress meetings
16. Completion time for Contract and liquidated damages

1.04 PROGRESS MEETINGS

- A. The Engineer shall schedule progress meetings at least once per month as required by progress of the Work with the first meeting approximately one (1) month after the pre-construction meeting.
- B. Attendance:
 1. County
 2. Contractor
 3. Subcontractors as appropriate to the agenda
 4. Suppliers as appropriate to the agenda
 5. Others as appropriate

- C. The Contractor's representative is to attend the project meetings and have the authority to act on behalf of the entity represented on field related matters. Contractor's representative is to study previous meeting minutes and current agenda items, in order to be prepared to discuss pertinent topics and provide specific information including but not limited to:
 - 1. Status of submittals and actions necessary to expedite them
 - 2. Status of activities behind schedule and actions necessary to regain the approved schedule
 - 3. Status of materials and equipment deliveries and action necessary to expedite materials and equipment and maintain the approved schedule
 - 4. Status of open RFI's and actions necessary to address them

- D. To the maximum extent practicable, the Contractor is to assign the same personnel to represent the Contractor at Progress Meetings throughout the progress of the work.

- E. The Contractor is to provide a current Shop Drawing submittal log at each progress meeting.

- F. The Contractor is to provide copies of the updated Progress Schedule at each project meeting in accordance with the General Conditions including a 3 week look ahead schedule for upcoming events.

- G. Suggested Agenda:
 - 1. Review and approve minutes from previous meeting
 - 2. Review of work progress since previous meeting to include current As-Builts
 - 3. Contractor's/Subcontractor's workforce and equipment
 - 4. Progressive As-Built Drawings
 - 5. Surveyor's submittals
 - 6. Field observations, problems and conflicts
 - 7. Construction progress and problems which impede construction schedule
 - 8. Shop Drawing submittal status
 - 9. Requests for Information (RFI) status
 - 10. Change Order status
 - 11. Review of off site fabrication and delivery schedules
 - 12. Corrective measures and procedures to regain approved schedule
 - 13. Revisions to construction schedule
 - 14. Job progress and schedule for succeeding work period
 - 15. Coordination of schedules
 - 16. Maintenance of quality standards
 - 17. Review submittal schedule; expedite as required
 - 18. Pending requests for information, changes and substitutions
 - 19. Review proposed changes for effect on construction schedule and completion date
 - 20. Pay application status
 - 21. Other business

H. Revision to Minutes:

1. Unless minutes are challenged, in writing, prior to the next regularly scheduled Progress Meeting, they will be accepted as properly summarizing the discussions and decisions of the meeting.
2. Persons challenging minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.
3. Challenge to minutes shall be settled as priority portion of "old business" at next regularly scheduled meeting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

3.01 PRE-CONSTRUCTION MEETING

- A. Pre-construction Meeting: At the pre-construction meeting the Contractor shall be provided with a blank electronic version of the spreadsheets for: Asset Attribute Data and Pipe Deflection tables. The Contractor's Surveyor shall use these tables to input the data and shall not alter the table format or formulas.

3.02 CONSTRUCTION PROGRESS MEETINGS

- A. Contractor shall provide the following:
1. Progressive As-Built Drawings
 2. Surveyor submittals
 - a. As-Built Asset Attribute Data Table (see Specification Section 01050 "Surveying and Field Engineering" Table 01050-2)
 - b. Pipe Deflection Table (see Specification Section 01050 "Surveying and Field Engineering" Table 01050-3)
 - c. Gravity Main Table (see Specification Section 01050 "Surveying and Field Engineering" Table 01050-4)
 - d. Boundary Surveys of fee simple and permanent easements for pump stations, treatment facilities, and constructed pipe in easements
 3. Construction Contract, As-Built Drawings, Specifications, General Conditions, Supplemental Conditions, Bid Proposal, Instruction to Bidders, Addenda, and all other Contract Documents
 4. Specifications and Addenda: Record manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed as well as any changes made by Field Order, Change Order or other
 5. Change orders, verbal orders, and other modifications to Contract
 6. Written instructions by the County as well as correspondence related to Requests for Information (RFIs).
 7. Accepted Shop Drawings, samples, product data, substitution and "or-equal" requests.
 8. Field test records, inspection certificates, manufacturer certificates and construction photographs.

9. As-Built Asset Attribute Data: Surveyor shall obtain field measurements of vertical and horizontal dimensions of constructed improvements. The monthly submittal shall include the Surveyor's certified statement regarding the constructed improvements being within the specified accuracies as described in Specification Section 01050 "Surveying and Field Engineering", Table 01050-1 Minimum Survey Accuracies or if not, indicating the variances.
10. Gravity Main Table: Surveyor shall prepare and update a Gravity Main Table to include as a minimum the pipe segment identification, pipe lengths, manhole inverts and tops, and slopes for gravity mains. Surveyor shall certify the data entered are correct and indicate if the minimum slopes have not been met.
11. Pipe Deflection Table: Surveyor shall input the type of pipe, pipe manufacturer, PVC manufacturer deflection allowance, allowable angle of offset and radius of curvature, laying length of pipe, and coordinates. Surveyor shall certify the data entered are correct and indicate if the deflection allowance, offset or radius of curvature exceeds the manufacturer's recommendations.

END OF SECTION

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SECTION 01270

MEASUREMENT AND PAYMENT - LUMP SUM CONTRACTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Measurement and payment provisions, schedule of values.

1.02 GENERAL MEASUREMENT AND PAYMENT PROVISIONS

- A. Payment for all work done in compliance with the Contract Documents, inclusive of furnishing all manpower, equipment, materials, and performance of all operations relative to construction of this project, will be made as a lump sum which will be complete payment for all work called for or reasonably inferable from the Contract Documents and other work will be considered incidental to the Contract and no additional compensation will be allowed.
- B. The Owner reserves the right to alter the Drawings, modify incidental work as may be necessary, and increase or decrease the work to be performed to accord with such changes, including deductions or additions to the scope of work outlined in the Contract Documents. Changes in the work shall not be considered as a waiver of any conditions of the Contract nor invalidate any provisions thereof. Changes resulting in changes in the scope or quantities of Work or time or other conditions of work will be basis for consideration of a Change Order which is to be negotiated and executed before proceeding with the work. A supplemental agreement between the Contractor and the Owner will be required when such changes meet the conditions described in the Supplementary Conditions. Work which has not been authorized by a written Change Order will not be subsequently considered for additional payment.
- C. The Contractor shall take no advantage of any apparent error or omission in the Drawings or Specifications, and the Engineer shall be permitted to make corrections and interpretations as may be deemed necessary for fulfillment of the intent of the Contract Documents.
- D. If the Contractor makes a claim for an extra or additional cost and requests a Change Order be issued prior to performing the work and the Engineer and/or Owner renders a decision denying such request, the Contractor must notify the Engineer in writing within three (3) days of the time that the Contractor is informed of the Engineer's decision. Otherwise the Owner will not consider any such difference as a claim for a Change Order or additional payment or time. Any such written notice received by the Engineer from the Contractor within the 3-day period shall be just reason for the Engineer to re-evaluate his previous decision.
- E. Failure on the part of the Contractor to construct any item to plan or authorized dimensions within the specification tolerances shall result in: reconstruction to acceptable

tolerances at no additional cost to the Owner; acceptance at no pay; or, acceptance at reduced price, all at the discretion of the Engineer.

- F. Work shall not be considered complete until all testing has been satisfactorily completed and the item of work has demonstrated compliance with plans and specifications.
- G. A preliminary monthly application for payment shall be submitted to the Owner/Engineer for review five (5) days prior to the submittal for approval of the Contractor's monthly payment request.

1.03 SCHEDULE OF VALUES

- A. The Contractor shall submit a complete Schedule of Values for approval prior to commencing construction. As a minimum, include those values identified in Section 01370. The Complete Schedule of Values shall be the basis for making payment applications and establishing prices for Change Orders.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

Work completed without approved Shop Drawings and/or samples shall be considered installed at the Contractor's risk.

1.01 SHOP DRAWINGS AND DATA

- A. Shop Drawings defined in the General Conditions, shall complement design and construction Drawings, and shall contain sufficient detail to clearly define all aspects of the Construction. These Drawings shall be complete and detailed.
- B. Contractor and Supplier's catalog sheets, brochures, diagrams, illustrations and other standard descriptive data shall be clearly marked with specification title and numbers to identify pertinent materials, product or models. Delete information which is not applicable to the Work by striking or cross-hatching.
- C. If Shop Drawings show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in the letter of transmittal. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the Contractor fails to describe such variations, the Contractor shall not be relieved of the responsibility for executing the Work in accordance with the Contract, even though such Drawings have been reviewed.
- D. Data on materials and equipment shall include, without limitation, materials and equipment lists, catalog data sheets, cuts, performance curves, diagrams, verification of conformance with applicable standards or codes, materials of construction and similar descriptive material. Materials and equipment list shall, for each item, give the name and location of the Supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.
- E. For all equipment furnished, the Contractor shall provide a list including the equipment name and address and telephone number of the Supplier's representative and service company so that service and/or spare parts can be readily obtained.
- F. The Contractor will obtain an installation list from suppliers and equipment suppliers who propose to furnish equipment or products for submittal to County/Professional along with the required Shop Drawings. The installation list shall include at least 5 installations where identical equipment has been installed and has been in operation for a period of at least 1-year.

1.02 REVIEW OF SHOP DRAWINGS AND SAMPLES

- A. The County /Professional's review of Shop Drawings, Data, and Samples as submitted by the Contractor will be to determine if the items(s) generally conform(s) to the information in the Contract Documents and is/are compatible with the design concept. The County/Professional's review and exceptions, if any, will not constitute an approval of dimensions, connections, quantities, and details of the material, equipment, device, or item shown. The County/Professional's review period is 30 days from receipt.
- B. The review of drawings and schedules will be general, and shall not be construed:
 - 1. As permitting any departure from the Contract Documents
 - 2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials
 - 3. As approving departures from details furnished by the County/Professional, except as otherwise provided herein
- C. If the drawings or schedules as submitted describe variations and show a departure from the Contract Documents which the County/Professional finds to be in the interest of the County and to be so minor as not to involve a change in Contract Price or Contract Time, the County/Professional may return the reviewed drawings without noting an exception.
- D. "Approved As Noted": Contractor shall incorporate County/Professional's comments into the submittal before release to manufacturer. The Contractor shall send a letter to the County/Professional acknowledging the comments and their incorporation into the Shop Drawing.
- E. "Amend and Resubmit": Contractor shall resubmit the Shop Drawing to the County/Professional. The resubmittal shall incorporate the County/Professional's comments highlighted on the Shop Drawing.
- F. "Rejected": Contractor shall correct, revise and resubmit Shop Drawing for review by County/Professional.
- G. Resubmittals will be handled in the same manner as first submittals. For resubmittals the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by County/Professional on previous submissions. The Contractor shall make any corrections required by the County/Professional.
- H. If the Contractor considers any correction indicated on the Drawings to constitute a change to the Drawings or Specifications, the Contractor shall give written notice thereof to the County/Professional.

- I. When the Shop Drawings have been completed to the satisfaction of the County/Professional, the Contractor shall carry out the Construction in accordance therewith and shall make no further changes therein except upon written instructions from the County/Professional.
- J. No partial submittals will be reviewed. Submittals not deemed complete will be stamped "Rejected" and returned to the Contractor for resubmittal. Unless otherwise specifically permitted by the County/Professional, make all submittals in groups containing all associated items for:
 - 1. Systems
 - 2. Processes
 - 3. As indicated in specific Specifications Sections
All drawings, schematics, manufacturer's product data, certifications, and other Shop Drawing submittals required by a system specification shall be submitted at one time as a package to facilitate interfaces checking.
- K. Only the County/Professional shall utilize the color "red" in marking Shop Drawing submittals.
- L. Failure to comply with any of the above may result in the rejection of Shop Drawings.

1.03 PRODUCT DATA

- A. Submit not less than 6-copies, unless approved by the County/Professional. Mark each copy to identify applicable products, models, options and other data. Supplement manufacturers' standard data to provide information unique to the Work.

1.04 MANUFACTURERS' INSTRUCTIONS

- A. When required in an individual Specification Section, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting and finishing, in quantities specified for product data.

1.05 SAMPLES

- A. Submit full range of manufacturers' standard colors, textures and patterns for the County's selection. Submit samples for selection of finishes within 30-days after Award of Contract. All color and finish selections must be submitted by the Contractor in a single submission, properly labeled and identified.
- B. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.

- C. Submit the number of samples specified in the respective Specification section, but no less than two (2). After review one (1) will be retained by the County. Reviewed samples that may be used in the Work are indicated in the Specification Section.
- D. Samples shall be delivered to the County as directed. The Contractor shall prepay shipping charges on samples. Materials or equipment for which samples are required shall not be used in the Work until approved by the County/Professional.
- E. Samples shall be of sufficient size to clearly illustrate:
 - 1. Functional characteristics of the product, with integrally related parts and attachment devices
 - 2. Full range of color, texture and pattern
 - 3. Each sample shall have a label indicating:
 - a. Name of Project
 - b. Name of Contractor and Subcontractor
 - c. Material or equipment represented
 - d. Place of origin
 - e. Name of product and brand (if any)
 - f. Location in Project
 - g. Specification title and number
 - h. Submittal number
 - i. Note: Samples of finished materials shall have additional marking that will identify them under the finished schedules.
- F. The Contractor shall prepare a transmittal letter, in triplicate (3) for each shipment of samples containing the information required in paragraph herein. The Contractor shall enclose a copy of this letter with the shipment and send a copy of this letter to the County/Professional. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify any Contract requirements.
- G. Approved samples not destroyed in testing shall be sent to the County or stored at the site of the Work. Approved samples of the hardware in good condition may be incorporated in the Work if requested in writing by the Contractor and approved in writing by the County/Professional. Samples that failed testing or were not approved will be returned to the Contractor at the Contractor's expense, if so requested at time of submission.

1.06 FIELD SAMPLES

- A. Provide field samples of finishes as required by individual Specifications sections. Install the sample completely and finished. Acceptable samples in place may be retained in completed Work.

1.07 DRAWINGS, PRODUCT DATA AND CERTIFICATES

- A. Each letter of transmittal shall identify each and every item transmitted by title, drawing number, revision number and date.

- B. The County generally will not check dimensions, quantities or schedules, except in cases where the information is lacking in the Specifications.
- C. The following is applicable to submitted drawings, data and certificates:
 - 1. Show relation to adjacent structures or materials.
 - 2. Clearly identify field dimensions.
 - 3. Show required dimensions and clearances.
 - 4. Performance characteristic and capabilities shall accompany original Shop Drawing submittals.
 - 5. Wiring diagrams and controls shall accompany original Shop Drawing submittals.
 - 6. Installation instructions shall accompany original Shop Drawing submittals.
 - 7. Each submittal shall identify applicable Standards, such as ASTM number or Federal Specification number.
 - 8. All information not pertinent shall be removed from the submittal, or shall be crossed out.
- D. When resubmission is required, the County/Professional will return only two (2) marked up copies. A third submission from the same manufacturer will not be accepted.

1.08 SUBSTITUTIONS

- A. The substitution requirements of this Section are in addition to the requirements of the General Conditions and Supplementary Conditions.
- B. When a particular product is specified or called for, it is intended and shall be understood that the proposal tendered by the Bidder includes those products in his Bid. Substitutions will only be considered in cases where original materials are unavailable or in an instance where substitute can be proven superior in its planned application
- C. The intent of these specifications is to provide the County with a quality facility without discouraging competitive bidding. For products specified only by reference standards, performance and descriptive methods, without naming manufacturer's products, the Contractor may provide the products of any manufacturer complying with the Contract Documents, subject to the review of product data by the County/Professional as specified herein.
- D. The County/Professional's approval is required for substitutions.
- E. The Contract is based on the materials, equipment and methods described in the Contract Documents.
- F. The County/Professional will consider proposals for substitution of materials equipment and methods only when such proposals are accompanied by full and complete technical data and all other information required by the County/Professional to evaluate the proposed substitution.

- G. Do not substitute materials, equipment or methods unless such substitution has been specifically approved for this Work by the County/Professional in writing. The Contractor must provide a submittal per this Section specifically requesting approval of the substitution. Failure to specifically identify the requested substitution may invalidate approval of a submittal.

1.09 AVAILABILITY OF SPECIFIED ITEMS

- A. Verify prior to bidding that all specified items will be available in time for installation during Construction for orderly and timely progress of the Work.
- B. In the event that specified items will not be available, notify the County/Professional prior to receipt of proposals.

1.10 OPERATING MANUALS

- A. Submit all manuals in accordance with requirements of Divisions 2 through 16 of the Contract Specifications and Section 01700 "Project Closeout."

1.11 WARRANTIES, GUARANTEES AND BONDS

- A. Provide as required by Technical Sections of the Specifications and Sections 01700 "Project Closeout" and Section 01740 "Warranties and Bonds."

1.12 CADD FILES

- A. The Professional's CADD files will be available on a limited basis to qualified firms at the County's prerogative. The procedure for requesting such files is noted elsewhere in these documents and there is a cost associated with handling and reproduction. Recipients are cautioned that these files may not accurately show actual conditions as constructed. Users are responsible to verify actual field conditions.
- B. The Professional's Drawings are to be used only for background information. If the Professional's Drawings are just reproduced and resubmitted (e.g. for ductwork drawings) they will be rejected.
- C. Copies of data furnished by the County/Professional to Contractor or Contractor to County/Professional that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

- D. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60-days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.
- E. When transferring documents in electronic media format, the transferring party makes no representations as to long-term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

1.13 PROGRESS PHOTOGRAPHS

- A. Progress photographs shall be provided with each Pay Request.
- B. Photographs and digital pictures shall be in color. Provide 1 copy of each digital picture on each of three (3) Flash Drives and provide 1 print of each photograph in two (2) separate albums.
- C. Photographs shall be from locations to illustrate the condition of Construction and state of progress adequately.
- D. Provide up to 12 digital photographs of views randomly selected by the County, taken prior to any construction and prior to each scheduled Application for Payment.
- E. Deliver electronic images, prints, and negatives to the County.
- F. Each print shall be single weight paper with glossy finish and the overall dimension shall be 7-1/2-inch x 10-inches (19.05 x 25.4 cm). The print shall be clear, sharp and free of distortion after the enlargement from the negative.
- G. Provide loose-leaf albums for each set of photographs to hold prints with a maximum of 50-leaves per binder.
- H. Each print shall be protected by flexible, transparent acetate or plastic sheet protector leaves with metal reinforced holes. Two (2) extra leaves shall be provided in each binder.
- I. Capture and provide digital, ortho-rectified, true-color, aerial photographs of the complete project site prior to start of Construction and at final completion. A final 6-inch or less ground pixel resolution is required. If using traditional photography, the photos will need to be captured at an appropriate scale and scanned at a high enough dpi to yield a final ground pixel size of 6-inches or less. If captured digitally, a final 6-inches or less ground sample distance is required. The final orthorectified photos shall use a projection of NAD 27, State Plane West and all vertical reference shall be NAVD 88, US feet. All orthophoto mosaics shall meet a final accuracy of plus or minus 5-feet.

- J. Provide a total of four (4) true-color, color balanced orthophoto mosaic prints. Three (3) prints each of the pre and post construction (final completion) orthophoto mosaics, for a total of six (6). Each orthophoto mosaic print shall be on double-weight paper with glossy finish and shall have overall dimensions of 36-inches x 58-inches. Two (2) copies of each of the digital orthophoto mosaics shall be supplied in Geotiff format on disk for each time period (pre and post construction). The final color balanced, true-color orthophoto mosaics will be projected in NAD 27, State Plane West and all vertical reference shall be NAVD 88, US feet and shall meet a final accuracy of plus or minus 5-feet.
- K. The Contractor shall provide before and after photographs of each portion of the site. The below ground facilities shall include all equipment, walls, floor, piping, supports and entrance. At major locations, photographs shall include before, during, and after prints and all prints shall be placed in binders in ascending date order to show the Work as it progresses.
- L. Descriptive Information:
 - 1. Each photograph shall have a permanent title block on the back and shall contain the typed information and arrangement as follows:
 - a. ORANGE COUNTY, FLORIDA
 - b. (ENTER PROJECT NAME)
 - c. BID No. (Enter Bid Number)
 - d. CONTRACTOR: (Name of Contractor)
 - e. DATE: (When photo was taken)
 - f. PHOTO NO.: (Consecutive Numbers)
 - g. PHOTO BY: (Firm Name of Photographer)
 - h. LOCATION: (Description of Location and View)
 - 2. The Contractor shall provide the Professional with a written description of each photograph. This description shall be included in the binders and a copy shall be submitted with the Flash Drives.

1.14 PROJECT RECORD DOCUMENTS

Project Record Documents shall be submitted in accordance with Section 01720 "Project Record Documents" of these specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SUBMITTAL PROCEDURES

- A. Article 9 of the General Conditions contains additional provisions regarding submittals.

- B. Preliminary Shop Drawing Data: Within 20-days after the Award of the Contract or before the Pre-Construction Meeting, the Contractor shall submit to the County/Professional a complete listing of manufacturers for all items for which Shop Drawings are to be submitted.
- C. Shop Drawing Submittal Schedule: Within 30-days after the Notice to Proceed, the Contractor shall submit to the County/Professional a complete schedule of Shop Drawings submittals with the respective dates for submission, the beginning of manufacture, testing and installation of materials, supplies and equipment, noting those submittals critical to the progress schedule.
- D. Submittal Log: An accurate updated log of submittals will be maintained by the Contractor and subject to review by the County/Professional at each scheduled progress meeting.
- E. If the Contractor considers any correction indicated on the Drawings to constitute a change to the Contract Drawings or specifications, the Contractor shall give written notice thereof to the County/Professional. This does not constitute a change order until accepted by the County.
- F. Shop Drawing and submittal data shall be reviewed by the County/Professional for each original submittal and first resubmittal; thereafter review time for subsequent resubmittals shall be charged to the Contractor. The Contractor shall reimburse the County for services rendered by the County/Professional at the rate multiplied by the County's Professional multiplier based on the fee schedule provided to the County for this Project. If a County engineer is performing any portion of the review, this fee is based upon the hourly rate of the engineer times the County's multiplier for overhead, benefits, and expenses. The Contractor agrees that the County shall deduct such charges from the Contract Amount by a deductive Change Order.
- G. Contractor Shop Drawing and Sample submittals shall include 5 copies in addition to any other copies that the Contractor wants returned. The County will retain 5 copies of approved submittals.
- H. Identify Project, Project Number, date, dates of previous submittals, Contractor, Sub-Contractors, suppliers with their addresses, pertinent Drawings by sheet and detail number, and Specification Section number, as appropriate. Identify all deviations from the Contract Documents. Provide space for Contractor and Professional review stamps.
- I. Contractor's delivery of Shop Drawings for review shall follow a reasonable sequence, as is necessary to support the dates on the Progress Schedule and avoid an overload of Shop Drawings awaiting review at any one time. Coordinate submittal of related items.

- J. Submit Shop Drawings per the schedule of Shop Drawing submittals, inserted in 1 loose-leaf binder, with tabs and index to the County/Professional. All individual submittal sheets inserted in said binder must be clearly marked and referenced to proper paragraph and subparagraph of specifications. Cross out any items on sheets which constitute information not pertaining to equipment specified. Clearly mark all components that are provided as "optional" by manufacturer. Shop Drawings shall be approved by the Contractor prior to submittal to the County/Professional. Shop Drawings will be reviewed by the County/Professional. After County/Professional approval, reproduce and distribute in accordance with requirements herein.
- K. All submissions of Shop Drawings, brochures and catalog cuts shall be accompanied by a transmittal letter listing the Drawings submitted by number and title.
- L. When engineering calculations and/or professional certification of performance criteria of materials, systems, and/or equipment are required, the County is entitled to rely upon the accuracy and completeness of such calculations and certifications submitted by the Contractor. Calculations, when required, shall be submitted in a neat, clear and in an easy to follow format. Such calculations and/or certifications shall be signed and sealed by a Professional Engineer registered in the State of Florida.
- M. Distribute copies of reviewed submittals to concerned parties. Instruct recipients to promptly report any inability to comply with provisions.
- N. Prior to submission of Shop Drawings and samples, the Contractor shall stamp and sign the submittals. Any submission which, upon examination by the County, shows evidence of not having been thoroughly checked, or is not in compliance with the provisions of this Section will be returned to the Contractor for completion before it will be considered for review.
- O. Notify the County of the need for making any changes in the arrangement of piping, connections, wiring, manner of installation, etc., which may be required by the material or equipment Contractor proposes to supply.
- P. On resubmittals, direct specific attention in writing or on the revised Drawings or sample to revisions other than the corrections required by County on previous submissions.
- Q. All drawings, schematics, manufacturer's product data, certifications and other drawing submittals required for a system specification shall be submitted at one time as a package to facilitate interface checking.
- R. The County will distribute Shop Drawings as follows for the indicated action taken:

SHOP DRAWING SUBMITTAL DISTRIBUTION

Representative Party	No Exception Taken or Make Correction Noted			Rejected or Revise & Resubmit		
	Submittal Transmittal	Shop Drawing	Review Comment Sheet	Submittal Transmittal	Shop Drawing	Review Comment Sheet
Engineer	2 Copies	File Copy	1 Copy	Original	File Copy	1 Copy
Contractor (see Note 1)	2 Copies	1 Copy Each Submittal	1 Copy	1 Copy	All Copies Except Engineers	1 Copy
County	1 Copy	1 Copy Each Submittal	1 Copy	1 Copy	None	1 Copy
Inspector	2 Copies	1 Copy Each Submittal	1 Copy	1 Copy	None	1 Copy
Project Record Data (see Note 2)	1 Copy	1 Copy Each Submittal	1 Copy	1 Copy	None	1 Copy

NOTES:

1. Contractor shall distribute additional copies to Subcontractors as required.
2. Stored by Contractor to be furnished to County upon closeout.

- S. All Shop Drawings shall be accompanied with a transmittal letter providing the following information:
1. Project Title and Contract Number
 2. Date
 3. Contractor's name and address
 4. The number of each Shop Drawing, project data, and sample required
 5. Notification of Deviations from Contract Documents
 6. Submittal Log Number conforming to specification section numbers
 - a. Submit each specification section separately.
 - b. Identify each Shop Drawing item required under respective specification section.
 - c. Identify resubmittal using specification section followed by A (first resubmittal), B (second resubmittal)...etc.

3.02 CONTRACTOR'S REVIEW

- A. Contractor's Responsibility for Coordination: Where the dimension, size, shape, location, capacity or other characteristic affects another item, and where the Contractor selects, fabricates or installs related or adjacent products to be used, the Contractor shall be responsible for coordination of related items. The Contractor shall insure that a proper exchange of information takes place prior to or during preparation of each submittal and that submittals reflect such coordination. The notation "verify" or "coordinate" on the Drawings indicates the necessity for Contractor coordination in the particular instances used.

- B. Contractor's Checking: When checking submittals from Subcontractors and suppliers, the Contractor shall mark all sets, indicating his corrections and comments in blue or green. Copies marked in red may be returned for revision.
- C. The Contractor is responsible to deliver and pick-up all submittals in a timely manner at the County/Professional's designated office. The Contractor is responsible for all related costs and expenses for the transmittal of such submittals.

3.03 COUNTY'S / PROFESSIONAL'S REVIEW

- A. Corrections or comments made on Shop Drawings during review do not relieve the Contractor from compliance with the requirements of Drawings and Specifications. This check is only for review of general conformance with the design concept of this Project and general compliance with information given in Contract Documents. Any substitutions or changes shall be properly noted.
- B. No action will be taken on "rough-in" Shop Drawings for plumbing and electrical connections when the items of equipment are not included in the same submittal.
- C. Review Time:
 - 1. On a normal basis, each submittal will be returned to the Contractor within 30 working days of the date it is received. Some submittals may require additional time.
 - 2. If, for any reason, the above schedule cannot be met, the Contractor will be so informed within a reasonable period and the Schedule of Submittals revised. If the specific submittal affects the critical path, the Contractor shall immediately notify the County/Professional in writing. In the event of separate submittals of individual components of a system, these submittals may be held until all components of the system are submitted, and the Contractor will be so notified.

END OF SECTION

SECTION 01301
PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.01 SUMMARY

A. General

1. Base all bids on materials and equipment specified in the Appendix D Orange County Utilities List of Approved Products.
2. Certain types of equipment and kinds of material are described in specifications by means of references to names of manufacturers and vendors, trade names, or catalog numbers.
 - a. When this method of specifying is used, it is not intended to exclude from consideration other products bearing other manufacturer's or vendor's names, trade names, or catalog numbers, provided said products are "or-equals," as determined by County/Professional.
3. Other types of equipment and kinds of material may be acceptable substitutions under the following conditions:
 - a. Or-equals are unavailable due to strike, discontinued production of products meeting specified requirements, or other factors beyond control of Contractor; or,
 - b. Contractor proposes a cost and/or time reduction incentive to the Owner.

1.02 QUALITY ASSURANCE

A. In making request for substitution or in using an approved product, Contractor:

1. Has investigated proposed product, and has determined that it is adequate or superior in all respects to that specified, and that it will perform the function for which it is intended.
2. Will provide same guarantee for substitute item as for product specified.
3. Waives all claims for additional costs related to substitution which subsequently arise.

1.03 DEFINITIONS

- A. Product: Manufactured material or equipment.

1.04 PROCEDURE FOR REQUESTING SUBSTITUTION

A. Substitution shall be considered only:

1. After award of Contract
2. Under the conditions stated herein

- B. Written request through Contractor only.

C. Transmittal Mechanics

1. Follow the transmittal mechanics prescribed for Shop Drawings in Specification Section 01300 "Submittals."
 - a. Product substitution will include in the transmittal letter, either directly or as a clearly marked attachment, the items listed in Paragraph D below.

D. Transmittal Contents

1. Product identification:
 - a. Manufacturer's name
 - b. Telephone number and representative contact name
 - c. Specification Section or Drawing reference of originally specified product, including discrete name or tag number assigned to original product in the Contract Documents.
2. Manufacturer's literature clearly marked to show compliance of proposed product with Contract Documents.
3. Itemized comparison of original and proposed product addressing product characteristics including but not necessarily limited to:
 - a. Size
 - b. Composition or materials of construction
 - c. Weight
 - d. Electrical or mechanical requirements
4. Product experience
 - a. Location of past projects utilizing product.
 - b. Name and telephone number of persons associated with referenced projects knowledgeable concerning proposed product.
 - c. Available field data and reports associated with proposed product.
5. Data relating to changes in construction schedule.
6. Data relating to changes in cost.
7. Samples
 - a. At request of County/Professional.
 - b. Full size if requested by County/Professional.
 - c. Held until substantial completion.
 - d. County/Professional is not responsible for loss or damage to samples.

1.05 APPROVAL OR REJECTION

- A. Written approval or rejection of substitution to be given by the Engineer.
- B. Engineer reserves the right to require proposed product to comply with color and pattern of specified product if necessary to secure design intent.
- C. In the event the substitution is approved, the resulting cost and/or time reduction will be documented by Change Order in accordance with the General Conditions.
- D. Substitution will be rejected if:
 1. Submittal is not through the Contractor with his stamp of approval.
 2. Request is not made in accordance with this Specification Section.

3. In the County/Professional's opinion, acceptance will require substantial revision of the original design.
 4. In the County/Professional's opinion, substitution will not perform adequately the function consistent with the design intent.
- E. Contractor shall reimburse the County for the cost of the evaluation whether or not substitution is approved.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

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SECTION 01310
PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 REQUIREMENT

- A. The Contractor will submit precedence method cost loaded Critical Path Method (CPM) Progress Schedules to the County depicting the approach to prosecution and completion of the Work. This requirement includes, but is not limited to the Contractor's approach to Activity cost loading, recovering schedule and managing the effect of changes, substitutions and Delays on Work sequencing.
- B. The Progress Schedule shall show how the Contractor's priorities and sequencing for the Work (or Work remaining) conform to the Contract requirements and the sequences of Work indicated in or required by the Contract Documents; reflect how the Contractor anticipates foreseeable events, site conditions and all other general, local and prevailing conditions that may affect cost, progress, schedule, furnishing and performance of the Work; and show how the Contractor's Means and Methods translate into Activities and logic.
- C. The Progress Schedule will consist of the Initial Submittal, Payment Submittals and Revision Submittals. Upon acceptance by the County, the Initial submittal will become the As-Planned Schedule for the Work. Revision submittals upon acceptance will become the As-Planned Schedule for the Work remaining to be completed as of the submittal date for that Revision.
- D. References to the Critical Path Method (CPM) are to CPM construction industry standards that are consistent with the requirements of this Section.

1.02 GLOSSARY OF TERMS

- A. The following terms, whether or not already defined elsewhere in the Contract Documents, have the following intent and meanings within this Section:
 - 1. Activity Value (Value): That portion of the Contract Price representing an appropriate level of payment for the part of the Work designated by the Activity.
 - 2. As-Planned Schedule: The first, complete Initial Progress Schedule submitted by the Contractor with the intent to depict the entire Work as awarded and accepted by the County or returned as no resubmittal required.
 - 3. Contract Float: Days between the Contractors anticipated date for completion of the Work, or of a specified portion of the Work, if any, and the corresponding Contract Time.

4. CPM Schedule: The Progress Schedule based on the Critical Path Method (CPM) of scheduling. The term Critical Path means any continuous sequence of Activities in the Progress Schedule controlling, because of their sum duration, the Early Date of a pertinent, specified Contract Time.
5. Early/Late Dates: Early/late times of performance, based on CPM calculations, for an Activity in the Progress Schedule. Early Dates will be based on proceeding with all or part of the Work on the date when the corresponding Contract Time commences to run. Late Dates will be based on completing all or part of the Work on the corresponding Contract Time, even if the Contractor plans early completion.
6. Milestones: Key, pre-determined points of progress in the completion of a facility, denoting interim targets in support of the Contract Times. Milestones may pinpoint targets for key excavation and substructure events, significant deliveries, critical path transition from superstructure to piping and electrical rough in and building enclosure. Also, hook-up of mechanical and electrical equipment, availability of power for testing, equipment shakedown, training of County personnel, start-up, Substantial Completion and other events of like import.
7. Official Schedule: The Initial or most recent Revision Submittal accepted by the County or returned as no resubmittal required and the basis for Payment Submittals until another Revision Submittal is submitted and accepted. The accepted Initial Submittal is also the As-Planned Schedule.
8. Payment Submittal: A monthly Progress Schedule update reflecting progress and minor adjustments on the Activities, sequencing and restraints for Work remaining.
9. Total Float: Days by which an activity may slip from its Early Dates without necessarily extending a pertinent Contract Time. Total Float at least equals Contract Float. Total Float may also be calculated and reported in working Days. When an activity is delayed beyond Early Dates by its Total Float it becomes a Critical Path activity and if delayed further will impact a Contract Time.

1.03 QUALITY ASSURANCE

- A. The Contractor may self-perform the Work covered by this Section or employ a Subcontractor, subject to the County's consent. Employment of a scheduling Subcontractor shall not in any way alter or reduce the Contractor's obligations under the Contract Documents.
- B. The Contractor will obtain a written interpretation from the County, if the Contractor believes that the selection of activities, logic ties and/or restraints requires a written interpretation of the Contract Documents. With each submission, the Contractor will point out by specific, written notation, any Progress Schedule feature that may reflect variations from any requirements of the Contract Documents.
- C. It is the Contractor's responsibility to obtain information directly from each Subcontractor and Supplier when scoping their respective Activities, Values, logic ties and restraints.

- D. Neither Acceptance nor Review of any Progress Schedule will relieve the Contractor from the obligation to comply with the Contract Times and any sequence of Work indicated in or required by the Contract Documents and to complete, within the Contract Times, any Work omitted from that Progress Schedule.
- E. Neither Acceptance nor Review of any Progress Schedule will imply approval of any interpretation of or variation from the Contract Documents, unless expressly approved by the County through a written interpretation or by a separate, written notation on the returned Progress Schedule Submittal.

1.04 MILESTONES AND SCHEDULE RECOVERY

- A. The County will select Milestones and Milestone Dates on the basis of the As-Planned Schedule. As the Official Schedule is revised, Milestone Dates will be revised accordingly. Milestone Dates will serve as target dates.
- B. Whenever any Activity slips by 14 or more Days from the Late Date for an activity in the Official Schedule, Milestone Dates selected by the County, or a pertinent Contract Time, the Contractor will deliver a Revision Submittal documenting the Contractor's schedule recovery plan and/or a properly supported request for an extension in the Contract Time. The narrative will identify the Delay and actions taken by the Contractor to recover schedule, whether by adding labor, Subcontractors or construction equipment, activity re-sequencing, expediting of submittals and/or deliveries, overtime or shift Work, and so forth. Activity shortening and overlapping shall be explained as to their basis (and be supported by increases in resources).
- C. Upon evaluation of that Revision Submittal, if the County determines there is sufficient cause, the County may withhold liquidated damages or provide a notice of intent to do so, if schedule is indeed not recovered, and/or may give a notice of default.

1.05 PROGRESS SCHEDULE SOFTWARE

- A. The scheduling software employed by the Contractor to process the Progress Schedule will be the current version of Primavera P6.0®, or Primavera® Contractor 5.0 CPM scheduling software.
- B. If the Contractor intends to use companion schedule reporting, analysis or graphics software tools, the Contractor will furnish to the County descriptive materials and samples describing such software tools.

1.06 NON-PERFORMANCE

- A. The County may refuse to recommend all or any part of any payment, if the Contractor fails, refuses or neglects to provide the required Progress Schedule information on a timely basis. Partial payments without a properly updated Progress Schedule shall be returned to the Contractor as non-conforming.

- B. If justified under the circumstances, the County also may prepare alternate Progress Schedules, as appropriate, and deduct from the Contract Amount all related costs by Change Order and/or take other action commensurate with the breach.

1.07 REPORTS, SCHEDULES AND PLOTS

- A. Schedule Reports will include Activity (ID) code and description, duration, calendar, Early Dates, Late Dates and Total Float. Separate Schedule Reports will tabulate, for each Activity, all preceding and succeeding logic types and lead times, whether CPM Plots displaying logic ties are appended or not.
- B. CPM Schedule Plots will be plotted on a suitable time scale and identify the Contract Times, Critical Paths, phases and work areas on 24-inch x 36-inch or smaller sheets. Activities will be shown on the Early Dates with Total Floats noted by Late Date flags. For Payment and Revision Submittals plot a target comparison based on the current Official Schedule.
- C. The Activity Value report will tabulate Activity code and description and Activity Value, percent complete and earned value as calculated by the scheduling software. Cash flow plots shall be provided showing the monthly and cumulative actual and planned earned values with curves shown for Early and Late Dates in the schedules. For Payment and Revision Schedule submittals, the cash flow curves shall also plot the most current Official Schedule planned earnings curves.
- D. Each submittal shall include listings of all added and deleted activities, logic, constraints, Activity Value changes and update information vs. the previous Progress Schedule submittal. This list may be manually prepared or generated by accessory software that will generate such listings.

1.08 NARRATIVE REQUIREMENTS

- A. The Initial Submittal narrative will describe the Contractor's approach to prosecution of the Work and the basis for determination of activity durations, sequence and logic, including the Contractor's management of the site, e.g., lay down, staging, parking, etc.; Contractor's phasing of the Work; use of crewing and construction equipment; identification of non-work County/Professional's, shifts, weekend Work and multiple calendars applied to activities and an explanation of the basis for restraint dates.
- B. Revision and Payment Submittal narratives will explain any changes to the approach or planning referred to in Paragraph A above on account of any change, delay, schedule recovery, substitution and/or Contractor-initiated revision occurring since the previous submittal.
- C. Each narrative will list the Critical Path Activities and compare Early and Late Dates against Contract Times and Milestone Dates. Narratives shall also recap progress and Days gained or lost vs. the current Official Schedule, and identify delays, their extent and causes.

- D. The Initial Submittal narrative will describe all delays occurring since Contract Award and all pending and anticipated "or equal" and substitution proposals. Payment and Revision Submittal narratives will describe any new delays and shall certify that the Contractor has not been delayed, as of the cut off date, by any acts or omissions of the County, except as otherwise specifically stated.

1.09 ACTIVITY REQUIREMENTS

- A. Separate activities will identify permits, design when included in the Work, construction, Submittal preparation and review (and resubmission and re-review), deliveries (site or storage), testing, start-up, commissioning and Punch List.
- B. Activities will be detailed to the extent required to show the transition of trade Work. Activities will delineate the progression of the Work.
- C. Activities will not combine separate or non-concurrent items of Unit Price or lump sum Work.
- D. Activity durations will equal the Work Days required to sufficiently complete the Work designated by the Activity, (i.e., when finish-to-start successors could start, even if the Activity is not quite 100% complete). Installation Activities will last from 10 to 40 workdays. Submittal review activity durations shall conform to specified timeframes.
- E. Activities will be assigned consistent descriptions and identification codes. Sort codes will group Activities by meaningful schemes.
- F. Activities will be assigned Activity Values as appropriate and needed to reasonably allocate the Contract Amount to the time periods that they will be earned and eligible for payment based on the Progress Schedule and Schedule of Values. Separate pay activities may be used to simplify cost loading of the Progress Schedule. When used, pay activities shall be loaded with the cost of Work that is included, at no cost, in related (generally, concurrent) CPM activities. Pay activities shall not control the rate of progress; however, their start and finish dates shall be consistent with those of their related CPM activities to ensure accurate Early Date and Late Date cash-flow plots.

1.10 FLOAT TOLERANCES AND FLOAT OWNERSHIP

- A. Any Progress Schedule with Early Dates after a Contract Time will yield negative Total and Contract Floats, whether shown/calculated or not. Any Revision Submittal with less than negative 20-days of Float will be returned as "Revise and Resubmit," unless a time extension is requested or the County assesses liquidated damages or gives notice of intent to do so, in the event schedule is not recovered.
- B. Float calculated from the definitions given in this Section supersede any conflicting Float values in any early completion Progress Schedule.

- C. Neither the County nor the Contractor own the Float time, the Project owns the Float time. Neither the County nor the Contractor use of positive Total Float will impact a Contract Completion Date or justify an extension of Contract Time.

1.11 SUBMITTALS

- A. Each Progress Schedule Submittal will consist of a narrative, 5 copies of the required reports and plots and an optical ROM data disk with the Contractor's corresponding schedule and schedule layout files in Primavera ".XER" format.
- B. The County will review Progress Schedule Submittals and return a review copy within 14-days after receipt and the Contractor shall, if required, resubmit within 7-days after return of the review copy.
- C. Requirements for the Initial Submittal:
 - 1. Within 20-days after receipt of Notice to Proceed and prior to commencing Work on the Project, prepare and submit to the County the Initial Submittal of the Progress Schedule for the Work. The Initial Submittal will show the Work as awarded, without delays, Change Orders or substitutions.
 - a. Activity Values will prorate Schedule of Values costs and/or pay items through to Activities. Provide a cross-reference listing with two parts; a part that will list each activity with the respective amounts allocated from each Schedule of Values and Unit Price Item making up the total value of each activity and a second part that will list the Schedule of Values and Unit Price Items with the respective amounts allocated from each activity that make up the total value of each item.
 - 2. After the As-Planned Schedule is established, the County will select Milestones and record the Milestone Early and Late Dates. As the Official Schedule evolves, Milestone Dates will be revised accordingly.
 - 3. If the County refuses to endorse the Initial Submittal (or a resubmission) as "Resubmittal Not Required," the As-Planned Schedule will not be established. In that event, the Contractor will continue to submit Payment and Revision Submittals reflecting progress and the Contractor's approach to remaining Work. The County will rely on the available Payment and Revision Submittals, subject to whatever adjustments it determines appropriate.
- D. Requirements for Payment Submittals:
 - 1. Payment Submittals with progress up to the closing date and updated Early Dates and Late Dates for progress and remaining Activities will be due with each Progress Payment. As-built data will consist of actual dates, percent complete, earned payment, changes, Delays and other significant events occurring before the closing date.
 - 2. Activity percent complete and earned value should indicate a level of completion that corresponds to the Application for Progress Payment for the same period. The earned value should be calculated by the scheduling software as Activity Value times percent complete. Explanation should be provided whenever the cumulative earned value of activities in a Payment Submittal is not within 10% of the value of Work completed as represented in the corresponding Application for Progress for Payment.

3. At the Contractor's option, a Payment Submittal may overlay minor adjustments on activities and sequencing for Work remaining. This excludes Activity re-scoping to reflect Delays, changes, schedule recovery or substitutions.

E. Requirements for Revision Submittals:

1. Revision Submittals will be submitted when necessary because of major changes or delays affecting activities, sequencing or restraints for Work remaining and/or to put forth a schedule recovery plan. Revision Submittals may also be required because of Contractor-initiated re-planning, or when Contractor plans to perform Work ahead or out-of-sequence that will require additional testing or inspection personnel, or when requested by the County when Work is performed out-of-sequence from the current Official Schedule such that the number of Days gained or lost can not be determined or the scheduled dates of completion of the Work in a Payment Submittal are not viewed as reliable.
2. If requesting a time extension, the Revision Submittal should show the impact of the delay after incorporating reasonable mitigation to minimize the impact and illustrate how the number of Days requested time extension was determined. The delay should be determined as the change in the forecast Contract Completion Date(s) resulting solely from delays that entitle the Contractor to a time extension as provided in the General Conditions. Any and all Contractor slippage and delay occurring prior to and concurrent with the delay potentially entitling the Contractor to a time extension shall be incorporated in the Revision and explained such that the concurrent and non-concurrent periods of delay are indicated. If the Contractor does not follow the procedures contained in this Section or, if the Contractor's analysis is not verifiable by an independent, objective evaluation by the County using the electronic files and data furnished by the Contractor, any such extension in Contract Time will not be granted.

F. Retrospective Delay Analysis.

1. If the County/Professional refuses to endorse any Revision Submittal as "Resubmittal Not Required," the Contractor and County will use the latest Official Schedule when evaluating the effect of Delays on Contract Time and/or Contract Price. The procedure to be used will consist of progressively updating the latest Official Schedule at key closing dates corresponding to starting and finishing dates of the delays and/or dates the delays became critical or dates the Critical Path may have changed for other reasons. For each Progress Schedule iteration, slippage between actual Milestone Dates and Initial Milestone Dates will be correlated to Delays occurring solely in that iteration.
2. For each iteration, revisions in Activities, logic ties and restraints affecting Work after the closing date will be included in that Progress Schedule only if they meet any of the following conditions. First, they are Progress Schedule revisions that the County consented to contemporaneously (i.e., before the closing date) in writing. Second, they reflect comments or objections raised by or on behalf of the County and that were actually confirmed by the as-built progress. Lastly, they represent Contractor's schedule recovery plans or other Progress Schedule revisions that were actually confirmed by the as-built progress.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01370
SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DEFINITION

- A. Schedule of Values: Schedule that divides the Contract Amount into pay items, such that the sum of all pay items equals the Contract Amount for the Work, or for any portion of the Work having a separate specified Contract Amount.

1.02 REQUIREMENT

- A. The Schedule of Values established as provided in the General Conditions will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to the County. Progress payments on account of Unit Price Work will be based on the number of units completed and shall be prorated by the percent complete on the number of units installed not meeting all requirements of the Contract including testing
- B. No payment will be made for Work performed on a lump sum contract or a lump sum item until the appropriate Schedule of Values is approved by the County.
- C. The equitable value of Work deleted from a lump sum contract or lump sum item shall be determined from the approved Schedule of Values.

1.03 SUBMITTALS

- A. Submit 3 copies of a Preliminary Schedule of Values within 15-days after the recommended award of the Contract.
- B. Submit 3 copies of a proposed final Schedule of Values within 20-days after receipt of Notice to Proceed as per the General Conditions.
- C. Submit the Schedule of Values, typed, on EJCDC 1910-8-E form or Orange County forms or spreadsheets provided by County. The Contractor's standard form or electronic media printout will be considered for acceptability by the County.
- D. List installed value of each major item of Work and each subcontracted item of Work as a separate line item to serve as a basis for computing values for Progress Payments. Round off values to nearest dollar.
- E. Coordinate listings with the Progress Schedule.
- F. For items on which payments will be requested for stored materials or equipment, list sub-values for cost of stored products with taxes paid and provide corresponding schedule of value item number. Stored materials quantities shall not exceed installed quantities on bid tab or as required by the Contract Documents.

- G. Submit a sub-schedule for each separate stage of Work specified in Section 01010 "Summary of Work."
- H. The sum of values listed shall equal the total Contract Amount for the Work or the Contract Amount for a part of the Work with a separate Contract Amount provided for by the Contract Documents.
- I. When the County requires substantiating information, submit data justifying line item amounts in question.

1.04 UNIT PRICE CONTRACTS

- A. For unit price contracts, the bid item prices on the Project Bid Schedule shall be used as the basis for the schedule of values. The Contractor shall resubmit the bid item prices in the format described herein, and may, at its option, or if requested by the County, divide the items in the Project Bid Schedule into sub-items to provide a more detailed basis of payment.

1.05 LUMP SUM CONTRACTS

- A. For lump sum contracts, if the Work involves separate facilities, e.g. multiple pump stations, the cost of the Work shall be separated by each facility and into schedule of value items. Break principal subcontract amounts down into these items; The lump sum cost for each facility shall be submitted individually and split into the schedule of values listed in items 1 through 15.
 1. Mobilization/Demobilization at 5% of the base bid.
 2. Project Record Documents at 1% of the base bid.
 3. Indemnification at \$100.00.
 4. Pre-construction Video.
 5. Field Office.
 6. Earthwork.
 7. Soil Import.
 8. Remove and Replace Concrete Maintenance Drive (RIB 9).
 9. Remove and Replace Existing Splash Pad (RIB 10).
 10. Remove and Replace 12" DI Piping (RIB 10).
 11. Retrofit Existing Propeller Meters.
 12. 60mil Textured Liner - White (Remove and Replace).
 13. Sodding.
 14. Stabilized Subgrade for Access Roads.

Additive Alternative

15. Furnish and Install New Meter Assembly.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01380
AUDIO – VISUAL DOCUMENTATION

PART 1 - GENERAL

1.01 PURPOSE AND DESCRIPTION OF WORK

- A. The purpose of the audio - visual documentation is to provide the County with regularly documented audio - visual records of the Construction process from the existing conditions through final completion.

1.02 PRE-CONSTRUCTION VIDEO REQUIREMENTS INCLUDED

- A. The Contractor shall employ a professional videographer to take a Pre-Construction video of the entire site including the areas of adjacent properties within 100-feet of the limits of Work and shall be made within 30-days of Work beginning. Special attention shall be made to show the existing paved roads, shoulders, signs, and other existing features.
- B. The Contractor shall submit a quality audio-video recording documenting Pre-Construction field conditions for the entire project. When the Work includes construction of water, wastewater, reuse, or other lines in the vicinity of any street or road, the Contractor shall take digital audio-video recordings of existing conditions along both sides of the street or road. The Pre-Construction video shall be submitted to the County and accepted prior to commencing any Work or using any Contractor laydown areas.
- C. Electronic digital photography shall also be used as necessary to record and facilitate resolution of on-site issues through the transmission of electronic photographs by e-mail from the site to the Professional's and County's offices.

PART 2 - PRODUCTS

2.01 AUDIO-VIDEO RECORDING

- A. Each audio-video recording shall be saved on appropriate media viewable on standard computers, and provided in Flash Drives.

- B. Each video file shall contain the following information and arrangement at the beginning as a title screen:
- Orange County, Florida
 - PROJECT NAME
 - PROJECT NUMBER
 - CONTRACTOR: (Name of Contractor)
 - DATE: (When photo was taken)
 - VIDEO BY: (Firm Name of Videographer)
 - LOCATION: (Description of Location(s) and View(s))
- C. Each video recording section shall begin with an audio description of the County's name, Contract name and number, Contractor's name, date and location information such as street name, direction of travel, viewing side, etc.
- D. Information appearing on the video recording must be continuous and run simultaneously by computer generated transparent digital information. No editing or overlaying of information at a later date will be acceptable.
- E. Digital information to appear in the upper left corner shall be as follows:
1. Name of Contractor
 2. Day, date and time
 3. Name of Project & Specification Number
- F. Time must be accurate and continuously displayed on the video record
- G. Written documentation must coincide with the information on the video so as to make easy retrieval of locations at a later date.
- H. The video system shall have the capability to transfer individual frames of video electronically into hard copy prints or photographic negatives.
- I. Audio shall be recorded at the same time as the video recording and shall have the same information as on the viewing screen. Special commentary shall be given for unusual conditions of buildings, sidewalks and curbing, foundations, trees and shrubbery, structures, equipment, pavement, etc.
- J. All Flash Drives shall bear labels with the following information:
1. Flash Drive Number
 2. County's Name
 3. Date of Recording
 4. Project Name and Number
 5. Location and Standing Limit of Video

2.02 CONSTRUCTION PHOTOGRAPHS

- A. The Contractor shall employ a competent photographer to take construction record photographs periodically during the course of the Work.

- B. Prints: Date imprinted 8-inch x 10-inch high resolution glossy single weight color print paper; 5 sets, bound in 3-ring binders to be provided to the County with each respective Application for Payment and distributed by the County as follows:
1. County (2 sets)
 2. Engineer (1 set)
 3. Contractor (1 set)
 4. Project Record Data (1 set stored by Contractor to be furnished to County upon Closeout)

PART 3 - EXECUTION

3.01 VIDEO VIEWS REQUIRED

- A. Complete coverage shall include all surface features within 100-feet of the Work area to be used by the Contractor and shall be supported by appropriate audio description made simultaneously with video coverage. Such coverage shall include, but not be limited to, all existing driveways, sidewalks, curbs, ditches, roadways, landscaping, trees, culverts, headwalls, and retaining walls, equipment, structures, pavements, manholes, vaults, handrails, etc. located within the work zone. Video coverage shall extend to the maximum height of all structures within this zone.
- B. The video recorder shall take special efforts to point out and provide audio commentary on cracking, breakage, damage, and other defects in existing features.
- C. All video recording shall be done during times of good visibility. No video recording shall be done during periods of visible precipitation, or when more than 10% of the ground area is covered with standing water, unless otherwise authorized by County.
- D. Prior to commencement of audio-video recording, the Contractor shall notify the County in writing within 48-hours of the audio-video recording. The County may provide a designated representative to accompany and observe all video recording operations. Audio-video recording completed without a County Representative present will be unacceptable unless specifically authorized by the County.

3.02 AUDIO-VIDEO REQUIREMENTS

- A. Major Locations:
1. The Contractor shall provide color digital video of each major facility and structures and facilities adjacent to the Construction before construction starts.
 2. All videos shall be recorded with character generator operating with date, time, and location on screen. During video recording, the Contractor shall narrate video explaining what is being shown. All master videos shall be delivered to the County.

3. The audio and video portions of the recording shall maintain viewer orientation. To this end, overall establishing views of all visible house and business addresses shall be used. In areas where the proposed construction location will not be readily apparent to the video recording viewer, highly visible yellow flags shall be placed, by the Contractor, in such a fashion as to clearly indicate the proposed centerline of Construction. When conventional wheeled vehicles are used as conveyances for the recording system, the vertical distance between the camera lens and the ground shall not exceed 10-feet. The camera shall be firmly mounted such that transport of the camera during the recording process will not cause an unsteady picture.
4. All video recording shall be done during time of good visibility. No video recording shall be done during precipitation, mist or fog. The recording shall only be done when sufficient sunlight is present to properly illuminate the subjects of recording and to produce bright, sharp video recordings of those subjects.
5. The average rate of travel during a particular segment of coverage shall be directly proportional to the number, size and value of the surface features within that construction area's zone of influence. The rate of speed in the general direction of travel of the vehicle used during taping shall not exceed 44-feet per minute.

3.03 PHOTOGRAPHS

- A. A minimum of 3 views (top, upstream, and downstream) each shall generally be taken prior to backfilling pipelines or structures. Photographs shall be provided for:
 1. Utility conflicts/relocations
 2. Manholes
 3. Pump stations
 4. Boring and jacking
 5. Directional drilling pipe entrance and exit
 6. Valve installation
 7. Air release valve installation
 8. Fire hydrant assembly
- B. Photo Identification
 1. Name of Project
 2. Name of Structure
 3. Orientation of View
 4. Date & Time of Exposure
 5. Film numbered identification of exposure

END OF SECTION

SECTION 01400
QUALITY CONTROL

PART 1 - GENERAL

1.01 SITE INVESTIGATION AND CONTROL

- A. Contractor shall verify all dimensions in the field and check field conditions continuously during construction. Contractor shall be solely responsible for any inaccuracies built into the Work due to Contractor's failure to comply with this requirement.
- B. Contractor shall inspect related and appurtenant Work and report in writing to County any conditions which will prevent proper completion of the Work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the Contractor at Contractor's sole cost and expense.

1.02 INSPECTION OF THE WORK

- A. The Work shall be conducted under the general observation of representatives of the County acting on behalf of the County to ensure strict compliance with the requirements of the Contract Documents. Such inspection may include mill, plant, shop, or field inspection, as required. The County shall be permitted access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated. Inspection by the County are in addition to the inspections required of Contractor by his QC Representatives.
- B. The presence of the County, however, shall not relieve the Contractor of the responsibility for the proper execution of the Work in accordance with all requirements of the Contract Documents. Compliance is a duty of the Contractor, and said duty shall not be avoided by any act or omission on the part of the County. Further, no requirement of this Contract may be waived or modified except by change order or formal (written) substitution approval.
- C. All materials and articles furnished by the Contractor shall be subject to rigid inspection, and no materials or articles shall be used in the Work until they have been inspected and accepted by the County. No Work shall be backfilled, buried, cast in concrete, hidden, or otherwise covered until it has been inspected. Any Work so covered in the absence of inspection shall be subject to uncovering. Where uninspected Work cannot be uncovered, such as in concrete cast over reinforcing steel, all such Work shall be subject to demolition, removal, and reconstruction under proper inspection and no additional payment will be allowed therefore.

- D. The Contractor is responsible for the Quality of his own work and shall designate a qualified individual, to be approved by the County, who will ensure that all work is performed in strict accordance with the Contract Documents. This quality representative shall inspect the work for the Contractor and provide to the County and the Contractor a report outlining all work accomplished, all inspections, and all testing performed for all days when work is performed. The objective of this report is to provide "Objective Evidence of Compliance" by the Contractor with the requirements of the Contract.

1.03 TIME OF INSPECTION AND TESTS

- A. Samples and testing required under these Specifications shall be furnished and prepared in ample time for the completion of the necessary tests and analyses before said articles or materials are to be used. Except as otherwise provided in the Contract Documents, performance of the required tests will be by the Contractor and all costs therefore will be borne by the Contractor at no cost to the County. Whenever the Contractor is ready to backfill, bury, cast in concrete, hide, or otherwise cover any Work under this Contract, the County shall be notified not less than 24-hours in advance to request inspection before beginning any such Work of covering. Failure of the Contractor to notify the County at least 24-hours in advance of any such inspections shall be reasonable cause for the County to order a sufficient delay in the Contractor's schedule to allow time for such inspection, any remedial, or corrective work required, and all costs of such delays, including its impact on other portions of the Work, shall be borne by the Contractor.

1.04 SAMPLING AND TESTING

- A. When not otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered. However, the County reserves the right to use any generally accepted system of inspection which, in the opinion of the County, will ensure the County that the quality of the workmanship is in full accord with the Contract Documents.
- B. Any waiver of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any technical or qualitative requirements of the Contract Documents.
- C. Notwithstanding the existence of such waiver, the County shall reserve the right to make independent investigations and tests as specified in the following paragraph and, upon failure of any portion of the Work to meet any of the qualitative requirements of the Contract Documents, shall be reasonable cause for the County to require the removal or correction and reconstruction of any such Work.

- D. In addition to any other inspection or quality assurance provisions that may be specified, the County shall have the right to independently select, test, and analyze, at the expense of the County, additional test specimens of any or all of the materials to be used. Results of such tests and analyses shall be considered along with the tests or analyses made by the Contractor to determine compliance with the applicable specifications for the materials so tested or analyzed provided that wherever any portion of the Work is discovered, as a result of such independent testing or investigation by the County which fails to meet the requirements of the Contract Documents, all costs of such independent inspection and investigation and all costs of removal, correction, reconstruction, or repair of any such Work shall be borne by the Contractor.

1.05 RIGHT OF REJECTION

- A. The County shall have the right at all times and places to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the Work at the site. If the County or inspector, through an oversight or otherwise, has accepted materials or Work which is defective or which is contrary to the Contract Documents, such material, no matter in what stage or condition of manufacture, delivery, or erection, may be rejected by County.
- B. Contractor shall promptly remove rejected articles or materials from the site of the Work after notification or rejection.
- C. All costs of removal and replacement of rejected articles or materials, as specified herein, shall be borne by the Contractor.
- D. If the Contractor fails to remove or replace defective work after notification to do so, the County may have the work removed and replaced by others and deduct all costs from the Contractor's pay requests.

1.06 TESTING LABS

- A. All geotechnical testing laboratory services for field testing will be paid by the County. The lab(s) shall function as independent lab(s) and report independently to the County and the Contractor. The test lab(s) may not approve or allow any deviation from the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01410
TESTING AND TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. County will employ and pay for services of an Independent Testing Laboratory to perform Testing specifically indicated on the Contract Documents or specified in the Specifications and may at any other time elect to have materials and equipment tested for conformity with the Contract Documents.
2. Contractor shall cooperate with the laboratory to facilitate the execution of its required services.
3. Employment of laboratory by County shall in no way relieve Contractor's obligations to perform the Work.

B. Related Requirements Described Elsewhere:

1. Conditions of the Contract.
2. Respective section of Specifications: Certification of products.
3. Each Specification section listed: Laboratory tests required and standards for testing.

1.02 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with County's personnel; provide access to work and manufacturer's operations.
- B. Secure and deliver to the County adequate representational samples of materials proposed to be used and which require testing.
- C. Provide to the County the preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the testing laboratory.
- D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. The County may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor, and no extra charge to the County shall be allowed on account of such testing and certification.
- E. Contractor shall not have direct contact with laboratory or laboratory personnel. All testing shall be coordinated through County.
- F. Furnish incidental labor and facilities:

1. To provide access to work to be tested.
2. To obtain and handle samples at the Project site or at the source of the product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

G. Notify County sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests. When tests or inspections cannot be performed after such notice, reimburse County for laboratory personnel and travel expenses incurred.. The following field testing schedule summarizes the responsibilities of various tests that may be required by the Contract Documents.

TEST	NOTES	PAID FOR
Soil Compaction	A. Pipe Work: Every 300 ft. at each lift of compaction B. Structures: As a minimum one test per 2000 SF of fill area per lift, or at least 2 tests per structure, per lift. As specified in material specifications sections	County
Low Pressure Air Exfiltration	Each section of gravity sewer pipe between manholes or lift station	Contractor
Hydrostatic Pressure	All segments of pressure piping (24-hour test).	Contractor
Hydrostatic Leakage	All segments of pressure piping (2-hour test).	Contractor
Bacteriological	As required by local and state agencies	County
Asphaltic Concrete Paving	As required by County	County
LBR	Each 600 SY of pavement	County
Concrete	Slump test each delivery, cylinders every 20 CY	County
Asbestos	Environmental testing of materials	County
All Other Testing	As specified in various sections of the Project Manual	As Indicated

H. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor's convenience.

I. If the test results indicate the material or equipment complies with the Contract Documents, the County shall pay for the cost of the testing laboratory. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the Contractor shall pay for the laboratory costs directly to the County or the total costs shall be deducted from any payments due to the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01560
EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The Work specified in this Section consists of designing, providing, maintaining and removing temporary erosion and sedimentation controls as necessary to protect the Work and prevent sedimentation from the Contractor's activities from entering water bodies or enter other parts of the County's or other property owners sites outside the Construction limits.
- B. Temporary erosion controls include, but are not limited to; grassing, mulching, netting, watering and reseeded on-site surfaces and soil and borrow area surfaces, and providing interceptor ditches at end of berms and at those locations which will ensure that erosion during Construction will be either eliminated or maintained within acceptable limits as established by the regulatory agencies having jurisdiction.
- C. Temporary sedimentation controls include, but are not limited to; silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the regulatory agencies having jurisdiction.

1.02 REQUIREMENTS

- A. The Contractor is responsible for providing effective temporary erosion and sediment control measures during Construction or until final controls become effective.
- B. The Contractor shall be responsible for filing Notice of Intent for Construction Activities with regulatory agencies (SJRWMD, SFWMD, and FDEP) as required by law, if thresholds are expected to be exceeded.
- C. The areas of unstabilized soil cover shall be minimized at all times to limit erosion and sedimentation.

1.03 SUBMITTALS:

- A. The Contractor shall prepare and submit an Erosion and Sedimentation Control Plan (Stormwater Pollution Prevention Plan) for County review and approval. The Plan shall be in effect throughout the Construction duration.

PART 2 - PRODUCTS

2.01 EROSION CONTROL

- A. Seed: Scarified Argentine Bahia.
- B. Sod: Bermuda grass, Argentine Bahia grass, Pensacola Bahia grass or St. Augustine. Grassing and Sodding Materials: As specified in Section 981 FDOT Specification for Road & Bridge Construction.
- C. Netting: Polypropylene mesh netting 5/8-inch x 3/4-inch (16 x 19mm) mesh with interwoven curlex fibers as manufactured by American Excelsior Company or equal. Netting: Fabricated of material in conformance with Section 985 FDOT Specification for Road & Bridge Construction.

2.02 SEDIMENTATION CONTROL

- A. Bales: Clean, synthetic hay type. Minimum dimensions of 14-inch by 18-inch by 36-inches at the time of placement.
- B. Netting: Fabricated of material in conformance with Section 985 FDOT Specification for Road & Bridge Construction.
- C. Sediment Control Fencing (Silt Fencing): As manufactured by American Excelsior Company or equal.
- D. Filter stone: Crushed stone conforming to Florida Department of Transportation Specifications.
- E. Concrete block: Hollow, non-load bearing type.
- F. Concrete: Exterior grade not less than 1-inch thick.
- G. Turbidity Barriers: Floating or staked as required.

PART 3 - EXECUTION

3.01 TEMPORARY EROSION CONTROL

- A. See Section 02578 "Solid Sodding."

3.02 SEDIMENTATION CONTROL

- A. Install and maintain silt fences and dams, traps, barriers, and appurtenances as shown on the approved descriptions and working Drawings. Replace deteriorated hay bales and dislodged filter stone. Repair portions of any devices damaged at no additional expense to the County.

- B. Install all sediment control devices in a timely manner to ensure the control of sediment. At sites where exposure to sensitive areas is likely, complete installation of all sediment control devices before starting earthwork.
- C. Use approved temporary erosion control features to correct conditions that develop during Construction that were not foreseen when the Erosion and Sedimentation Control Plan was first approved.

3.03 PERFORMANCE

- A. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results that comply with the requirements of the Regulatory agency having jurisdiction, the County or the Professional, the Contractor shall immediately take whatever steps necessary to correct the deficiency at its own expense to protect the Work and any adjacent property to the site, as well as to prevent contamination of any river, stream, lake, tidal waters, reservoir, canal or other water impoundments.
- B. The side slope areas with unstabilized or unprotected soil cover shall be minimized at all times to limit erosion and sedimentation.
- C. Incorporate permanent erosion control features into the Project at the earliest practical time.
- D. Remove temporary erosion and sedimentation controls when the Work is complete and in accordance with the Erosion and Sedimentation Control Plan (Stormwater Pollution Prevention Plan) and the Notice of Intent for Construction Activities filed with regulatory agencies.

3.04 MAINTENANCE OF EROSION AND CONTROL FEATURES

- A. Provide routine maintenance of permanent and temporary erosion control features, at no expense to the County, until the Project is complete and accepted.

END OF SECTION

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SECTION 01580
PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. The Contractor shall furnish, install, and maintain all sign materials including sign posts, weighted stands, brackets, any required mounting hardware, and miscellaneous materials required for temporary signs for the purpose of:
 - 1. Project Identification.
 - 2. Informational signs to direct traffic
 - 3. On-site safety signs as appropriate for the Work
- B. Remove temporary signs on completion of Construction prior to obtaining Certificate of Occupancy and Substantial Completion.
- C. Allow no other signs to be displayed without written approval of the County.

1.02 SUBMITTALS

- A. Submit complete Shop Drawings identifying locations, material, layout, sign content, font type and size, and sample colors. Make sign and lettering to scale, clearly indicating condensed lettering if used. The sign details will be submitted to the County for approval prior to fabrication.
- B. Submit method of erection to include materials, fasteners, and other items to assure compliance with the requirements for wind pressures as required by the authorities having jurisdiction.
- C. Submit signs in accordance with any details provided in the Drawings.
- D. Prior to erection obtain and submit all required permits from the authorities having jurisdiction.

1.03 PROJECT IDENTIFICATION SIGN

- A. Provide 1 painted sign at the site, or at each end of the Work if a linear project, or at each of the separate sites of Work, if applicable. The sign will be not less than 32-square feet area, with a minimum dimension of 4-feet and painted graphics with content to include:
 - 1. Title of Project
 - 2. Orange County Government name and logo
 - 3. Names and titles of the Board of County Commissioners, County Administrator, Director of Orange County Utilities Department, the Consulting Engineer, and the Contractor

- B. Erect on the site at a lighted location of high public visibility, adjacent to main entrance to site, as approved by the County. The sign must be located 5-feet from all rights-of-way and 20-feet from all property lines.

1.04 INFORMATIONAL SIGNS

- A. All signs and other traffic control devices shall conform to the requirements for shape, color, size, and location as specified in the latest Manual on Uniform Traffic Control and Safe Streets and Highways and the Florida Manual of Traffic Control and Safe Practices for Street and Highway Construction, Maintenance and Utility Operations. Information as to the above may be obtained from FDOT Division engineers.

PART 2 - PRODUCTS

2.01 SIGN MATERIALS

- A. Structure and Framing: New construction grade lumber, structurally adequate and suitable for exterior application and specified finish.
- B. Sign Panels: New A-B Grade, exterior type, APA DF plywood with inset hardwood edges and mitered corners, standard large sizes to minimize joints.
 - 1. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles, minimum 3/4-inch.
- C. Rough Hardware: Galvanized steel, of sizes and types to enable sign assemblies to resist wind pressures as required by the authorities having jurisdiction but not less than a wind velocity of 50-mph.
 - 1. Use minimum 1/2-inch diameter button head carriage bolts to fasten sign panels to supporting structures. Bolt heads to be painted to match sign face.
- D. Paint: Exterior quality, as specified in Division 9 or as a minimum as specified herein.
 - 1. Primer and finish coat: exterior, semi-gloss, alkyd enamel.
 - 2. Colors for structure, framing, sign surfaces, and graphics: As shown on the Drawings or as selected by the County.
- E. Safety Sign Number Tags
 - 1. Removable aluminum or galvanized steel, with 4-inch high, blue numerals and steel tag hooks.

PART 3 - EXECUTION

3.01 PROJECT IDENTIFICATION SIGN

- A. Install project identification signs within 10-days of the Notice to Proceed date. Failure to erect the signs may be reason to delay approval of the initial Application for Payment.

- B. Paint exposed surfaces of supports, framing, and surface material; one (1) coat of primer and two (2) coats of finish paint.
- C. Set signs plumb and level and solidly brace as required to prevent displacement during the Construction period. If mounted on posts, sink posts 3-feet to 4-feet below grade, leaving a minimum of 8-feet of each post above grade for mounting the sign.
- D. Install informational signs at a height for optimum visibility, on ground mounted poles or attached to temporary structural surfaces.

3.02 MAINTENANCE

- A. Maintain signs and supports in a neat, clean condition; repair damages to structure, framing, or sign.
- B. Relocate informational signs as required by the progress of the Work.
- C. Poorly maintained, defaced, damaged, or dirty signs shall be replaced, repaired, or cleaned without delay.
- D. Special care must be taken to ensure that construction materials and dust are not allowed to obscure the face of a sign.
- E. Signs not in effect shall be covered or removed.

3.03 REMOVAL

- A. Remove signs, framing, supports, and foundations at Substantial Completion of the Work.
- B. Leave areas clean and patch as required to remove any traces of temporary signs.

END OF SECTION

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SECTION 01590
CONSTRUCTION FIELD OFFICE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Contractor provision of temporary utilities to include electricity, lighting, internet connectivity, heat, ventilation, telephone service, water, and sanitary facilities.
- B. Contractor provision of temporary controls to include barriers, enclosures and fencing, and water control.
- C. Contractor provision of temporary facilities to include access roads, parking, and temporary buildings.
- D. Contractor provision of field offices for the County.
- E. Restrictions on the use of existing adjacent facilities.

1.02 TEMPORARY ELECTRICITY

- A. Provide and pay for power service required for Construction and testing from local utility source.
- B. Provide temporary electric feeder from existing electrical service at location as directed by utility company. Power consumption will not disrupt the County's need for continuous service. Coordinate with the County before making taps or disturbing existing service.
- C. Provide separate metering and pay for cost of energy used until substantial completion. If electric service is turned over to and paid for by the County prior to substantial completion, reimburse the County for energy used up to substantial completion.
- D. Provide power outlets for Construction operations, with branch wiring and distribution boxes located as required. Provide OSHA approved flexible power cords as required.
- E. Contractor-installed permanent convenience receptacles may be used during Construction.

1.03 TEMPORARY LIGHTING

- A. Provide and maintain adequate lighting for Construction operations to achieve a minimum lighting level of one (1) watt/sq ft.
- B. Provide and maintain two (2) foot-candle lighting to exterior staging and storage areas after dark for security purposes.

- C. Provide and maintain 0.25-watt/sq ft H.I.D. lighting to interior Work areas after dark for security purposes.
- D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- E. Maintain lighting and provide routine repairs.
- F. Permanent building lighting may be used during Construction.

1.04 TEMPORARY HEAT AND COOLING

- A. Provide and pay for heating and cooling as required to maintain specified conditions for Construction operations or as required for proper conduct of operations included in the Work.
- B. Prior to operation of permanent equipment for temporary purposes, verify that installation is approved for operation, equipment is lubricated and temporary filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.
- C. Maintain minimum ambient temperature of 50°F and maximum relative humidity of 50% in areas where Construction is closed in and final finishes are to be placed, unless indicated otherwise in specifications.

1.05 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.06 TEMPORARY WATER SERVICE

- A. Provide, maintain, and pay for suitable quality water service required for Construction operations. Coordinate with the County if water supply is not separately metered. Pay all costs and expenses associated with such use.
- B. Extend branch piping with outlets located so water is available by hoses with threaded connections.

1.07 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures on-site. Maintain daily in clean and sanitary condition. Adjacent County office building toilet facilities are not to be used by Contractor.

1.08 BARRIERS

- A. Provide barriers to prevent unauthorized entry to Construction areas and to protect existing facilities and adjacent properties from damage from Construction operations.

- B. Provide barricades required by governing authorities for public rights-of-way.
- C. Provide protection for plant life designated to remain. Replace damaged plant life.
- D. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.09 FENCING

- A. Unless directed otherwise in other sections of the Contract Documents, provide a 6-foot high fence completely around Construction site; provided with hinged vehicular and pedestrian gates with locks. Fencing will be galvanized, 2-inch mesh, chain link with solid top rail. Provide line posts and end posts as needed to maintain stretched and uniform fencing with no sags.
- B. Fencing plan will be approved by the County for each phase of the project. Submit fencing layout diagram prior to the Pre-Construction meeting.
- C. Provide visual fabric barrier at least 6-foot high on all fencing separating parking areas from Construction activities. Submit barrier fabric for approval before starting fencing. Barrier fabric will be capable of retaining physical integrity and color during the entire Construction period.

1.10 ACCESS ROADS

- A. Provide and maintain uninterrupted public access to existing buildings. Construction activities will not interfere with access. If Contractor fails to maintain public access after 2 written notices within a 24-hour period, the County reserves the right to correct such situation and back charge the Contractor.
- B. Construct and maintain temporary roads accessing public thoroughfares to serve Construction area.
- C. Extend and relocate access roads as Work progress requires. Provide detours necessary for unimpeded traffic flow.
- D. Provide and maintain access to fire hydrants, free of obstructions.
- E. Designated existing on-site roads may be used for Construction traffic. Repair or restore any damaged areas caused as a result of Construction activity. Such repair will be to a like-new condition.

1.11 PARKING

- A. Provide temporary surface parking areas to accommodate Construction personnel.
- B. Do not allow Construction vehicle parking on existing pavement unless approved by County.

1.12 FIELD OFFICES (FOR UTILITIES DEPARTMENT)

- A. Promptly after starting Work, the Contractor will provide and maintain 1 field office for the use of the County until Substantial Completion.
- B. The field offices will be an appropriate size required for the use of the County, as well as contain two offices and three desks. The field office structure will be a minimum of 10-feet x 40-feet. The layout of the County's field office will include adequate space to hold project meetings (minimum seating for 15).
- C. Installation of the field offices will meet all local codes and ordinances. The Contractor will as a minimum install the structures on a level, well-drained area. Structures will be designed and installed to resist 130-mph winds or applicable State of Florida code, whichever is more stringent.
- D. The field offices will be provided with structurally sound and safe steps and landings for each door. The doors will have secure locks. Construct appropriate walkway and landings. Construct covers over each door that extends 3-feet from the building and the full width of the landing.
- E. The field offices will be designated as a "No Smoking Area."
- F. The windows will be arranged for cross ventilation with screens.
- G. Provide air conditioning and heating systems with thermostat control.
- H. Provide electric power for the duration of the Work.
- I. The Contractor will provide the following with the field office, at a minimum:
 - 1. Electric lights (fifty (50) foot-candles at desktop height) and power supply outlets.
 - 2. When available, provide high-speed Internet access to all desks for the duration of the Work.
 - 3. Acceptable toilet facilities with appropriate signage that meet all of the local and State health codes and regulations.
 - 4. Fire extinguisher (Halon type, minimum 4 lb. capacity).
 - 5. Water coolers, bottled water and paper cups.
 - 6. Tables for viewing the Project Drawings.
 - 7. Standard office supplies.
 - 8. Weekly janitorial services.

1.13 SPECIFIC REQUIREMENTS FOR THE FIELD OFFICES

Provide the following for the exclusive use of the County: (Unless otherwise noted, the quantity should be sufficient for the duration of the Work.)

- A. Office Furnishings: The furniture will be delivered and placed as directed by the County.
- B. Desks: Flat top, double pedestal, with one box and one file drawer in each pedestal, 60-inches by 30-inches. Total quantity will be three (3).

- C. Chairs: Three (3) office-type chairs, adjustable heights, on rollers, with armrests.
- D. Conference Table and Chairs: One (1) table (3-feet by 8-feet minimum), scratch and stain resistant and 15 meeting-type chairs.
- E. Drawing Table: Two (2) plywood or standard drawing tables, 3-feet by 6-feet, with all required appurtenances and 2 extended height stools suitable for use at the drawing tables.
- F. Printer: One(1) - All in one color inkjet printer capable of printing, scanning and coping Ledger, Legal and Letter sizes. Standard interfaces shall include Hi-Speed USB 2.0, Wireless (802.11b/g/n), Ethernet. Minimum requirements include: 35 page automatic document feeder, printing 20 color copies per minute at 6000 x 1200 dpi resolution, scan resolution 2400 x 2400 dpi, flat bed document glass size Ledger (11" x 17") with standalone copy features, minimum of 250 sheet input capacity cassettes and 2 additional complete set of ink cartridges. Brother MFC-J6710DW or equal. Printers to be retained by the County.. All warranties, maintenance, servicing and sufficient appropriate ink/toner cartridges and paper for the duration of the Work.
- G. One (1) each refrigerator, microwave, coffee machine, and toaster oven.
 - 1. Provide Internet connection in each of the four offices in the field trailer. The connection shall be at least 5.0 Mbps of download speed or greater. Provide office with a wireless network 802.11 n with minimum of 8 concurrent users in addition to the network requirements. Wireless network shall allow additional portable computers to gain internet access within the office.
- H. File Cabinets, Storage, Bookcases:
 - 1. Three (3) Lateral Files: HON 600 Series, or equal, 42-inch wide, four-drawer.
 - 2. Two (2) steel vertical, hanging mobile plan stands, with approximately 12-hanging clamps. Provide all required clamps, of sufficient length to hold the Contract Drawings.
 - 3. Storage: Two (2) industrial grade steel cabinets, locking handles, 36-inches wide by 18-inches deep by 72-inches high.
 - 4. Bookcases: Three (3) HON metal bookcases, or equal, 34-1/2-inches wide by 12-5/8-inches deep by 71-inches high, color to be selected by the Engineer.
- I. Miscellaneous Field Supplies:
 - 1. One (1) minimum/maximum digital thermometer, with batteries for the duration of the Work.
 - 2. One (1) rain gauge.

1.14 REMOVAL OF TEMPORARY UTILITIES, FACILITIES, AND CONTROLS

- A. Remove all temporary utilities, equipment, facilities, and materials prior to submitting Final Application for Payment.
- B. Remove temporary underground installations to minimum depth of 2-feet and re-grade site.
- C. Clean and repair damage caused by installation or use of temporary Work.

- D. Restore any existing facilities used during Construction to original condition, unless otherwise directed in other sections of Contract Documents. Restore existing landscaping, drainage, paving, etc. to an "as-was" condition, unless otherwise directed in other sections of Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01610
DELIVERY, STORAGE AND HANDLING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section specifies the general requirements for the delivery, handling, storage and protection for all items required in the construction of the Work.
- B. Deliver, handle and store products in accordance with manufacturer's recommendations and by methods and means that will prevent damage, deterioration, and loss including theft and protect against damage from climatic conditions. Control delivery schedules to minimize long-term storage of products at the site and overcrowding of construction spaces. In particular, provide delivery/installation coordination to ensure minimum holding or storage times for products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss. Damaged or defective items, in the opinion of the County, will be replaced at no cost to the County.

1.02 REQUIREMENTS

- A. The Contractor is responsible for all material, equipment and supplies sold and delivered to the County under this Contract until final inspection of the Work and acceptance thereof by the County.
- B. All materials and equipment to be incorporated in the Work will be handled and stored by the Contractor before, during and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind whatsoever to the material or equipment.
- C. All materials and equipment, which in the opinion of the County, have become so damaged as to be unfit for the use intended or specified, will be promptly removed from the site of the Work, and the Contractor will receive no compensation for the damaged materials or equipment or for its removal.
- D. In the event any such material, equipment and supplies are lost, stolen, damaged or destroyed prior to final inspection and acceptance, the Contractor will replace same without additional cost to the County.

1.03 DELIVERY

- A. Transport and handle items in accordance with manufacturer's instructions.

- B. The County and the Contractor's project superintendent must be on-site to accept all deliveries shipped directly to the job site. If the project superintendent is not present for a delivery, that delivery may be rejected by the County. If any delivery is rejected due to non-availability of the Contractor's project superintendent, delivery shall be rescheduled at no additional cost to the County.
- C. Schedule delivery to reduce long-term on-site storage prior to installation and/or operation. Under no circumstances will materials or equipment be delivered to the site more than 1-month prior to installation without written authorization from the County.
- D. Coordinate deliveries in order to avoid delay in, or impediment of, the progress of the Work.
- E. Schedule deliveries to the site not more than 1-month prior to scheduled installation without written authorization from the County.
- F. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.
- G. All items delivered to the site will be unloaded and placed in a manner that will not hamper the Contractor's normal construction operation or those of Subcontractors and other Contractors and will not interfere with the flow of necessary traffic.
- H. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible. Maintain packaged materials with seals unbroken and labels intact until time of use.
- I. Immediately on delivery, inspect shipments with the County to ensure compliance with requirements of Contract Documents and accepted submittals, and that products are properly protected and undamaged. If the Contractor does not notify the County regarding the delivery and the County rejects any part of the delivery, there will be no additional cost to the County for the material to be returned. For items furnished by others (i.e. County), perform inspection in the presence of the County. Provide written notification to the County of any problems.
- J. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the County.

1.04 STORAGE AND HANDLING

- A. Provide equipment and personnel to handle products by methods recommended by the manufacturer to prevent soiling or damage to products or packaging, with seals and labels intact and legible.
- B. The Contractor is responsible for securing a location for on-site storage of all material and equipment necessary for completion of the Work. The location and storage layout will be submitted to the County at the Pre-Construction conference.

- C. Manufacturer's storage instructions will be carefully studied by the Contractor and reviewed with the County. These instructions will be carefully followed and a written record of this kept by the Contractor.
- D. All material delivered to the job site will be protected from dirt, dust, dampness, water, and any other condition detrimental to the life of the material from the date of delivery to the time of installation of the material and acceptance by the County.
- E. When required or recommended by the manufacturer, the Contractor will furnish a covered, weather protected storage structure providing a clean, dry, non-corrosive environment for all mechanical equipment valves, architectural items, electrical and instrumentation equipment, and special equipment to be incorporated into this Project.
- F. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions and free from damage or deterioration.
- G. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within 7-days after written notice to do so has been given, the County retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contract Amount. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, engineering, and any other costs associated with making the necessary corrections.

1.05 SPECIFIC STORAGE AND HANDLING

(Additional specific storage and handling requirements may be found in the specification sections addressing the material requirements.)

- A. All mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas) will be stored in a weather tight building to prevent damage. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the County. The building will be provided with adequate ventilation to prevent condensation. Maintain temperature and humidity within range required by manufacturer.
 - 1. All equipment will be stored fully lubricated with oil, grease and other lubricants unless otherwise instructed by the manufacturer. Mechanical equipment to be used in the Work, if stored for longer than 90-days, will have the bearings cleaned, flushed and lubricated prior to testing and startup, at no extra cost to the County.
 - 2. Moving parts will be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding." Upon installation of the equipment, the Contractor will start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.

3. Lubricants will be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants will be put into the equipment at the time of acceptance. Prior to acceptance of the equipment, the Contractor will have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer will be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment will be judged to be defective. It will be removed and replaced at the Contractor's expense.
 4. Electric motors provided with heaters will be temporarily wired for continuous heating during storage. Upon installation of the equipment, the Contractor will start the equipment, at least half load, and once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.
- B. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
 - C. Cement and lime will be stored under a roof and off the ground and will be kept completely dry at all times.
 - D. Brick, block and similar masonry products will be handled and stored in a manner to minimize breakage, chipping, cracking and spilling to a minimum.
 - E. Precast Concrete will be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking.
 - F. All structural and miscellaneous steel and reinforcing steel will be stored off the ground or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams will be stored with the webs vertical.
 - G. Metals will be stored dry, all under cover and vented to prevent build-up of humidity, all off ground to provide air circulation.
 - H. Lumber will be stacked to provide air circulation. Store materials for which maximum moisture content is specified in an area where moisture content can be maintained.
 - I. Gypsum wallboard systems will be stored to protect all metal studs, furring, insulation boards, batts, accessories and gypsum board to prevent any type of damage to these materials. Rusted material components, damp or wet insulation or gypsum boards will not be accepted.

- J. Acoustical materials will be delivered to the job site in unbroken containers labeled and clearly marked. Materials will not be removed from containers until ready to install, but will be stored in dry area with cartons neatly stacked. Before installation, acoustical board will be stored for not less than 24-hours in the Work area at the same temperature and relative humidity.
- K. Linear items will be stored in dry area with spacers to provide ventilation. Stack linear items to prevent warping, complying with manufacturer's instructions.
- L. Paints and other volatile materials will be stored within approved safety containers. No glass jugs will be permitted. Storage areas will be equipped with not less than 2 fire extinguishers (CO2 type) sufficient to discharge a distance of 25-feet when fully charged and have current tags. No other building materials will be stored in this area. Used rags will be removed daily. Clean rags will be stored in metal closed containers.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01700
PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

The term "Project Closeout" is defined to include requirements near the end of the Contract Time, in preparation for Substantial Completion acceptance, occupancy by the County, release of retainage, final acceptance, final payment, and similar actions evidencing completion of the Work. Time of closeout is directly related to "Substantial Completion"; therefore, the time of closeout may be either a single period for the entire Work or a series of time periods for individual elements of Work that has been certified as substantially complete at different dates. This time variation, if any, will be applicable to the other provisions of this section.

1.02 SCOPE OF WORK

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
 - 1. Final Cleaning
 - 2. Substantial Completion
 - 3. Final Acceptance

1.03 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.
- C. Section 01720 "Project Record Documents"
- D. Section 01740 "Warranties and Bonds"

1.04 PREREQUISITES FOR SUBSTANTIAL COMPLETION.

When the Contractor considers all the Work as substantially complete, submit to the County a written notice stating so and requesting an inspection to determine the status of completion. Partial substantial completion requests will not be accepted. The Contractor will attach to the notice a list of items known to be incomplete or yet to be corrected. Complete the following before requesting the County's inspection for certification of substantial completion.

- A. In the progress payment request that coincides with or is the first request following, the date substantial completion is claimed, show 100% completion or list incomplete items, the value of incomplete Work, and reasons for the Work being incomplete. Inspection procedures include supporting documentation for completion as indicated in these Contract Documents.
- B. Submit a statement showing an accounting of changes to the Contract Sum.
- C. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents in accordance with Section 01740 "Warranties and Bonds."
- D. Obtain and submit lien releases enabling the County's full, unrestricted use of the Work and access to services and utilities.
- E. Consult with County before submitting Record Documents in accordance with Section 01720 "Project Record Documents."
- F. Submit Operation and Maintenance Manuals.
- G. Make final changeover of permanent locks. Submit keys and keying schedule.
- H. Deliver tools, spare parts, extra stock, and similar items.
- I. Complete final cleaning requirements necessary for Substantial Completion.

1.05 FINAL CLEANING.

Complete the following cleaning operations prior to Substantial Completion or Owner occupancy.

- A. Remove from job site all tools, surplus materials, construction equipment, storage sheds, debris, waste and temporary services.
- B. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- C. Structures:
 - 1. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges and other foreign matter.
 - 2. Remove all traces of splashed materials from adjacent surfaces.
 - 3. Ensure exterior surfaces have a uniform degree of cleanliness.
 - 4. Visually inspect interior surfaces and remove all traces of soil, waste materials, smudges and other foreign matter.
 - 5. Remove paint droppings, spots, stains and dirt from finished surfaces.
 - 6. Remove labels that are not permanent labels.
 - 7. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

8. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Leave concrete floors broom clean.
9. Wipe surface of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean light fixtures and lamps.
10. Clean permanent filters of ventilating systems and replace disposable filters if units were operated during construction. Clean ducts, blowers and coils if units were operated without filters during construction.

1.06 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor will submit the proposed format, content and tab structure for all Operating and Maintenance Manuals for the County's review and approval. The tab structure for Operating and Maintenance Manuals will follow specification division format as accepted by the Construction Specification Institute. After the County approves the proposed format, content, and tab structure for the Operating and Maintenance Manuals, the Contractor will create and deliver 5 complete sets.
- B. Operation and Maintenance documentation is required for each piece of mechanical, electrical, communications, instrumentation and controls, pneumatic, hydraulic, conveyance, and special construction. If required by the technical specifications, provide Operation and Maintenance documentation for any other product not listed in the foregoing.
- C. The requirements of this Section are separate, distinct and in addition to product submittal requirements that may be established by other Sections of the Specifications. Owner's manuals, manufacturer's printed instructions, parts lists, test data and other submittals required by other Sections of the Specifications may be included in the Operating and Maintenance Manuals provided that they are approved and are formatted in a manner consistent with the requirements of this Section.
- D. Deliver Operation and Maintenance Manuals directly to the County.
- E. Operating and Maintenance Manual documents must include, but are not limited to, table of contents, approved submittals, manufacturer's operating and maintenance instructions, brochures, Shop Drawings, performance curves and data sheets annotated to indicate equipment actually furnished (e.g. identifying impeller size, model, horsepower, etc), procedures, wiring and control diagrams, records of factory and field tests and device/controller settings and calibration, program lists or electronic data, maintenance and warranty terms and contact information, spare parts listings, inspection procedures, emergency instructions, and other Operating and Maintenance documentation that may be useful to the County. The material and equipment data required by this Section must include all data necessary for the proper installation, removal, normal operation, emergency operation, startup, shutdown, maintenance, cleaning, adjustment, calibration, lubrication, assembly, disassembly, repair, inspection, trouble-shooting, and warranty service of the equipment or materials.

- F. The Contractor must bind the Operating and Maintenance Manual documents in heavy-duty, 3-ring vinyl-covered binders including pocket folders for folded sheet information. Mark binder identification on both the front and spine of each binder. Binder information must list the project title, identify separate structures or locations as applicable, identify the general subject matter covered in the manual and must include the words "OPERATING AND MAINTENANCE INSTRUCTIONS".
 - 1. The Contractor must submit the Operating and Maintenance documents on three-hole punched, 8-1/2-inch x 11-inch sheets or on three-hole punched sheets that are foldable in multiples of 8-1/2-inch x 11-inch. The three-hole punched edge will be the left 11-inch edge.
 - 2. The Contractor may request waivers to the size requirement for specific instances. The Contractor's waiver request must be in writing to the County. The Contractor's waiver request must include a justification for seeking the waiver.

- G. The Contractor must provide an electronic version of the complete and final Operating and Maintenance Manuals in original electronic file format on a flash drive. The Contractor must also provide one (1) electronic pdf file of each bound Operating and Maintenance Manual that represents each Manual's content. The electronic pdf file must match the Operating and Maintenance Manual content and organizational structure.

1.07 SUBSTANTIAL COMPLETION INSPECTION PROCEDURES

- A. Upon receipt of the Contractor's request for inspection, the County will either proceed with inspection or advise the Contractor of incomplete prerequisites.

- B. Following the initial inspection, the County will either prepare the certificate of Substantial Completion, or advise the Contractor of Work which must be performed before the certificate will be issued. The County will repeat the inspection when requested in writing and when assured that the Work has been substantially completed.

- C. Results of the completed inspection will form the initial "punch list" for final acceptance.

1.08 PREREQUISITES FOR FINAL ACCEPTANCE.

Complete the following before requesting the County's final inspection for certification of final acceptance, and final payment. List known exceptions, if any, in the request.

- A. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates for insurance for products and completed operations where required.

- B. Submit written certification that:
 - 1. The County's final punch list of itemized Work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance.
 - 2. The Contract Documents have been reviewed and Work has been completed in accordance with Contract Documents.

3. Equipment and systems have been tested in the presence of the County and are operational.
4. Work is completed and ready for final inspection.

C. Submit consent of surety.

D. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

1.09 FINAL ACCEPTANCE INSPECTION PROCEDURES

A. The County will re-inspect the Work upon receipt of the Contractor's written notice that the Work, including punch list items resulting from earlier inspections, has been completed, except for those items for which completion has been delayed because of circumstances that are acceptable to the County.

B. Upon completion of re-inspection, the County will either prepare a certificate of final acceptance or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled, which are required for final acceptance.

C. If necessary, the re-inspection procedure will be repeated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The purpose of the Project Record Documents is to provide the County with factual information regarding all aspects of the Work, both concealed and visible.
- B. To insure the Work was constructed in conformance with the Contract Drawings, the following survey documents are required to be prepared and certified by a Surveyor as per Spec Section 01050 Surveying and Field Engineering:
 - 1. Asset Attribute Data Form
 - 2. Pipe Deflection Table
 - 3. Gravity Main Data
 - 4. Boundary Survey and Survey Map Report for pump stations and easements with constructed improvements

The Asset Attribute Data and Pipe Deflection Table forms can be found on the County's web site:

<http://www.orangecountyfl.net/WaterGarbageRecycling/UtilitiesCapitalImprovementProgram.aspx>

1.02 DEFINITIONS

- A. Boundary Survey: Boundary survey, map and report certified by a Surveyor shall be provided that meets the requirements of Chapter 5J-17 'Minimum Technical Standards', FAC.
- B. Surveyor: Contractor's Surveyor that is licensed by the State of Florida as a Professional Surveyor and Mapper pursuant to Chapter 472, F.S.

1.03 QUALITY ASSURANCE

- A. Delegate the responsibility for maintenance of the Record Documents to one person on the Contractor's staff as approved by the County.
- B. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of specifications and each sheet of Drawings and other documents where such entry is required to show progress and changes properly.
- C. Make entries within 24-hours after receipt of information has occurred.

1.04 RECORD DOCUMENTS AT SITE

- A. Maintain at the site and always available for County's use one (1) record copy of:
 - 1. Construction Contract, Drawings, Specifications, General Conditions, Supplemental Conditions, Bid Proposal, Instruction to Bidders, Addenda, and all other Contract Documents
 - 2. Change Orders, Verbal Orders, and other modifications to Contract
 - 3. Written instructions by the County as well as correspondence related to Requests for Information (RFIs)
 - 4. Accepted Shop Drawings, Samples, product data, substitution and "or-equal" requests
 - 5. Field test records, inspection certificates, manufacturer certificates and construction photographs
 - 6. Paper copies of the Progressive As-Built Drawings
 - 7. Current Surveyor's tables for the Assets Attribute Data, Pipe Deflection Data, and Gravity Main Data
- B. Maintain the documents in an organized, clean, dry, legible condition and protected from deterioration, loss and damage until completion of the Work, transfer of all record data to the final As-built Drawings for submittal to the County.
- C. Store As-Built Documents and samples in Contractor's office apart from documents used for construction. Do not use As-Built document for construction purposes. Label each document "AS-BUILT" in neat large printed letters. File documents and samples in accordance with CSI/CSC format.
- D. Record information concurrently with construction progress. Do not conceal any Work until required information is recorded.

PART 2 - PRODUCTS

2.01 AS-BUILT SURVEY DRAWINGS

- A. Maintain the electronic As-Built Drawings to accurately record progress of Work and change orders throughout the duration of the Contract.
- B. Date all entries. Enter RFI No., Change Order No., etc. when applicable.
- C. Call attention to the entry by highlighting with a "cloud" drawn around the area affected or other means. In the event of overlapping changes, use different colors for entries of the overlapping changes.
- D. Design call-outs shall have a thin strike line through the design call-out and all As-Built information must be labeled (or abbreviated "AB") and be shown in a bolder text that is completely legible.
- E. Entries shall consist of graphical representations, plan view and profiles, written comments, dimensions, State Plane Coordinates, details and any other information as required to document field and other changes of the actual Work completed. As a

minimum, make entries to also record:

1. Depths of various elements of foundation in relation to finish floor datum and State Plane Coordinates and elevations.
2. As-Built Asset Attribute Data tables shall be completed in the Drawings.
3. When electrical boxes, or underground conduits and plumbing are involved as part of the Work, record true elevations and locations, dimensions between boxes.
4. Actually installed pipe or other work materials, class, pressure-rating, diameter, size, specifications, etc. Similar information for other encountered underground utilities, not installed by Contractor, their owner and actual location if different than shown in the Contract Documents.
5. Details, not on original Contract Drawings, as needed to show the actual location of the Work completed in a manner that allows the County to find it in the future.
6. The Contractor shall mark all arrangements of conduits, circuits, piping, ducts and similar items shown schematically on the construction documents and show on the As-Built Drawings the actual horizontal and vertical alignments and locations.
7. Major architectural and structural changes including relocation of doors, windows, etc. Architectural schedule changes according to Contractor's records and Shop Drawings.

2.02 RECORD DOCUMENTS

- A. Three (3) paper copy sets and three (3) digital media sets of the following final Record Documents below.
 1. The following documents shall be signed and sealed by the Surveyor:
 - a. As-built survey drawings as previously described in paragraph 2.01.
 - b. As-built Asset Attribute Data (see Specification Section 01050 "Surveying and Field Engineering," Table 01050-2 for an example)
 - c. Boundary Survey on a 8 1/2"x11" format of fee simple and/or permanent easement sites for pump stations, treatment facilities, etc.. As a minimum the Boundary Survey shall show all above ground and underground structures or equipment, pipe, and conduit. All property or easement corners and the center of wetwell shall be shown with GPS coordinates. The Boundary Survey field work shall be dated after the Work has been completed.
 - d. Boundary Survey on a 8 1/2"x11" format for Work related to constructed pipes within any permanent easements. As a minimum the Boundary Survey shall show the location of the pipe centerline and property corners with GPS coordinates. The Boundary Survey field work shall be dated after the Work has been completed within the easements.
 - e. Gravity Main Table (see Specification Section 01050 "Surveying and Field Engineering", Table 01050-4 for an example)
 - f. Pipe Deflection Table (see Specification Section 01050 "Surveying and Field Engineering" Table 01050-3 for an example). An electronic blank table will be supplied by the County.
 2. Provide an encompassing digital AutoCAD file in the Engineer's current version of AutoCAD and the file shall be saved under in the format dwg. The file includes all the information of the As-Built Survey and any other graphical information in the As-Built Drawings. It shall include the overall Work, utility system layout and

- associated parcel boundaries and easements. Feature point, line and polygon information for new or altered Work and all accompanying geodetic control and survey data shall be included. The Surveyor's certified As-Built Asset Attribute Data shall be added to the As-Built Drawings.
3. Provide Scanned "As-Built" Drawing sets complete and include the title sheet, plan/profile sheets, cross-sections, and details. Each individual sheet contained in the printed set of the As-Built Drawings shall be included in the electronic drawings, with each sheet being converted into an individual tif (tagged image file). The plan sheets shall be scanned in tif format Group 4 at minimum of 400 dpi resolution to maintain legibility of each drawing. Then, the tif images shall be embedded into a single pdf (Adobe Acrobat) file representing the complete plan set.
 4. Provide Scanned Record Documents reflecting changes from the Contract Documents.

PART 3 - EXECUTION

3.01 FINAL RECORD DOCUMENTS SUBMITTAL

- A. Submit the Final Record Documents within 20-days after Substantial Completion.
 1. Participate in review meetings as required and make required changes and promptly deliver the Final Record Documents to the County.

END OF SECTION

SECTION 01740
WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
- B. Due to sequencing of work and construction schedules, the Contractor recognizes the Owner may need to utilize RIBs that have been completed prior to the official Substantial Completion date for the Project. Deeming a RIB to be partially substantially complete will not initiate the warranty period. Instead, the warranty period for all the RIBs, labor and materials, shall begin at the Substantial Completion date established for the entire Project.

1.02 RELATED WORK

- A. Refer to Conditions of Contract for the general requirements relating to warranties and bonds.
- B. General closeout requirements are included in Section 01700 "Project Closeout."
- C. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections of Division 2 through 16.

1.03 DEFINITIONS

- A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the County.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the County.

1.04 SUBMITTALS

- A. Submit written warranties to the County prior to requesting a Substantial Completion Inspection as outlined in Section 01700 "Project Closeout." If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the County.

- B. When a designated portion of the Work is completed and occupied or used by the County, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the County within 15-days of completion of that designated portion of the Work.
- C. When a special warranty is required to be executed by the Contractor, or the Contractor and a Subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the County for approval prior to final execution.
- D. Refer to individual Sections of Divisions 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.
- E. Prior to Substantial Completion Inspection, submit to the County two (2) copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, Subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents and sized to receive 8-1/2-inch by 11-inch three-hole punched paper.
 - 2. Table of Contents will be neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification Section in which specified and the name of the product or work item.
 - 3. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address and telephone number of the installer, supplier and manufacturer.
 - 4. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the project title or name and the name, address and telephone number of the Contractor.
 - 5. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.05 WARRANTY REQUIREMENT

- A. The Contractor will warrant all equipment in the Contractor's one-year warranty period even though certificates of warranty may not be required. For all major pieces of equipment, the Contractor shall submit a warranty from the equipment manufacturer. "Major" equipment is defined as a device having a 5 HP or larger motor or which lists for more than \$1,000.00.
- B. In the event that an equipment manufacturer or supplier is unwilling to provide a one-year warranty commencing at Substantial Completion, the Contractor will obtain from the manufacturer a warranty of sufficient length commencing at the time of equipment delivery to the job site, such that the warranty will extend to at least 1-year past substantial completion.

- C. If an individual specification section requires a particular warranty more stringent than that required by this Section or the General Conditions, the more stringent requirements will govern for the applicable portion of the Work.
- D. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- E. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty will be equal to the original warranty with an equitable adjustment for depreciation.
- F. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the County has benefited from use of the Work through a portion of its anticipated useful service life.
- G. County's Recourse: Written warranties made to the County are in addition to implied warranties, and will not limit the duties, obligations, rights and remedies otherwise available under the law, nor will warranty periods be interpreted as limitations on time in which the County can enforce such other duties, obligations, rights, or remedies.
- H. Rejection of Warranties: The County reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- I. The County reserves the right to refuse to accept Work for the project where a special warranty, certification, or similar commitment is required on such work or part of the Work, until evidence is presented that entities required to counter-sign such commitments are willing to do so.
- J. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and Subcontractors required to countersign special warranties with the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 DELIVERABLES

- A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and Subcontractors, and bind into a commercial quality standard 3-ring binder; submit 5 copies of the warranties and bonds to the County

for review.

1. The warranties and bonds shall include:
 - a. Equipment or product description
 - b. Manufacturer's name, principal, address and telephone number
 - c. Contractor, name of responsible principal, address and telephone number
 - d. Local supplier's or representatives name and address
 - e. Scope of warranty or bond
 - f. Proper procedure in case of failure
 - g. Instances which might affect the validity of warranty or bond
 - h. Date of beginning of warranty, bond or service and maintenance contract
 - i. Duration of warranty, bond or service maintenance contract

B. Warranties

1. Refer to Section 02442. During the warranty period, any defects which affect the integrity or strength of the liner shall be repaired at the Contractor's expense in a manner acceptable to the County.

END OF SECTION

SECTION 02080

ABANDONMENT, REMOVAL, AND SALVAGE OR DISPOSAL OF EXISTING PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This section specifies the furnishing of all labor, materials, equipment, and incidentals required to abandon, remove, salvage, and/or dispose of existing pipelines and appurtenances as shown on the Drawings and as specified herein.

1.02 QUALITY ASSURANCE

- A. Permits and Licenses: Contractor shall obtain and pay respective fees for all necessary permits and licenses for performing the Work and shall furnish a copy of same to the County prior to commencing the Work. The Contractor shall comply with the requirements of the permits. All removal or abandonment of asbestos pipe material shall be performed by a licensed asbestos abatement Contractor or Subcontractor registered in the State of Florida.
- B. Notices: Contractor shall issue written notices of planned Work to companies or local authorities owning utility conduit, wires, or pipes running to or through the project site. Copies of said notices shall be submitted to the County.
- C. Standards:
 - 1. Florida Administrative Code, Chapter 62-204.800
 - 2. National Emission Standards Hazardous Air Pollution (NESHAP), 40 CFR Part 61, Subpart M, latest revision
 - 3. Occupational Safety and Health Act, 29 CFR
 - 4. The Environmental Protection Agency (EPA) Asbestos Abatement Worker Protection Rule
 - 5. Florida Statute 455.300
 - 6. Asbestos pipe handling best management practices provided at the end of this section
- D. Quality Control
 - 1. It shall be the responsibility of the Contractor to provide supervision and inspections to ensure that the existing piping is removed and disposed, salvaged, or abandoned as designated in the Drawings and as specified herein.
 - 2. Asbestos Pipe
 - a. All removal or abandonment of pipe material containing asbestos shall be performed by a licensed asbestos abatement Contractor or Subcontractor.

- b. The asbestos abatement Contractor or Subcontractor shall contact the Orange County Environmental Protection Division (407-836-1400) prior to removal or abandonment of any asbestos material and shall obtain all required permits and licenses and issue all required notices as required by the Orange County Environmental Protection Division. The Contractor shall be responsible for all fees associated with permits, licenses, and notices to the governing regulatory agencies.
- c. The asbestos abatement Contractor shall perform Work in accordance with all applicable standards referenced in paragraph 1.02.C of this section.
- d. The asbestos abatement Contractor shall have experience performing asbestos removal similar to this Project.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Shop Drawings

1. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
2. Shop Drawings shall be submitted to the County for review and acceptance prior to construction in accordance with these specifications for the following:
 - a. Grout
 - b. Caps and plugs
 - c. Credentials of licensed asbestos abatement Contractor including current certification.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 REMOVAL, ABANDONMENT, SALVAGE, AND DISPOSAL

- A. General: Existing piping designated on the Drawings to be removed shall be exposed and removed by the Contractor.
- B. Removal and Disposal
 1. Pipe designated to be removed shall be completely drained and the contents properly disposed. The piping system including fittings and valves shall then be completely removed from the site.
 2. Existing services and/or connections not shown on the Drawings shall be removed in accordance with this section at no additional cost. Existing live services encountered shall be maintained.
 3. Asbestos: Pipe material containing asbestos shall be removed and disposed by a licensed asbestos abatement Contractor or Subcontractor.

4. Structures shall be removed in accordance with Section 02050 "Demolition of Existing Structures."

C. Removal of material to be salvaged

1. Pipe designated on the Drawings to be removed and salvaged shall be completely drained and the contents properly disposed. The pipe shall then be thoroughly pressure washed, palletized on wooden skids to a dimension not exceeding the recommendation of the manufacturer, and conveyed to the County at the location designated by the County.
2. Items to be salvaged:
 - a. Air release valves
 - b. Sanitary manhole rings and covers
 - c. Isolation valves
 - d. Valve boxes
 - e. Fire hydrant and valve assemblies

D. Abandonment

1. Pipe designated on the Drawings to be abandoned (or retired in place) shall be left in place, drained, and its contents properly disposed. Pipe requires end caps or plugs. All air release valves and vaults, valve boxes, fire hydrants, manholes, and manhole rings and covers shall be removed and disposed of or salvaged as specified above.
2. All pipe 4-inches or larger to be abandoned in place shall be completely filled with grout and each end of the pipe shall be plugged in a manner acceptable to the County.
3. Grout: Where designated on the Drawings, pipe to be abandoned shall be filled with grout in accordance with Section 03600 "Grouting."
4. Plugs: Pipe to be abandoned shall be capped or plugged with a mechanical joint fitting that will prevent soil or other deposits from entering the pipe.

E. Asbestos Pipe Handling Best Management Practices

1. Projects will require worker documentation before entering the regulated Work area. A copy of: their current training certificate (workers and their supervisor); current medical condition showing the doctor approved their working with asbestos and wearing a respirator; signed acknowledgment forms; and current record (6-months) of each workers respirator fit test will be required from all workers.
2. Projects also require air monitoring. OSHA will accept historic data on air monitoring within 12-months of the Project, provided the data is from a project of like material and conditions with a crew of the same experience, supervision, and training. Otherwise, monitoring is required throughout the Project. OSHA requires two (2) types of personnel air monitoring, full shift and 30-minute excursion level (when highest levels are anticipated).
3. Some provisions should be made for worker showering or otherwise washing following work before removing respirators, etc. Even if direct exposure is not anticipated, and at a minimum, a source of water to rinse the respirators, wash workers faces and hands, and (in the event of unanticipated direct exposure) some place to shower is required. The workers will also need a change room and some place to keep their street clothes and personal possessions.

4. Proposals to remove asbestos pipe sections by cutting must address how the cutting debris will be captured and kept from becoming airborne. Soil that could be considered contaminated may also have to be removed.
5. Licensed asbestos abatement Contractors or Subcontractors should have a pollution endorsement in their liability insurance in case of asbestos fiber release. A contingency plan, in case the project does not run as smoothly as expected, should be developed and include emergency phone numbers kept on site during the Project.
6. Daily logs of the asbestos removal work should be kept, and should include sign in sheets for the workers and whatever air monitoring was done. Accident reports and other reports or correspondence if something unusual happened should also be included.
7. Waste receipts must be kept through all stages of transport from the site to, and including, the acceptance at the dumpsite where the material will be abandoned. Amount of material removed must be equal to the amount of material to be turned into to the dump.
8. The primary Contractor will give "approval for tear down" at project completion, indicating that all asbestos removal operations are complete and whether there is a need for any air monitoring. Air monitoring, if not required by any governing agency or approved permit as discussed previously, may also be required by the County if documentation to the general public pertaining to contamination is deemed necessary. This air monitoring is normally done by collecting area samples downwind of the project at the barrier tape or just inside it. It requires a source of electricity to run the pumps, which is often provided by a generator.

END OF SECTION

SECTION 02100
TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. The Work specified in this Section consists of designing, providing, maintaining and removing temporary erosion, sedimentation and turbidity controls as necessary.
2. Temporary erosion controls include, but are not limited to, grassing, mulching, setting, watering and reseeding on-site surfaces and soil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by federal, state and local requirements and by the County.
3. Temporary sedimentation controls include, but are not limited to; silt fence, silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by federal, state and local requirements and by the County.
4. Temporary turbidity controls include, but are not limited to, floating or staked turbidity barriers which will ensure that turbidity pollution will be either eliminated or maintained within acceptable limits as established by Federal, state, and local requirements and by the County.
5. Contractor is responsible for providing effective temporary erosion, sediment, and turbidity control measures during construction or until permanent controls become effective.

- B. Related Work Described Elsewhere: South Florida Building Code and Standard Building Code, FDOT Standard Specifications for road and bridge construction and FDOT Design Standards.

PART 2 - PRODUCTS

2.01 EROSION CONTROL

- A. Netting Fence: fabricated of material acceptable to the County.
- B. Sod is specified in Section 02578, "Solid Sodding."

2.02 SEDIMENTATION CONTROL

- A. Bales: clean, seed-free cereal hay type.
- B. Netting: fabricated of material acceptable to the County.
- 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.
- F. Rock Bags: conforming to FDOT Specifications.

2.03 TURBIDITY CONTROL

- A. Conforming to FDOT Design Standards Index 103 - Turbidity Barriers.

PART 3 - EXECUTION

3.01 EROSION CONTROL

- A. Minimum Procedures for Grassing Are:
 1. Scarify slopes to a depth of not less than 6-inches and remove large clods, rock, stumps and 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 drills 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 on sloped surfaces.
 5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit unsatisfactory growth. Backfill and seed eroded areas.

3.02 SEDIMENTATION CONTROL

- A. Install and maintain silt fence, silt dams, traps, barriers and appurtenances as shown on the approved descriptions and working Drawings. Hay bales which deteriorate and filter stone which is dislodged shall be replaced.

3.03 TURBIDITY CONTROL

- A. Install and maintain turbidity barriers daily and as described in FDOT Index #103.

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, the Contractor shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

END OF SECTION

SECTION 02215
FINISH GRADING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Provide finish grading to all areas within the limits of construction.
- B. Grade sub-soil. Cut out areas to receive stabilizing base course materials for paving and sidewalks. Place, finish grade, and compact topsoil.

1.02 PROTECTION

- A. Prevent damage to existing fencing, trees, landscaping, natural features, benchmarks, pavement, and utility lines. Correct damage at no cost to the County.

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.
- B. Topsoil: Friable loam free from subsoil, roots, grass, excessive amount of weeds, stones, and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4% and a maximum of 25% organic matter. The topsoil shall be suitable for the proposed plant growth shown on the Drawings and specified. Use topsoil stockpiles on site if conforming to these requirements. If there is not sufficient topsoil available at the project site, the Contractor shall furnish additional topsoil as required to complete the Work at no additional cost to the County.

PART 3 - EXECUTION

3.01 SUB SOIL PREPARATION

- A. Rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, etc. Remove sub-soil that has been contaminated with petroleum products.

- B. Cut out areas to subgrade elevation which are to receive stabilizing base for paving and sidewalks.
- C. Bring sub soil to required levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.
- D. Slope grade away from building a minimum of 2-inches in 10-feet unless indicated otherwise on the Drawings.
- E. Cultivate subgrade to a depth of 3-inches where topsoil is to be placed. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted sub-soil.

3.02 PLACING TOPSOIL

- A. Place topsoil in areas where seeding, sodding, and planting is to be performed. Place to the following minimum depths, up to finished grade elevations.
 - 1. 6-inches for seeded areas
 - 2. 4-1/2-inches for sodded areas
 - 3. 24-inches for shrub beds
 - 4. 18-inches for flower beds
- B. Use topsoil in relatively dry state. Place during dry weather.
- C. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles, and contours of subgrades.
- D. Remove stones, roots, grass, weeds, debris, and other foreign material while spreading.
- E. Manually spread topsoil around trees, plants, and buildings to prevent damage which may be caused by grading equipment.
- F. Lightly compact placed topsoil.

3.03 SURPLUS MATERIAL

- A. Remove surplus sub soil and topsoil from site.
- B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 02220
EXCAVATING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Excavate, backfill, and compact as required for the construction of the utility system consisting of piping and appurtenances, and structural construction as shown on the Drawings and specified herein. The Contractor shall furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, compaction, grading, and slope protection to complete the Work. The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, all under ground utilities locations and appurtenances shown on the construction Drawings.
- B. Definitions:
1. Maximum Density: Maximum weight in pounds per cubic foot of a specific material as determined by AASHTO T-180 (ASTM D155).
 2. Optimum Moisture: Percentage of water in a specific material at maximum density.
 3. Rock Excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.
 4. Suitable: Suitable materials for fills shall be non-cohesive, non-plastic granular local sand and shall be free from vegetation, organic material, marl, silt, or muck. The Contractor shall furnish all additional fill material required.
 5. Unsuitable: Unsuitable materials are highly organic soil (peat or muck) classified as A-8 in accordance with AASHTO Designation M 145.
- C. Plan For Earthwork: The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the Work, the general and local conditions, and all other matters which can in any way affect the Work under this Contract. Prior to commencing the excavation, the Contractor shall submit a plan of his proposed operations, including maintenance of traffic, to the County for review. The Contractor shall consider, and his plan for excavation shall reflect, the equipment and methods to be employed in the excavation. The prices established in the Proposal for the Work to be done will reflect all costs pertaining to the Work.

1.02 QUALITY ASSURANCE

- A. Testing laboratory employed by the County will make such tests as are deemed advisable. The Contractor shall schedule his work to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress. Costs for initial testing shall be paid by the County; however, tests which have to be repeated because of the failure of the tested material to meet specification shall be paid for by the Contractor and the cost of re-testing shall be deducted from payments due the Contractor.
- B. Standards
 - 1. AASHTO: American Association of State Highway and Transportation Officials
 - 2. ANSI: American National Standards Institute
 - 3. ASCE: American Society of Civil Engineers
 - 4. ASTM: American Society for Testing and Materials
 - 5. AWWA: American Water Works Association
 - 6. OSHA 29 CFR Subpart P – Excavations and Trenches a) 1926.650, 1926.651, 1926.652
 - 7. OSHA 29 CFR Subpart J - a) 1910.146 for Confined Space Entry

1.03 JOB CONDITIONS

- A. Existing Utilities
 - 1. The Contractor is responsible for subsurface verification of existing utilities prior to construction. Locate existing utilities in the area of work in accordance with Sunshine State One Call regulations, Chapter 556, "Underground Facility Damage Prevention and Safety Act", FS.
 - 2. Should uncharted or incorrectly charted piping or other utility be encountered during excavation, notify the County. Keep all facilities in operation and repair damaged utilities to the satisfaction of the County.
 - 3. Damage and repair costs to such piping or utilities are the Contractor's responsibility.
 - 4. If utilities are to remain in place, the Contractor shall provide adequate means of protection.
- B. Test borings and the sub-surface exploration data if previously done on the site will be made available upon request and are for the Contractor's information only.

1.04 PROTECTION

- A. Sheet piling and Bracing
 - 1. Requirements of the Trench Safety Act shall be adhered to at all times.

2. Furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, to protect adjacent structures and power poles from undermining, and to protect workers from hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams or other acceptable methods. If the County is of the opinion that at any point sufficient or proper supports have not been provided, the County may order additional supports put in at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and compacted. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no additional expense to the County.
3. The Contractor shall construct the sheeting outside the neat lines of the foundation unless indicated otherwise for the method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressure to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected by the Contractor at their own expense so as to provide the necessary clearances and dimensions.
4. Where sheeting and bracing is required to support the sides of excavations for structures, the Contractor shall engage a Professional Geotechnical Engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design, and the Professional Engineer shall provide certification of this.
5. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.
6. The Contractor shall leave in place to be embedded in the backfill all sheeting and bracing not shown on the Drawings but which the County may direct him in writing to leave in place at any time during the progress of the Work for the purpose of preventing damage to structures, utilities, or property, whether public or private. The County may direct that timber used for sheeting and bracing be cut off at any specified elevation.
7. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, or otherwise as may be directed by the County.
8. The right of the County to order sheeting and bracing left in place shall not be construed as creating any obligation on the County's part to issue such orders, and their failure to exercise this right shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the Work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

9. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than 1-foot above the top of any pipe.

B. Pumping and Drainage:

1. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing the water level to return to the natural level as stipulated in Section 02140 "Dewatering." The Contractor shall engage a Professional Geotechnical Engineer registered in the State of Florida to design the dewatering systems. The Contractor shall submit to the County for a plan for dewatering systems prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan, and the Professional Engineer shall provide certification of this. The Professional Engineer shall be required to monitor the performance of the dewatering systems during the progress of the Work and require such modifications as may be required to assure that the systems are performing satisfactorily.
2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the proposed bottom of excavation and to preserve the integrity of adjacent structures. Dewatering by trench pumping will not be permitted if migration of fine grained natural material from bottom, sidewalls, or bedding material will occur.
3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.
4. The Contractor shall take all additional precautions to prevent uplift of any structure during construction.
5. Permission to use any storm sewers or drains for water disposal purposes shall be obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. However, the Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and he shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the County or the authority having jurisdiction, at no cost to the County.
6. The Contractor shall prevent flotation by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.
7. Removal of dewatering equipment shall be accomplished after compaction/density testing has been completed and the system is no longer required. The Contractor shall remove the material and equipment constituting the system.
8. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, or other contaminants in order to prevent adverse effects on groundwater quality.

1.05 TESTING AND INSPECTION SERVICE

- A. The County will provide a geotechnical testing and inspection service. The services include testing soil materials and quality control testing during filling and backfilling operations. Samples of soil materials shall be furnished to the testing service by the Contractor. The County shall pay costs of initial geotechnical testing. The Contractor shall pay for any subsequent testing required due to failure and laboratory stand-by charges incurred.
- B. The Contractor shall provide monthly density testing reports to the County during backfilling activities. Density testing reports not submitted in a timely manner shall result in rejection of the pipe installed and rejection of the density testing reports until such time that density re-testing is coordinated and repeated at the Contractors expense.
- C. Density testing scheduled subsequent to backfilling activities shall be coordinated with, and witnessed by the County. Failure by the Contractor to coordinate or have the County present shall result in rejection of the submitted density testing reports and re-testing at the Contractor's expense.
- D. Dewatering systems shall not be removed until compaction/density testing has been completed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General:
 - 1. All fill material shall be subject to the review and acceptance of the County.
 - 2. All fill material shall be free of organic material, trash, or other objectionable material. The Contractor shall remove excess or unsuitable material from the job site.
- B. Common Fill Material: Common fill shall consist of mineral soil, substantially free of clay, organic material, muck, loam, wood, trash, and other objectionable material which may be compressible or which cannot be compacted properly. Common fill shall not contain stones larger than 3-1/2-inches in any dimension in the top 12-inches or 6-inches in any dimension in the balance of fill area. Common fill shall not contain asphalt, broken concrete, masonry, rubble or other similar materials. It shall have physical properties that allow it to be easily spread and compacted during filling. Additional common fill shall be no more than 12 % by weight finer than the No. 200 mesh sieve, unless finer material is approved for use in a specific location by the County. Select Common Fill shall be as specified as above from common fill, except that the material shall contain no stones larger than 1/2-inches in largest dimension, and shall be no more than 5 % by weight finer than the No. 200 mesh sieve.

- C. Structural Fill: Structural fill shall be reasonably well graded sand to gravelly sand having the following gradation:

US Sieve Size	Percent Passing By Weight
No. 1	100
No. 4	75 - 100
No. 40	15 - 80
No. 100	0 - 30
No. 200	0 - 12

- D. Class 1 Soils*: Manufactured angular, granular material, 1/4 to 1-1/2-inches (6 to 4 mm) size, including materials having significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Sieve analysis for crushed stone is given below separately.

Crushed Stone: Crushed stone shall consist of clean mineral aggregate free from clay, loam or organic matter, conforming to ASTM C33 stone size No. 89 and with particle size limits as follows:

U.S. Sieve Size	% Passing By Weight
1/2	100
3/8	100
No. 4	20 - 25
No. 8	5 - 30
No. 16	0 - 10
No. 50	0 - 2

- E. Class II Soils**:

1. GW: Well graded gravels and gravel-sand mixtures, little or no fines. Fifty percent or more retained on No. 4 sieve. More than 95 % retained on No. 200 sieve. Clean.
2. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines. Fifty percent or more retained on No. 4 sieve. More than 95 % retained on No. 200 sieve. Clean.
3. SW: Well graded sands and gravelly sands, little or no fines. More than passes No. 4 sieve. More than 95 % retained on No. 200 sieve. Clean.
4. SP: Poorly graded sands and gravelly sands, little or no fines. More than 50 % passes No. 4 sieve. More than 95 % retained on No. 200 sieve. Clean.

*Soils defined as Class I materials are not defined in ASTM D2487.

**In accordance with ASTM D2487, less than 5 % pass No. 200 sieve.

- F. Coarse Sand: Sand shall consist of clean mineral aggregate with particle size limits as follows:

U.S. Sieve Size	Percent Passing By Weight
3/8	100
No. 10	85 – 100
No. 40	20 – 40
No. 200	0 - 12

- G. Other Material: All other material, not specifically described, but required for proper completion of the Work shall be selected by the Contractor and acceptable by the County.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clearing:
1. The construction areas shall be cleared of all obstructions and vegetation including large roots and undergrowth within 10-feet of the lines of the excavation.
 2. Strip and stockpile topsoil on the site at the location to be determined by the County.

3.02 EXCAVATION

- A. General: Excavations for roadways, structures, and utilities must be carefully executed in order to avoid interruption of utility service.
- B. Excavating for Roadways/Structures/Utilities:
1. Excavation shall be made to such dimensions as will give suitable room for building the foundations and the structures, for bracing and supporting, for pumping and draining, and for all other work required.
 - a. Excavation for precast or prefabricated structures shall be carried to an elevation 2-feet lower than the proposed outside bottom of the structure to provide space for the select backfill material. Prior to placing the select backfill, the excavation shall be measured by the County to verify that the excavation has been carried to the proper depth and is reasonably uniform over the area to be occupied by the structure.
 - b. Excavation for structures constructed or cast in place in dewatered excavations shall be carried down to the bottom of the structure where dewatering methods are such that a dry excavation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the founding elevation in dewatered excavations shall be replaced with Class B concrete.
 - c. Footings: Cast-in-place concrete footing sides shall be formed immediately after excavation.
 2. Immediately document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during the course of construction.

3. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of the Work.
4. Encounters with subsurface obstructions shall be hand excavated.
5. Excavation and dewatering shall be accomplished by methods that preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or other construction methods shall be removed and replaced by crushed stone as required by the County at the Contractor's expense.
6. The bottom of excavations shall be rendered firm and dry before placing any piping or structure.
7. All pavements shall be cut with saws or approved power tools prior to removal.
8. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor.

3.03 DRAINAGE

- A. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition. The dewatering method used shall prevent disturbance of earth below grade.
- B. All water pumped or drained from the Work shall be disposed of in a suitable manner without undue interference with other work, without damage to surrounding property, and in accordance with pertinent rules and regulations.
- C. No construction, including pipe laying, shall be allowed in water. No water shall be allowed to contact masonry or concrete within 24-hours after being placed. The Contractor shall constantly guard against damage due to water and take full responsibility for all damage resulting from his failure to do so.
- D. The Contractor will be required at his expense to excavate below grade and refill with crushed stone (gradation 57 or 89) or other acceptable fill material if the County determines that adequate dewatering has not been provided.

3.04 UNDERCUT

- A. If the bottom of any excavation is below that shown on the Drawings or specified because of Contractor error, convenience, or unsuitable subgrade due the Contractor's excavation methods, he shall refill to normal grade with fill at his own cost. Fill material and compaction method shall be approved by the County.

3.05 FILL AND COMPACTION

- A. Compact and backfill excavations and construct embankment according to the following schedule. (Modified Proctor standard shall be ASTM D-1557):

STRUCTURES AND ROADWORK

Area	Material	Compaction
Beneath Structures	Structural Fill	12-inch lifts, compacted to 98% maximum density as determined by AASHTO T-180. Fill Should not be placed over any in-place soils until those deposits have been compacted to 98% Modified Proctor.
Around Structures	Structural Fill	12-inch lifts, 95% of maximum density as determined by AASHTO T-180. Rubber Tire or vibratory plate compactors shall be used
Beneath Paved Surfaces	Common Fill	12-inch lifts, 98% by maximum density as determined by AASHTO T-180 or as required by the FDOT Standards.
Open Areas	Common Fill	12-inch lifts, 95% by maximum density as determined by AASHTO T-180.

- B. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.
- C. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. The backfill operation shall be performed to comply with all rules and regulations and in such a manner that it does not create a nuisance or safety hazard.
- D. Embankments shall be constructed true to lines, grades, and cross sections shown on the plans or ordered by the County. Embankments shall be placed in successive layers of not more than 8-inches in thickness, loose measure, for the full width of the embankment. As far as practicable, traffic over the Work during the construction phase shall be distributed so as to cover the maximum surface area of each layer.
- E. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to the County. Acceptance will be considered only after the Contractor has performed tests, at the Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. The County's acceptance shall be in writing.
- F. One compaction test location shall be required for each 300 linear feet of pipe and for every 100 square feet of backfill around structures as a minimum. The County may determine that more compaction tests are required to certify the installation depending on field conditions. The locations of the compaction tests within the trench shall be in conformance with the following schedule:
1. At least one test at the spring line of the pipe.

2. At least one test for each 12-inch layer of backfill within the pipe bedding zone for pipes 24-inches and larger.
3. One test at an elevation of 1-foot above the top of pipe.
4. One test for each 2-feet of backfill placed from 1-foot above the top of the pipe to finished grade elevation.
5. Density testing is required for sanitary sewer manholes. Tests shall be staggered around the manhole within 3-feet of the structure's outside diameter.
 - a. First test shall be 1-foot above the structure base.
 - b. Second test shall be 2-feet above the first test and subsequent tests every 2-feet up the finished grade.
6. The Contractor shall provide additional compaction and testing prior to commencing further construction if the County's testing reports and inspection indicate that the fill has been placed below specified density.
7. The Contractor shall coordinate testing with the County approved testing laboratory and shall provide monthly test results to the County in a timely manner during construction activities. Density testing scheduled subsequent to backfilling activities shall be coordinated with the County and witnessed by the County representative. Failure by the Contractor to coordinate or have the County representative present shall result in rejection of the submitted density testing reports and re-testing at the Contractor's expense. Density testing reports not submitted in a timely manner shall result in rejection of the pipe installed and rejection of the density testing reports until such time that density re-testing is coordinated and repeated at the Contractor's expense as deemed necessary by the County's representative.
8. Dewatering systems shall not be removed until compaction/density testing has been completed.

END OF SECTION

SECTION 02442
HIGH-DENSITY POLYETHYLENE GEOMEMBRANE

PART 1 – GENERAL

1.01 Description

This section describes the work necessary to install High-Density Polyethylene (HDPE) geomembrane (liner) as required for the rehabilitation of a reclaimed water recharge system as indicated on the Drawings and specified herein.

1.02 Related Work

1.03 Definitions

CONTRACTOR – Party which is under contract with the OWNER to perform the work contained within this specification.

ENGINEER - The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.

Geomembrane Manufacturer (MANUFACTURER) - The party responsible for manufacturing the geocomposite rolls.

INSTALLER- Party responsible for field handling, transporting, storing and deploying the geomembrane.

1.04 Qualifications

The installer shall have completed a project in the last ten years which included a minimum installation of 500,000 square feet of geomembrane.

1.05 Material

White High Performance High-Density Polyethylene (HDPE) Liner Geomembrane manufactured by GSE Environmental, LLC, or pre-approved equal.

The materials supplied under these Specifications shall consist of 100% virgin products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

1.06 Submittals

Submit the following in accordance with the General Conditions of these specifications:

- 1) Manufacturer Corporate Background
- 2) A list of completed facilities totaling 2,000,000 square feet of geomembrane during the last five years.
- 3) Geomembrane Installer Corporate Background
- 4) Shop Drawings.
- 5) Four (4) samples (1 ft/sq. minimum each) of the proposed geomembrane finished product.
- 6) Installation schedule.
- 7) Liner material and installation warranty.
- 8) A certification by the Manufacturer stating the Installer is qualified, properly trained, and able to successfully install the Manufacturer's liner and perform the liner installation work.

1.07 Warranty

The material shall be warranted, on a pro-rata basis against Manufacturer's defects for a minimum period of 10 years from the date of Substantial Completion. The installation shall be warranted against defects in workmanship for a period of 5 year from the date of Substantial Completion. See Section 01740 for additional Warranty Information.

1.08 Measurement and Payment

High-density geomembranes shall be measured per square yard. Payment for the work in this section shall be included as part of the lump sum bid amounts stated in the proposal. Refer to Section 01270 for additional measurement and payment provisions and schedule of values requirements.

1.09 Material Labeling, Delivery, Storage and Handling

- A. Labeling- Each roll delivered to the site shall be wrapped and labeled by the Manufacturer. The label will identify the:
 1. manufacturer's name.
 2. product identification.
 3. thickness.
 4. length.
 5. width.
 6. roll number.
- B. Delivery- Rolls will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
- C. Storage- The on-site storage location provided by the Contractor to protect the geomembrane from abrasions, excessive dirt and moisture shall have the following characteristics:

1. level (no wooden pallets),
2. smooth,
3. dry,
4. protected from theft and vandalism, and
5. adjacent to the area being lined.

D. Handling

1. The Installer shall note any visible damage to roll materials on the Bill of Lading prior to unloading roll materials. Should any visible damage be noted, Installer or Consultant shall notify the Manufacturer in writing immediately.
2. The Contractor and Installer shall handle all rolls in such a manner to ensure they are not damaged in any way.
3. The Installer shall take any necessary precautions to prevent damage to underlying layers during geomembrane placement.

PART 2 - PRODUCTS

2.01 Geomembrane

A. Resin

1. Resin shall be new prime quality virgin, compounded polyethylene resin.
2. Natural resin (without carbon black) shall meet the following additional minimum requirements:

Table 1: Raw Material Properties

Property	Test Method ⁽¹⁾	HDPE
Density (g/cm ³)	ASTM D 1505	≥0.932
Melt Flow Index (g/10 min)	ASTM D 1238 (190/2.16)	≤1.0
OIT (minutes)	ASTM D 3895 (1 atm/200°C)	≥160

¹Test equipment and procedures that enable effective and economical confirmation that the product will conform to specifications based on the noted procedures. Some test procedures have been modified for application to geosynthetics. All procedures and values are subject to change without prior notification.

B. Geomembrane Sheets

1. Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.

2. Geomembrane liner sheets shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.
3. All geomembrane liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in Table 2.
4. There shall be no factory seaming.

C. Geomembrane Properties

1. The flexible membrane liner material shall be 60 mil textured high-density polyethylene (HDPE) geomembrane manufactured with a minimum 22.5-foot seamless width. There shall be no factory seams.
2. The surface texturing shall be of the same type of polymer and formulation as the base sheet polymer and its formulation.
3. The geomembrane shall be textured on both sides using coextrusion texturing methods. Spray on and embossed or structured texturing shall not be approved.
4. The geomembrane shall have a white top surface.
5. The specified geomembrane shall have properties that meet or exceed the values listed in the following table below.

Table 2: Geomembrane Properties

Property	Test Method	Frequency	Minimum Average Roll Value ⁽¹⁾
			60 mil
Thickness, mil <ul style="list-style-type: none"> • Nominal • Minimum • Average • Lowest individual reading 	ASTM D 5994	every roll	60 54 51
Density, g/cm ³	ASTM D 1505	200,000 lbs	0.940
Tensile Properties (each direction)	ASTM D 6693, Type IV		
Strength at Break, lb/in-width	Dumbbell, 2 ipm		115 132
Strength at Yield, lb/in-width	G.L. 2.0 in G.L. 1.3 in	20,000 lbs	200 13
Elongation at Break, %			
Elongation at Yield, %			

Tear Resistance, lb	ASTM D 1004	45,000 lbs	45
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	130
Multi-axial Break Resistance, %	ASTM D 5617	per formulation	15
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾
Asperity Height, mil	ASTM D 7466	second roll	18
Notch Constant Tensile Load ⁽³⁾ , hr	ASTM D 5397, Appendix	200,000 lbs	1,000
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>160
High Pressure Oxidative Induction Time, mins	ASTM D 5885 150°C, O ₂ , 3.4 Mpa	per formulation	>800
Oven Aging 85°C High Pressure OIT (min. avg.) - % retained after 90 days	ASTM D 5721 ASTM D 5885	per formulation	80
UV Resistance High Pressure OIT (min. avg.) - % retained after 1,600 hours	GM 11 ASTM D 5885	per formulation	80
Typical Roll Dimensions			
Roll Length ⁽⁴⁾ , ft	Double-Sided Textured		520
Roll Width ⁽⁴⁾ , ft			22.5
Roll Area, ft ²			11,700

NOTES:

- ¹⁾ Leak Location Liner geomembrane may have an overall ash content of 3.0% due to the conductive layer. These values apply to the non-conductive black layer only.
 - ²⁾ Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ³⁾ NCTL may be conducted on smooth conducted on representative smooth geomembrane samples.
 - ⁴⁾ Roll lengths and widths have a tolerance of ± 1%.
- * Modified

D. Extrudate Rod or Bead

1. Extrudate material shall be made from same type resin as the geomembrane.

2. Additives shall be thoroughly dispensed.
3. Materials shall be free of contamination by moisture or foreign matter.

E. Vents

Vents shall be installed in the geomembrane as specified on the drawings and in accordance with the Manufacturer's recommendations.

PART 3 - EXECUTION

3.01 Field Preparation

Prior to installation of geomembrane liner, the footprint of the liner shall be inspected by the installer for protruding tree or plant roots, rocks, or other deleterious materials which were not removed during the clearing and grubbing process and which may damage the liner. The Contractor responsible for clearing and grubbing shall remove these materials and reestablish the grades required to lay the geomembrane liner. See Geotechnical Report for additional site preparation and compaction requirements.

3.02 Pre-Installation

- A. A Geomembrane Pre-Construction Meeting shall be held at the site prior to installation of the geomembrane. At a minimum, the meeting shall be attended by the Installer, Contractor, Owner and Engineer.
- B. Prior to implementing the work within this Section, the Installer shall carefully inspect the installed work of all other Sections and verify that all work is complete to the point where the installation of this Section may properly commence without adverse impact.
- C. If the Installer has any concerns regarding the installed work of other Sections, he shall notify the Engineer.
- D. Equipment
 1. Gauges showing temperatures in apparatus such as extrusion welder or fusion welder shall be present.
 2. An adequate number of welding apparatus shall be available to avoid delaying work.
 3. Power source must be capable of providing constant voltage under combined line load.

3.03 Material Placement

- A. Underlying geosynthetic material shall have all folds, wrinkles, and other undulations removed before placement of the geomembrane.
- B. Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.
- C. The Installer shall maintain a daily field record of the actual placement of each panel, noting the weather conditions, seaming, parameters, panel numbers, seams welded, samples taken, and tests run. The Installer shall provide a copy of the field record to the Consultant no later than the following day.
- D. Unroll the geomembrane using methods that will not damage geomembrane and will protect the underlying surface from damage.
- E. Geomembrane shall be installed and checked per the manufacturer's installation manual. The geomembrane conductive layer shall be installed with the conductive layer down. Please note that a spark tester or ohm meter can be used to determine which side of the geomembrane is the conductive layer. Place in accordance with panel layout submittal and seam panels utilizing the Iso-Wedge modified heater wedge and its respective inserts in the fusion weld equipment. Weld seams in accordance with the Manufacturer recommendations.
- F. In the presence of wind, all geomembranes shall be weighted down with sandbags or the equivalent. Such sandbags shall be used during placement and remain until replaced with cover material.
- G. Do not allow heavy vehicular traffic directly on geomembrane.
- H. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.
- I. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.
- J. Cover soil shall be placed over the geomembrane when shown on the Drawings in a manner that prevents damage to the geomembrane. Placement of the cover soil shall proceed immediately following the placement and inspection of the geomembrane.
- K. Spotting of deployed geomembranes shall be done with no disturbance to the soil subgrade or geosynthetic materials upon which they are placed. Geomembrane "dragging" during placement shall be avoided or minimized when necessary.

3.04 Seams and Overlaps

- A. The geomembrane shall be placed in such a manner as to orient the seams parallel to the line of the maximum slope, i.e. along the slope, not across the slope. Where seams must be oriented across the slope, the geomembrane shall be placed in such a manner that the “up slope” panel forms the upper panel and overlaps the “down slope” panel.
- B. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
- C. Slope seams (panels) shall extend a minimum of 5-feet beyond the grade break into the flat area.
- D. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the Engineer and Installer.
- E. Align seam overlaps consistent with the requirements of the welding equipment being used. A 6-inch overlap is commonly suggested.
- F. During welding operations, provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.
- G. Extrusion Welding
 - 1. Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane.
 - 2. Clean geomembrane surfaces by disc grinder or equivalent.
 - 3. Purge welding apparatus of heat-degraded extrudate before welding.
 - 4. Where the Scope of Work or Drawings require the geomembrane to have an insulated electrically conductive bottom, perform electrical isolation procedure and testing at all extrusion welded patches in accordance with manufacturer installation instructions.
- H. Hot Wedge Welding
 - 1. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
 - 2. Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder.
 - 3. Protect against moisture build-up between sheets.
- I. Trial Welds

1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
2. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
3. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.
 - i. Cut four, one-inch wide by six-inch long test strips from the trial weld.
 - ii. Quantitatively test specimens for peel adhesion, and then for shear strength.
 - iii. Trial weld specimens shall pass when the results shown in the following tables for HDPE are achieved in both peel and shear test.

Property	Test Method	60 mil
Peel Strength (fusion), ppi	ASTM D	98
Peel Strength (extrusion), ppi	6392	78
Shear Strength (fusion & ext.), ppi	ASTM D 6392	121

- iv. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).
 - v. The break is ductile.
 - vi. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
4. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.
 5. The weld sample shall be kept for subsequent testing on laboratory tensometer equipment in accordance with ASTM D 6392.

J. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation as determined by the Engineer. Installer shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds. Cold weather seaming should follow the guidelines as outlined in GRI GM 9.

K. Defects and Repairs

1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

3.05 Field Quality Assurance

Contractor shall submit qualifications of third-party tester for approval by the County.

A. Field Testing

1. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.
 - a. Vacuum testing shall be performed in accordance with ASTM D 5641.
 - b. Air Pressure testing shall be performed in accordance with ASTM D 5820.
 - c. Other approved methods.
2. Coordinate all field testing activities with project RPR.

B. Destructive Testing (performed by third-party with assistance from Installer, if requested by the Owner or Engineer).

1. Location and Frequency of Testing
 - a. Collect destructive test samples at a frequency of one per every 500 lineal feet of seam length.
 - b. Test locations will be determined after seaming. The Engineer shall use judgement to minimize destructive sampling in the critical containment zone, recognizing that original seams made by hot wedge welding are more desirable than extrusion fillet seaming to patch areas where destructive samples are taken. Make appropriate use of test seams.
 - c. Exercise Method of Attributes as described by GRI GM-14 (Geosynthetic Research Institute, <http://www.geosynthetic-institute.org>) to minimize test samples taken.
2. Sampling Procedures are performed as follows:
 - a. Installer shall cut samples at locations designated by the Engineer as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
 - b. Consultant will number each sample, and the location will be noted on the installation as-built.
 - c. Samples shall be twelve (12) inches wide by minimal length with the seam centered lengthwise.
 - d. Cut a 2-inch wide strip from each end of the sample for field-testing.
 - e. Cut the remaining sample into two parts for distribution as follows:
 - i. One portion for Installer, 12-inches by 12 inches
 - ii. One portion for the Third Party laboratory, 12-inches by 18-inches

- iii. Additional samples may be archived if required.
 - f. Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
 - g. Installer shall repair all holes in the geomembrane resulting from destructive sampling.
 - h. Repair and test the continuity of the repair in accordance with these Specifications.
- 3. Failed Seam Procedures
 - a. If the seam fails, Installer shall follow one of two options:
 - i. Reconstruct the seam between any two passed test locations.
 - ii. Trace the weld to intermediate location at least 10 feet minimum or where the seam ends in both directions from the location of the failed test.
 - b. The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than 10 feet long.
 - c. If sample passes, then the seam shall be reconstructed or capped between the test sample locations.
 - d. If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

C. Owner's Testing

In addition to the Contractor's testing requirements, the Owner reserves the right to perform additional testing at the Owner's expense.

3.06 Repair Procedures

- A. Prior to covering the deployed geomembrane, each roll shall be inspected for damage resulting from construction.
- B. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.
- C. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.
- D. Installer shall be responsible for repair of defective areas.
- E. Agreement upon the appropriate repair method shall be decided between Engineer and Installer by using one of the following repair methods:

1. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
2. Abrading and Re-welding- Used to repair short section of a seam.
3. Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
4. Capping- Used to repair long lengths of failed seams.
5. Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.
6. Remove the unacceptable seam and replace with new material.

F. The following procedures shall be observed when a repair method is used:

1. All geomembrane surfaces shall be clean and dry at the time of repair.
2. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.
3. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

G. Repair Verification

1. Number and log each patch repair (performed by Engineer).
2. Non-destructively test each repair using methods specified in this Specification.

3.07 Concrete Attachment Procedure

Liners shall be attached to existing and new concrete as shown on the Drawings and in accordance with the Manufacturer's recommendations and procedures.

END OF SECTION

SECTION 02570
STABILIZED SUBGRADE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: All labor, materials, and equipment required to install stabilized subgrade.

1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO) latest edition:
 - 1. AASHTO T-180 – Moisture-Density Relations of Soils Using a 10-lb Rammer and 18-in Drop
- B. Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition:
 - 1. Section 914 – Stabilization Materials

1.03 QUALITY ASSURANCE

- A. Field compaction density, stability, and thickness testing frequencies of the subgrade shall be tested once every 300 linear feet of paving per 24-foot wide strip, staggered left, center, and right of centerline. Where less than 300 linear feet of asphalt is placed in 1-day, provide minimum of 1 test for each per day's construction at a location designated by the County.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
 - 1. Materials certificates signed by material producer and Contractor, certifying that each material item complies with specified requirements.

1.05 SYSTEM DESCRIPTION

- A. Stabilize the roadbed below the proposed base to provide a firm and unyielding subgrade.
- B. Provide a finished roadbed section that meets the bearing value requirements regardless of the quantity of stabilizing materials necessary to be added.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.
- B. The Contractor may choose the type of stabilizing material.
- C. Materials may be lime rock, shell rock, cemented coquina, or shell-base sources approved by the FDOT.
- D. At least 97% by weight of the total material shall pass a 3-1/2-inch (90-mm) sieve. Material having a plasticity index greater than 10 or a liquid limit greater than 40 shall not be used as a stabilizer.

2.02 LIMEROCK

- A. For limerock, carbonates of calcium and magnesium shall be at least 70%.

2.03 CRUSHED SHELL

- A. Crushed shell for this use shall be mollusk shell (i.e., oysters, mussels, clams, cemented coquina). Steamed shell will not be permitted.
- B. At least 50% by weight of the total material shall be retained on the No. 4 (4.75 µm) sieve.
- C. Not more than 20% by weight of the total material shall pass the No. 200 (75 µm) sieve. The determination of the percentage passing the No. 200 (75 µm) sieve shall be by washing only.

2.04 LOCAL MATERIALS

- A. Local materials used for this stabilizing may be soils or recyclable materials such as crushed concrete, roof tiles, asphalt coated base, or reclaimed pavement. However, no materials that deteriorate over time, cause excessive deformations, contain hazardous substances, contaminates, or do not improve the bearing capacity of the stabilized material may be used.

PART 3 - EXECUTION

3.01 GENERAL

- A. Prior to the beginning of stabilizing operations, construct the area to be stabilized to an elevation such that, upon completion of stabilizing operations, the completed stabilized subgrade will conform to the lines, grades, and cross-section shown in the plans. Prior to spreading any additive stabilizing material, bring the surface of the roadbed to a plane approximately parallel to the plane of the proposed finished surface.

- B. Process the subgrade to be stabilized in 1 course, unless the equipment and methods being used do not provide the required uniformity, particle size limitation, compaction, and other desired results, in which case, the County will direct that the processing be done in more than 1 course.

3.02 APPLICATION OF STABILIZING MATERIAL

- A. When additive stabilizing materials are required, spread the designated quantity uniformly over the area to be stabilized.
- B. When materials from an existing base are to be used in the stabilizing at a particular location, place and spread all of such materials prior to the addition of other stabilizing additives.
- C. Spread commercial stabilizing material by the use of mechanical material spreaders, except that where use of such equipment is not practicable, use other means of spreading, but only upon written approval of the proposed alternate method.

3.03 MIXING

- A. Perform mixing using rotary tillers or other equipment meeting the approval of the County. The Contractor may mix the materials in a plant of an approved type suitable for this Work. Thoroughly mix the area to be stabilized throughout the entire depth and width of the stabilizing limits.
- B. Perform the mixing operations as specified (either in place or in a plant) regardless of whether the existing soil, or any select soils placed within the limits of the stabilized sections, have the required bearing value without the addition of stabilizing materials.

3.04 MAXIMUM PARTICLE SIZE OF MIXED MATERIALS

- A. At the completion of the mixing, ensure that the gradation of the material within the limits of the area being stabilized is such that 97% will pass a 3-1/2-inch sieve and that the material does not have a plasticity index greater than 8 or liquid limit greater than 30. Note that clay balls or lumps of clay size particles (2 microns or less) cannot be considered as individual particle sizes. Remove any materials not meeting the plasticity requirements from the stabilized area. The Contractor may break down or remove from the stabilized area materials not meeting the gradation requirements.

3.05 COMPACTION

- A. Compact the materials at a moisture content permitting the specified compaction. If the moisture content of the material is improper for attaining the specified density, either add water or allow the material to dry until reaching the proper moisture content for the specified compaction.

3.06 FINISH GRADING

- A. Shape the completed stabilized subgrade to conform to the finished lines, grades, and cross-section indicated in the Drawings. Check the subgrade using elevation stakes or other means approved by the County.

3.07 CONDITION OF COMPLETED SUBGRADE

- A. After completing the stabilizing and compacting operations, ensure that the subgrade is firm and substantially unyielding to the extent that it will support construction equipment and will have the bearing value required by the Drawings.
- B. Remove all soft and yielding material, and any other portions of the subgrade that will not compact readily. Replace yielding material with suitable material so that the whole subgrade is brought to line and grade with proper allowance for subsequent compaction.

3.08 MAINTENANCE OF COMPLETED SUBGRADE

- A. After completing the subgrade, maintain it free from ruts, depressions, and any damage resulting from the hauling or handling of materials, equipment, and tools. The Contractor is responsible for maintaining the required density until the subsequent base or pavement is in place including any repairs or replacement of curb and gutter or sidewalk which might become necessary in order to recompact the subgrade in the event of underwash or other damage occurring to the previously compacted subgrade. Perform any such recompaction at no expense to the County. Construct and maintain ditches and drains along the completed subgrade section.

3.09 FIELD QUALITY CONTROL

- A. When proper moisture conditions are attained, compact the material to not less than 98% of maximum density determined by AASHTO T-180, and a minimum LBR of 40.

END OF SECTION

SECTION 02576
CONCRETE SIDEWALKS AND DRIVEWAYS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Constructing new concrete sidewalks, driveways, and curb and gutters as shown on the Drawings.

1.02 QUALITY ASSURANCE

- A. Codes and Standards: Comply with applicable sections of F.D.O.T. Specifications and local governing regulations.
- B. The mixture, placement, and curing of all concrete work shall be in accordance with F.D.O.T. Specifications.

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Furnish manufacturer's product data, design mixes, test reports, and materials certifications.

1.04 JOB CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities, as specified under Section 01570 "Maintenance of Traffic."
- B. Utilize flagman, barricades, warning signs, and warning lights as required.

1.05 GUARANTEE

- A. All restored areas within the public right-of-way shall be guaranteed for 1-year after final acceptance. In the event of cracked or broken concrete surfaces, the Contractor shall make the necessary repairs to restore the concrete within 10-calendar days after notification by the County. The cost of such repairs shall be paid by the Contractor.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 CONCRETE MATERIALS

- A. Forms: Steel or wood for each type of use of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
 - 1. Use flexible spring steel forms or laminated boards to form radius bends as required.
 - 2. Coat forms with a non-staining form release agent that will not discolor or deface the surface of the concrete.
- B. Fibermesh Reinforcement: Fibermesh reinforcement fibers shall be 2-inches to 3-inches collated polypropylene fibers. Fibers shall be in strict accordance with the manufacturer recommendations and within the time as specified in ASTM C94, Type III 4.13 and applicable building codes.
- C. Concrete Materials: Comply with requirements of F.D.O.T. Section 347 for concrete materials, admixtures, bonding materials, curing materials, and others as required.
- D. Epoxy Resin Grout: Type N as specified in F.D.O.T. Section 926.
- E. Aggregate, brick, or other material required to match existing driveway or walk shall be as approved by the County.

2.03 CONCRETE MIX, DESIGN, AND TESTING

- A. Comply with requirements of applicable F.D.O.T. Section 347 for concrete mix design, sampling and testing, and quality control, and as herein specified.
- B. Design the mix to produce standard weight concrete consisting of Portland cement, aggregate, air entraining admixture, and water to produce the following properties.
 - 1. Compressive Strength: Class B, 3,000 psi for walks and curbs.
 - 2. Compressive Strength: Class A, 4,000 psi for driveways.
 - 3. Air Content: 3% to 6% .
- C. Concrete slump shall not exceed plus or minus 1-inch from approved design slump.

PART 3 - EXECUTION

3.01 CONCRETE SIDEWALK, DRIVEWAY, AND CURB AND GUTTER

A. Surface Preparation:

1. Remove loose material from the compacted sub base surface immediately before placing concrete.
2. Proof-roll prepared sub base surface to check for unstable areas and the need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

B. Form Construction:

1. Set forms to the required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of the Work and so that forms can remain in place at least 24-hours after concrete placement.
2. Check completed form work for grade alignment to the following tolerances:
 - a. Top of forms not more than 1/8-inch in 10-feet.
 - b. Vertical face on longitudinal axis, not more than 1/4-inch in 10-feet.
3. Clean forms for reuse immediately after use, and coat with form release agent as often as required to ensure separation from concrete without damage.

C. Concrete Placement:

1. Do not place concrete until sub base and forms have been checked for line and grade. Moisten if required to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are completed to required finish elevation and alignment. Use special colors or aggregate as required to match existing material.
2. Place concrete using methods which prevent segregation of the mix. Consolidate concrete along the face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices. Do not use vibrators to push or move concrete in forms or chute.
3. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.
4. An automatic machine may be used for sidewalk or curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed the minimum herein specified. Machine placement must produce sidewalks and/or curbs and gutters to the required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

5. Joints: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of the concrete, unless otherwise indicated. Construct transverse joints at right angles to the centerline, unless otherwise indicated. When joining existing structures place transverse joints to align with previously placed joints, unless otherwise indicated.
 - a. Weakened-Plane Joints: Provide weakened-plane (contraction) joints sectioning concrete into areas as shown on the Drawings. Construct weakened plane joints for a depth equal to at least 1/4 concrete thickness, by sawing within 24-hours of placement or formed during finishing operations. Place joints at intervals not to exceed 10-feet if not otherwise indicated.
 - b. Construction Joints: Place construction joints at the end of all pours and at locations where placement operations are stopped for a period of more than 1/2-hour, except where such pours terminate at expansion joints. Construction joints shall be as shown or, if not shown, use standard metal keyway-section form of appropriate height.
 - c. Expansion Joints:
 - (1) Provide premolded joint filler for expansion joints abutting concrete curbs, catch basin, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.
 - (2) Locate expansion joints at 12-feet on center for concrete walks unless otherwise indicated.
 - (3) Extend joint fillers full-width and depth of joint, and not less than 1/2-inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.
 - (4) Furnish joint fillers in one-piece lengths for the full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together. Pieces shorter than 4-inches shall not be used unless specifically shown as such.
 - (5) Protect the top edge of the joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.
 - (6) Fillers and Sealants: Comply with the requirements of these specifications for preparation of joints, materials installation, and performance, and as herein specified.

D. Concrete Finishing:

1. After striking-off and consolidating concrete, smooth the surface by screening and floating. Use hand methods only where mechanical floating is not possible. Adjust the floating to compact the surface and produce a uniform texture.
2. After floating, test surface for trueness with a 20-foot straightedge. Variations exceeding 1/3-inch for any two points within 10-feet shall not be acceptable. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
3. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round 10-1/2-inch radius, unless otherwise indicated. Eliminate any tool marks on concrete surface.

4. After completion of floating and when excess moisture or surface sheen has disappeared, broom finish sidewalks by drawing a fine-hair broom across concrete surface, perpendicular to a line of pedestrian traffic. If the existing material has another finish, match existing finish.
5. Do not remove forms for 24-hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas.

E. Curing:

Protect and cure finished concrete paving and walks, complying with applicable requirements of F.D.O.T. Section 350. Use moist-curing methods for initial curing of approved concrete curing compounds whenever possible.

F. Repairs and Protections:

1. Repair or replace broken or defective concrete, as directed by the County.
2. Drill test cores where directed by the County, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy resin grout.
3. Protect concrete from damage until acceptance of work. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
4. Sweep concrete pavement and wash free of stains and discolorations, dirt, and other foreign material just prior to final inspection.

3.02 FIELD QUALITY CONTROL

- A. General: Repair or remove and replace unacceptable concrete sidewalk, driveways, or curb and gutter as directed by the County.
- B. Surface Elevation: Actual surface elevations shall be within ± 0.05 feet of specified or indicated elevations at any given point. Surface elevations between any 2 given points shall be interpolated from a direct line between the 2 points. Surfaces exceeding actual elevation tolerances of more than ± 0.05 feet at any 2 points within a distance of 15-feet will not be acceptable.

END OF SECTION

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SECTION 02578

SOLID SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Establishing a stand of grass by furnishing and placing grass sod. Included are fertilizing, watering, and maintenance as required to assure a healthy stand of grass. Solid sodding shall be placed on all slopes greater than 4:1, within 10-feet of all proposed structures, and in all areas where existing grass or sod (regardless of it's condition) is removed or disturbed by Contractor's operation unless otherwise specified or shown on the Drawings.

1.02 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
 - 1. A certification of sod quality by the producer shall be delivered to the County ten days prior to use.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 GRASS SOD

- A. Grass sod for the road rights-of-way shall be of variety to match the existing adjacent area and shall be well matted with grass roots. The sod shall be taken up in rectangles, preferably 12-inch by 24-inch, shall be a minimum of 2-inches in thickness, and shall be live, fresh, and uninjured at the time of planting.
- B. Grass sod for restoration of new construction sites and/or areas disturbed by construction on existing sites shall be St. Augustine well matted with grass roots. The sod shall be taken up in rectangles, preferably 12-inch by 24-inch, shall be a minimum of 2-inches in thickness, and shall be live, fresh, and uninjured at the time of planting.

- C. It shall be reasonably free of weeds and other grasses and shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. The sod shall be planted as soon as possible after being dug and shall be shaded and kept moist until it is planted.

2.03 FERTILIZER

- A. Commercial fertilizers shall comply with the state fertilizer laws.
- B. The numerical designations for fertilizer indicate the minimum percentages (respectively) of (1) total nitrogen, (2) available phosphoric acid, and (3) water-soluble potash contained in the fertilizer.
- C. The chemical designation of the fertilizer shall be 6-6-6. At least 50% of the nitrogen shall be derived from organic sources. At least 50 % of the phosphoric acid shall be from normal super phosphate or an equivalent source, which will provide a minimum of two units of sulfur. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or other container.

2.04 WATER FOR GRASSING

- A. The water used in the sodding operations shall be by the Contractor as approved by the County.

PART 3 - EXECUTION

3.01 PREPARATION OF GROUND

- A. The area over which the sod is to be placed shall be scarified or loosened to a depth and then raked smooth and free from debris. Where the soil is sufficiently loose and clean, the County, at its discretion, may authorize the elimination of ground preparation.

3.02 APPLICATION OF FERTILIZER

- A. Before applying fertilizer, the soil pH shall be brought to a range of 6.0 - 7.0.
- B. The fertilizer shall be spread uniformly over the area to be sodded at the rate of 700-pounds per acre, or 16-pounds per 1,000 square feet, by a spreading device capable of uniformly distributing the material at the specified rate. Immediately after spreading, the fertilizer shall be mixed with the soil to a depth of approximately 4-inches.
- C. On steep slopes, where the use of a machine for spreading or mixing is not practicable, the fertilizer shall be spread by hand and raked in and thoroughly mixed with the soil to a depth of approximately 2-inches.

3.03 PLACING SOD

- A. The sod shall be placed on the prepared surface, with edges in close contact and shall be firmly and smoothly embedded by light tamping with appropriate tools.
- B. Where sodding is used in drainage ditches, or on slopes of 4:1 or greater, the setting of the pieces shall be staggered to avoid a continuous seam along the line of flow. Along the edges of such staggered areas, the offsets of individual strips shall not exceed 6-inches. In order to prevent erosion caused by vertical edges at the outer limits, the outer pieces of sod shall be tamped so as to produce a featheredge effect.
- C. On slopes greater than 2:1, the Contractor shall, if necessary, prevent the sod from sliding by means of wooden pegs driven through the sod blocks into firm earth at suitable intervals.
- D. Sod which has been cut for more than 72-hours shall not be used unless specifically authorized by the County after the inspection thereof. Sod which is not planted within 24-hours after cutting shall be stacked in an approved manner, maintained, and properly moistened. Any pieces of sod that, after placing, show an appearance of extreme dryness shall be removed and replaced by fresh, uninjured pieces.
- E. Sodding shall not be performed when weather and soil conditions are, in the County's opinion, unsuitable for proper results.

3.04 WATERING

- A. The areas on which the sod is to be placed shall contain sufficient moisture, as determined by the County, for optimum results. After being placed, the sod shall be kept in a moist condition to the full depth of the rooting zone for at least 2-weeks. Thereafter, the Contractor shall apply water as needed until the sod roots and starts to grow for a minimum of 60-days (or until final acceptance, whichever is latest).

3.05 MAINTENANCE

- A. The Contractor shall maintain, at his expense, the sodded areas in a satisfactory condition until final acceptance of the Project. Such maintenance shall include repairing of any damaged areas and replacing areas in which the establishment of the grass stand does not appear to be developing satisfactorily.
- B. Replanting or repair necessary due to the Contractor's negligence, carelessness, or failure to provide routine maintenance shall be at the Contractor's expense.

END OF SECTION

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SECTION 09865
SURFACE PREPARATION AND SHOP PRIME PAINTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section specifies the labor, materials, equipment and incidentals required for the surface preparation and application of shop primers on ferrous metals, excluding stainless steel, as specified herein.

1.02 RELATED WORK

- A. Field painting is included in Section 09900 "Painting."

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Submit to the County for review and comment manufacturer's specifications and data on the proposed primers and detailed surface preparation, application procedures and dry mil thickness.
- C. Submit representative physical samples of the proposed primers, if required by the County.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 MATERIALS

- A. Submerged Services: Shop primer for ferrous metals which will be submerged or which are subject to splash action or which are specified to be considered submerged service shall be sprayed with 1 coat of Glidden Epoxy High Build Primer 5461/5452, or an acceptable equal, at a minimum dry film thickness of 5.0-mils.

- B. Non-submerged Services: Shop primer for ferrous metals, other than those covered by Paragraph 2.01 A, shall be sprayed with 1 coat of Glidden T&S Primer 5205, or an acceptable equal, at a minimum dry film thickness of 2.0-mils.
- C. Non-primed Surfaces: Gears, bearing surfaces and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during all periods of storage and erection and shall be satisfactory to the County up to the time of the final acceptance test.
- D. Compatibility of Coating System: Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with their corresponding primers and finish coats specified in Section 09900 "Painting" for use in the field and which are recommended for use together.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Surface Preparation and Priming
 - 1. Non-submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC SP 6, Commercial Grade, immediately prior to priming. Submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC SP 10, immediately prior to priming.
 - 2. Surfaces shall be dry and free of dust, oil, grease, dirt, rust, loose mill scale, and other foreign material before priming.
 - 3. Shop prime in accordance with acceptable paint manufacturer's recommendations.
 - 4. Priming shall follow sandblasting before any evidence of corrosion has occurred and within 24-hours.

END OF SECTION

SECTION 09901
COATINGS AND LININGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This specification pertains to the specialty coating and lining of manholes and lift station wet wells and valve vaults. As well as the coating of above ground assets including but not limited to: steel, ductile iron pipe, ductile iron fittings, valves, hydrants, hardware and all appurtenances. Brass, bronze and 316 Stainless Steel shall not be coated.
- B. Precast concrete rehabilitation and new structures: The Work shall include the furnishing and installation of an interior protective lining/coating corrosion protection system including all necessary materials, equipment and tools as required for a complete installation in accordance with the manufacturers recommendations. The completed system shall provide a waterproof, corrosion protection system to prevent any deterioration of concrete surfaces from hydrogen sulfide and other corrosive gases/acids produced by wastewater and to prevent infiltration. To ensure total unit responsibility, all materials and installation thereof shall be furnished by, and coordinated with, 1 supplier/manufacturer.

1.02 QUALITY ASSURANCE

- A. All work shall be proved to be in first class condition and constructed in accordance with the Drawings and specifications. All defects disclosed by tests and inspections shall be remedied immediately by the Contractor at no expense to the County.
- B. Fiberglass liner manufacturers shall certify that the liner has been manufactured, sampled, tested, and inspected in accordance with ASTM D 3753.
- C. Polyethylene liner manufacturers shall certify that the liner has been designed and manufactured in accordance with ASTM F 1759 and these specifications.
- D. Holiday Testing: Each coat shall be holiday tested at the recommended 100-125 volts DC per mil in accordance with the latest edition of the following standards: NACE SP0188-2006, NACE Standard RP0490, ASTM G62

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

1.04 COVERAGE

- A. The protective lining/coating corrosion protection shall cover all concrete surfaces within the wetwell or manhole including the adjustment ring area.
- B. Coatings and lining surfaces shall be holiday free and all defects shall be repaired in accordance with the manufacturer's recommendations prior to the next coat being applied.

1.05 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C1244: Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
 - 2. ASTM D3299: Filament-Wound Glass-Fiber Reinforced Thermoset Resin Corrosion-Resistant Tanks
 - 3. ASTM D3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
 - 4. ASTM D3753: Glass-Fiber-Reinforced Polyester Manholes and Wetwells
 - 5. ASTM D6365: Nondestructive Testing of Geomembrane Seams using the Spark Test.
 - 6. ASTM F1759: Design of High-Density Polyethylene (HDPE) Manholes for Sub-surface Applications
 - 7. ASTM F1869: Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - 8. ASTM G62: Standard Test Methods for Holiday Detection in Pipeline Coatings.
- B. NACE INTERNATIONAL (Formerly The National Association of Corrosion Engineers)
 - 1. NACE SP0188-2006 (formerly RP0188): Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
 - 2. NACE Standard SP0490-2007 (formerly RP0490): Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coating of 250 to 760 μm (10 to 30-mils).
 - 3. NACE Standard SP0178-2007 (formerly RP0178): Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 HDPE LINERS

- A. The Work shall include the furnishing and installation of an interior protective liner system including all necessary labor, materials, equipment and tools as required for a complete installation. Liner shall be high-density polyethylene (HDPE). This liner shall provide a waterproof, corrosion resistant liner to prevent any deterioration of concrete surfaces from hydrogen sulfide and other corrosive gases/acids produced by wastewater and to prevent infiltration. To ensure total unit responsibility, all materials and installation thereof shall be furnished by, and coordinated with, 1 supplier/manufacturer.
- B. Manhole HDPE Liner shall have a minimum thickness of 2-mm (78-mil) and wetwell HDPE shall have a minimum thickness of 5-mm (195-mil). All HDPE liner sheets shall be extruded with a large number of anchoring studs, a minimum of (420/m², 39/ft²), manufactured during the extrusion process in 1-piece with the sheet so there is no welding and no mechanical finishing work to attach the studs to the sheet. The liner shall have a pull out of 112.5-lbs/anchoring stud. A manufacturer certified fabricator shall custom fit the liner to the formwork in order to protect the concrete surfaces from sewer gases.
- C. All welding shall be performed in accordance with the published directives and procedures of the manufacturer and by welders certified by the manufacturer and documentation shall be provided to the County prior to the Work. Completion of welding will provide a 1-piece monolithic HDPE protective liner system that will provide excellent resistance to hydrogen sulfide attack and will not pull off the wall in the event that infiltration occurs. Flat liner sheet, not anchored, used for overlapping joints, shall have a minimum thickness of 3-mm for manholes or 5-mm for wetwells and shall contain a co-extruded bottom surface layer of conductive polyethylene. Conductive cap strip material shall have a free path from the back side of the sheet to a portion of the concrete surface.
- D. Field welding of the liner at the riser joints shall be completed only after vacuum testing (ASTM C1244) of the new structure has been completed and any concrete joint deficiencies have been rectified. Vacuum testing is not required on rehabilitation of existing structures.
- E. Testing and supervision of the installation and welding shall be performed by qualified staff only and must be checked when completed by visually checking and by Spark Testing all welded joints per ASTM D6365. Holiday testing 20,000 to 35,000 volts. All high voltage discontinuity (spark) testing shall be performed using a Tinker & Rasor model AP/W Holiday Detector or equal.
- F. Penetrations (Forcemain, conduit, etc) shall have an internal boot comprising of minimum of 3/8-inch 316SS band clamp compressing a 2-inch wide neoprene with full circumferential welded boot around each penetration in accordance with the manufacturer's details.

2.03 PREFORMED POLYPROPYLENE (PP) LINERS

- A. The Work shall include the furnishing and installation of an interior protective liner system including all necessary labor, materials, equipment and tools as required for a complete installation. This liner shall provide a waterproof, corrosion resistant liner to prevent any deterioration of concrete surfaces from hydrogen sulfide and other corrosive gases/acids produced by wastewater and to prevent infiltration. To ensure total unit responsibility, all materials and installation thereof shall be furnished by, and coordinated with, 1 supplier/manufacturer.
- B. All joints shall be field welded by hot air extrusion welding with PP welding bead. Field welding of the PP liner at the riser joints shall be completed only after vacuum testing (ASTM C1244) of the new structure has been completed and any concrete joint deficiencies have been rectified. Vacuum testing is not required on rehabilitation of existing structures.
- C. Testing and supervision of the installation and welding shall be performed by qualified staff only and must be checked when completed by visually checking and by Spark Testing all welded joints per ASTM D6365. Holiday testing 20,000 to 35,000 volts. All high voltage discontinuity (spark) testing shall be performed using a Tinker & Rasor model AP/W Holiday Detector or equal.
- D. Penetrations (Forcemain, conduit, etc) shall be gasketed PP pipe bell connectors or PP sleeves for boot type connectors and shall be attached to the PP liner by hot air extrusion welding with PP welding bead in accordance with the manufacturer's details.

2.04 FIBERGLASS LINERS

- A. General: Fiberglass reinforced polyester wetwell and manhole liners shall be manufactured from commercial grade polyester resin or other vinyl ester resin with fiberglass reinforcements. The resin system shall be suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid, as well as other gases associated with the wastewater collection systems. Fiberglass products shall be manufactured in accordance with National Bureau of Standards, Voluntary Product Standard PS 1569 and ASTM D-3753. All inserts and sleeves for piping shall be in accordance with the liner manufacturer's recommendations and shall result in complete coverage of all pre-cast sections and be capable of passing a spark test. The manufacturer shall have a minimum of 5-years experience in manufacturing products which meet the specified standards and shall provide 3 references to verify the qualifications of the manufacturer.
- B. Materials: Resins shall be a commercial grade unsaturated polyester resin. Reinforcing materials shall be commercial grade "E" type glass in the form of mat, chopped roving, continuous roving, roving fabric or a combination of the above, having a coupling agent that will provide a suitable bond between the glass reinforcement and resin. All materials including resins, glass reinforcement, fillers and additives shall be chemically resistant to hydrogen sulfide gas and the sanitary sewer environment. The combined thickness of the inner surface and the interior layer shall not be less than 0.10-inch. Seams shall be sealed

at the factory with the same glass-resin jointing process.

- C. Fabrication: The exterior surface shall be relatively smooth with no sharp projections and no exposed fibers. The exterior surface shall have a gray Gel-coat coating. The interior surface shall be resin rich with no exposed fibers and shall be free of crazing, delaminations, blisters larger than 1/2-inch diameter, wrinkles of 1/8-inch or greater in depth, resin runs, dry areas, sharp projections, or surface pits greater than 6 per square foot if they are less than 3/4-inch diameter and less than 1/16-inch deep. The exterior surface shall be free of blisters larger than 1/2-inch in diameter. To provide UV protection, the exterior surface shall have a factory applied gray pigment for a minimum thickness of 0.125-inches.
- D. Physical Properties: The fiberglass reinforced wetwell and manhole liner shall be designed for H-20 wheel loading and tested in accordance with ASTM D 3753 8.5 (note 1). The fiberglass reinforced wetwell liner and manholes shall meet the following physical requirements:

	Hoop Direction	Axial Direction
Tensile Strength (psi)	18,000	5,000
Tensile Modulus (psi)	0.6 x 10 ⁶ for MH's 0.8 x 10 ⁶ for Wetwell's	0.7 x 10 ⁶
Flexural Strength (psi)	26,000	4,500
Flexural Modulus (psi)	1.4 x 10 ⁶	0.7 x 10 ⁶
Compressive MH's(psi)	18,000	12,000

- E. Chemical Resistance: When tested in accordance with ASTM D3753 8.7 the log of percent retention of each property after immersion testing when plotted against the log of immersion time and extrapolated to 100,000-hours shall assure retention of at least 50% of the initial properties.
- F. FRP liner shall be 1-piece with no vertical or horizontal seams allowed. The FRP shall be fabricated in accordance with NBS PS 15-69, and shall consist of commercial grade polyester resin, UV inhibitor, chopped strand, woven roving, and continuous reinforcement. Minimum liner thickness shall be 1/2-inch for all diameter wells, and shall not have external ribs. Liner size shall be field verified by liner manufacturer's representative. Tolerance of the inside diameter shall be +/- 1% of the required liner diameter.
- G. Testing: All tests shall be performed as specified in ASTM D3753 latest edition, Section 8, test method D-790 (note 5) and test method D695. Each completed liner shall be examined for dimensional requirements, hardness and workmanship. All required ASTM D3753 testing shall be completed and records of all testing provided to the County. As a basis of acceptance, the manufacturer shall provide an independent certification which shall consist of a copy of the manufacturer's test report, and be accompanied by a copy of the test results that the liner has been sampled, tested and inspected in accordance with the provisions of this specification and meets all its requirements. The independent certification and manufacturer's test report shall be provided to the County prior to delivery of the Liner.

- H. **Fiberglass Reinforced Top:** The fiberglass manhole liner top shall be fabricated using fiberglass material as above. Material and installation to meet all physical requirements as above. Top to be attached to wetwell liner pipe with fiberglass layup to comply with ASTM D3299. When reinforcement is necessary for strength, the reinforcement shall be fiberglass channel laminated to the inside of the liner top and shall comply with ASTM D3299. 4,000-psi concrete shall be poured around the entire manhole fiberglass cone section. Lift station top slabs shall be re-poured with HDPE interior liner. Contractor shall ensure an airtight connect between the Pump Station HDPE lined top slab and interior wetwell liner.
- I. **Non-Shrink Grout:** Non-shrink grout used in the bench area of manholes and fillet areas of wetwells, or on pipe penetrations shall be 100% calcium aluminate, un-thinned and unaltered, as manufactured by Sewpercoat, Strong-Seal, or an approved equal.
- J. **Miscellaneous Materials:** Additional items of construction necessary for the complete installation of the fiberglass liner shall conform to specific details on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these Specifications.

2.05 FERROUS METAL SURFACES (INCLUSIVE OF STEEL AND DIP, HYDRANTS, FITTINGS AND APPURTENANCES)

Cleaning, surface preparation, coating application, and thickness shall be as specified herein and shall meet or exceed the coating manufacturer's recommendations. When the manufacturer's minimum recommendations exceed the specified requirements, Contractor shall comply with the manufacturer's minimum recommendations. All cleaning, surface preparation, coating application, thickness, testing, and coating materials (where available) shall be in accordance with the referenced standards of AWWA, ANSI, NACE, SSPC, NSF, and ASTM. Color-coding shall be Safety Blue, Safety Green and Pantone Purple 522-C for water, wastewater and reclaimed water respectfully. Surfaces shall be holiday detected in accordance with ASTM G 62. Areas found to have holidays shall be marked and repaired in accordance with the paint manufacturer's instructions. The County shall be notified of time of testing so that he might be present to witness testing.

- A. **Procedures for Coating Exterior of DIP, Hydrants, Fittings and Appurtenances**
 - 1. **Surface Preparation:** Do not abrasive blast or prepare more surface area than can be coated in the same day; prepare surfaces and apply prime coatings within an 8-hour period.
 - a. **Steel:** Shall require NACE-1/SSPC-SP5 White Metal Blast Cleaning minimum angular anchor profile of 1.5-mils. White metal blast cleaning removes all of the coating, mill scale, rust, oxides, staining, corrosion products, and other foreign matter from the surface.
 - b. **DIP:** DIP with asphaltic seal coat, Hydrants, FBE (Valves and appurtenances), Shall require NACE-3/SSPC-SP6 Commercial Blast Cleaning minimum angular anchor profile of 1.5-mils. Commercial blast cleaning removes all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other

foreign matter from all surfaces and allows stains to remain on 33% (percent) of each unit area of surface.

- c. Note: Primer Option - Hydrants, FBE (Valves and appurtenances), existing factory coatings: Where specifically called out in the Coating System Table below, NACE-4/SSPC-SP7 may be substituted for the commercial blast for hydrants and factory applied FBE (Valves and appurtenances) where the coating manufacturer has specifically provided compatible coatings with existing coatings including urethane, epoxy, alkyd and water-based coatings. Under no circumstances shall DIP with asphaltic seal coat be over-coated. NACE-4/SSPC-SP7 Brush-Off Blast Cleaning shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose coating. Tightly adherent mill scale, rust, and coating may remain on the surface. Mill scale, rust, and coating are considered tightly adherent if they cannot be removed by lifting with a dull putty knife after abrasive blast cleaning has been performed.
2. Contaminants: Remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating in accordance with SSPC-SP1 for the substrate and between each coating layer.
3. Temperature: Surface temperature of substrate shall be a minimum of 5°F above the dew point and rising and generally between 40°F to 100°F. Temperatures shall not exceed manufacturer's recommendations.
4. Stripping: Edges, corners, crevices, welds, and bolts shall be given a brush coat/stripe coat for each material/layer. The stripe coat shall be applied by a brush and worked in both directions.
5. Coatings Systems: Two (2) options for coating systems are provided. Each coat shall be a distinctive color or shade to verify each coating in the system.
6. Prime coat: DIP, DIP with asphaltic seal coat, Hydrants, FBE (Valves and appurtenances) prime coat shall be zinc-rich. Zinc-rich shall only be used on bare metal. Factory applied FBE/Asphaltic/Mastic coatings on valves and appurtenances shall be completely removed per NACE 3 / SSPC-SP6.
7. Note: Where specifically called out in the Coating System Table for factory applied FBE (Valves and appurtenances) surface preparation may be NACE-4/SSPC-SP7 and the prime coat shall be an Inorganic water based epoxy. Asphaltic seal coats and mastics shall not be overcoated with Inorganic water based epoxy.
8. Intermediate coat: Varies per coating system.
9. Final Coat: Varies per coating system.
10. Holiday Testing: Each coating layer shall be holiday tested at the recommended 100-125 volts DC per mil in accordance with the latest edition of the following standards: NACE SP0188-2006, NACE Standard RP0490, ASTM G62 and per the manufacturers recommendations. All low voltage holiday testing shall be performed using a Tinker & Razor model M-1 Holiday Detector or equal.
11. Coating Systems: Either System 1 or System 2 shall be used for above ground, non-immersion ferrous metal surfaces (Inclusive of Steel, DIP, Hydrants, Fittings and Appurtenances).

Color Codes

Generic Name	Application	Tnemec	Carboline	PPG / Ameron
Safety Blue	Water Master Meters	True Blue / Safety 11SF	9122	BL Safety Blue
Safety Green	Pump Station Piping	Hunter Green 08SF	V358	GN Safety Green
Pantone Purple 522C	Reclaimed Master Meters	Purple Rain / Safety 14 SF	7528	PL Safety Purple
Safety Green	Hydrant Bonnet & Caps	Hunter Green 08SF	V358	GN Safety Green
Safety Orange	Hydrant Bonnet & Caps	Tangerine Orange / Safety 04 SF	1420	OR 2Safety Orange
Safety Red	Hydrant Bonnet & Caps	Candy Apple Red / Safety 06SF	7573	RD 2 Safety Red
Safety Silver	Hydrant Barrel	Aluminum 57GR	J766	SL Safety Silver

System 1 - Zinc / Urethane / Fluoropolymer

Description	Generic Coating Name	Tnemec	DFT mils	Carboline	DFT mils
Prime Coat all materials. Surface Prep NACE 1 or NACE 3	Zinc-Rich	Zinc Series 90-97	2.5 - 3.5	Carbozinc 621	3.0 - 8.0
Prime Coat - option for FBE or Hydrants only. Surface Prep NACE 4	Inorganic water based epoxy – overcoat existing coatings	Typoxy Series 27WB	4.0 - 14.0	NA	NA
Intermediate Coat.	Aliphatic Acrylic Polyurethane	Endura-Shield Series 73	2.0 - 3.0	Carbothane 133 HB	3.0 - 5.0
Final Coat.	Advanced Thermoset Fluoropolymer Polyurethane	Hydroflon Series 700	2.0 - 3.0	Carboxane 950	2.0- 3.0

System 2 - Zinc / Epoxy / Urethane

Description	Generic Coating Name	Tnemec	DFT mils	Carboline	DFT mils	PPG / Ameron	DFT mils
Prime Coat all materials. Surface Prep NACE 1 or NACE 3	Aromatic Urethane, Zinc-Rich	Zinc Series 90-97	2.5 - 3.5	Carbozinc 621	3.0 - 8.0	Amercoat 68HS	3
Prime Coat option for FBE, Hydrants. Surface Prep NACE 4	Inorganic water based epoxy – overcoat existing coatings	Typoxy Series 27WB	4.0 - 14.0	NA	NA	NA	NA
Intermediate Coat.	Polyamidoamine Epoxy	Color Hi-Build Epoxoline II Series N69	4.0 - 10.0	Carboguard 60	4.0 - 6.0	Amerlock 2/400	4.0 - 6.0
Final Coat.	Aliphatic Acrylic Polyurethane	Endura-Shield Series 73	2.0 - 3.0	Carboxane 950	2.0 - 3.0	Amercoat 450H	2.0 - 3.0

2.06 SPECIALTY COATINGS

- A. The Specialty Coatings are for rehabilitation of existing precast concrete manholes and existing valve vaults. New precast structures shall be lined only. All specialty coatings applicators shall follow the procedure as outlined below:
1. Pre-Inspection: Applicator shall take appropriate action to comply with all local, state and federal regulations including those set forth by OSHA, EPA, the County and any other applicable authorities. Prior to conducting any work, perform inspection of structure to determine need for protection against hazardous gases or oxygen-depleted atmosphere and the need for flow control or flow diversion.
 2. Bypass plan: Bypass plan for flow control or bypass shall be submitted to the County for approval prior to conducting the work. Any active flows shall be dammed, plugged, or diverted as required to ensure all liquids are maintained below or away from the surfaces to be coated until final applications are cured as recommended by the corrosion protection system manufacturer.
 3. Surface Preparation: NACE 6/SSPC-SP13 "Surface Preparation of Concrete." Dry abrasive blasting, wet abrasive blasting, vacuum-assisted abrasive blasting, and centrifugal shot blasting, high pressure water cleaning (5,000 to 10,000-psig), water jetting (10,000 to 30,000-psig) or combination of methods to remove deteriorated concrete, brick or mortar, laitance, hard contaminants, existing coatings, localized micro-organisms and gas contaminants from the concrete walls, floor, ceiling, and other concrete surfaces and shall display a surface profile suitable for application of the system. Minimum surface profile shall be ICRI CSP-5 or greater. Containment shall be provided to capture spent abrasive material and deteriorated concrete for removal by the Contractor.
 4. Substrate Inspection: After completion of surface preparation, the Contractor shall inspect for: Leaks, Cracks, Holes, Exposed Rebar, Ring and Cover Condition, Invert Condition, Inlet and Outlet Pipe Condition. After the defects in the structure have been identified, repair with a manufacturer approved underlayment or material to assure proper rehabilitation of the surface defect and compatibility with the specialty coating system product to be applied. Repairs to exposed rebar, defective pipe penetrations or inverts, shall be recommended by the specialty coating manufacturer and approved by the County prior to proceeding with the repair. Final preparation and cleaning of repaired surfaces is required prior to application of the coating and shall comply with the corrosion protection system manufacturer's recommendations.
 5. Manufacturer's certification: Applicators, installers, welders and application equipment shall be certified by the manufacturer of the corrosion protection system and documentation shall be provided to the County prior to the work.
 6. Area to be coated: All exposed concrete of the entire interior surface of precast structure including but not limited to benching, pipe penetrations, walls, bottom of top slab, chimney, etc. Flow channel inverts are not necessary to coat. Corrosion protection system shall interface with adjoining construction materials/components throughout the manhole structure to effectively seal and protect substrates from attack by corrosive elements and to ensure the effective elimination of infiltration into the sewer system.

7. Application: Application of specialty coating system shall be in strict accordance with manufacturer's recommendation. Specified surfaces should be shielded to avoid exposure of direct sunlight, other intense heat source or, where cementitious products are employed, excessive ventilation. Where varying surface temperatures do exist, coating installation should be scheduled when the temperature is falling versus rising. Verification of the corrosion protection system thickness shall be verified during application via wet gauge methods or following cure of the system using appropriate non-destructive or destructive methods.
 8. Holiday Testing: Cure time shall be in accordance with the Manufacturers product data sheet. Final concrete structure corrosion protection system shall be completely free of holidays, pinholes or voids. High voltage Holiday testing shall be required and holidays marked and repaired with same material and to same thickness as required of original installation. All high voltage discontinuity (spark) testing shall be performed using a Tinker & Rasor model AP/W Holiday Detector or equal and at 100-125 volts DC per mil or per the manufacturers recommendations.
 9. Destructive Testing: Destructive testing may be performed as directed by the County to verify coating adhesion and coating DFT. Repairs to areas tested by destructive means shall be repaired by the certified applicator at the Contractor's expense.
 10. Reporting: Provide final written report to the County detailing the location, date of report, description of repair or original installation and manufacturer data and cut sheets of the corrosion protection system and applicable testing results as per sections 7, 8 and 9.
 11. Warranty: The report shall contain a copy of the warranty.
- B. System SC-1: Sauereisen Sewergard 210 (Trowelable), 210FS (Trowelable Fast Set), 210S (Sprayable) or 210RS (Rotary Spray) shall be applied and then shall be finished with a coat of Sauereisen Sewergard Glaze 210G. The lining system to be utilized shall be an epoxy mortar or aggregate filled epoxy. Material furnished under this specification shall be a pre-packaged from the manufacturer. Materials shall be trowel applied or sprayed and shall conform to the Manufactures product data sheet as supplied by the manufacturer.
1. Additional Preparation: To ensure a good bond, the newly blasted surface shall be thoroughly vacuumed to remove all sand and debris and surface shall be dry prior to application.
 2. Surfacer for Rehabilitation/repair: Substrate in requiring repairs in excess of 1/8-inch shall be repaired with Sauereisen Underlayment No F-120, F-121 or F-209 Filler prior to application of protective lining/coating corrosion protection system.
 3. Thickness:
 - a. Sewergard 210 / 210FS / 210RS: The material shall be applied in 1 or more layers for a total thickness of minimum of 125-mils DFT (1/8-inch). After application, the material shall be damp rolled with excess water shaken off prior to back rolling.
 - b. Sprayable 210S: The material shall be applied in 1 or more layers for a total thickness of minimum of 60-mils shall be required for the Spray applied 210S.
 4. Finishing Glaze: After application, and curing of either the 210, 210FS, 210RS or 210S, the material shall be coated with a minimum of 20-mils of Sauereisen Sewergard Glaze 210G by roller or spray application in accordance with the manufacturers recommendations.

5. Holiday Testing: The protective lining/coating protection system shall be cured in accordance with the manufacturer's recommendations prior to holiday testing at a minimum of 14,500 volts.
- C. System SC-2: Tnemec Perma-Shield Coating System.
1. Additional Preparation: To ensure a good bond, the newly blasted surface shall be thoroughly vacuumed to remove all sand and debris and surface shall be dry prior to application and surface shall be minimum 5°F above the dew point. Moisture content not to exceed 3-pounds per 1,000 square feet in a 24-hour period verify dryness using a "plastic film tape-down test" ASTM D4263 and perform Anhydrous Calcium Chloride ASTM F1869.
 2. Surfacers for Rehabilitation/repair: Substrate in requiring repairs in excess of 1/8-inch shall be repaired Series 217 or 218 Filler prior to application of protective lining/coating corrosion protection system. Concrete surface shall be pre-wet or dampened with potable water prior to surfacer application.
 3. Thickness: Lining Series 434: The material shall be applied in 1 or more layers for a total thickness of minimum of 125-mils DFT (1/8-inch).
 4. Finishing Glaze: After application, and curing, the material shall be coated with 15-20-mils of Series 435 in accordance with the manufacturer's recommendations.
 5. Holiday Testing: The protective lining/coating protection system shall be cured in accordance with the manufacturer's recommendations prior to holiday testing at a minimum 14,500 volts.
- D. System SC-3: Sewercoat (PG and 2000 HS) Calcium aluminate mortar: The lining system to be utilized shall be 100% calcium aluminate cement with 100% calcium aluminate aggregate. Materials shall be spray applied by either a wet gunning (low-pressure spray) or dry gunning (shotcrete) method and shall conform to the manufacturer's product data sheet as supplied by the manufacturer. The equipment shall be clean and free of any hydrated or un-hydrated Portland Cement.
1. Additional Preparation: To ensure a good bond, the newly blasted surface shall be fully saturated with water prior to application.
 2. Thickness: The material shall be applied in 1 or more layers to such total thickness as required. A minimum of 1-inch shall be applied.
 3. Finishing: After spraying, the material shall be brushed or trowel finished.
 4. Curing: Curing by appropriate methods (curing compound, water mist, etc.) should be implemented as the surface begins to harden and dry (as early as 1-hour after application).
- E. System SC-4: Raven 405: System shall be 100% solids epoxy. Thinning with solvents shall not be permitted. Surface preparation, mixing, pot life, ambient conditions, application, film thickness per coat, cure time, and recoat time shall be in accordance the manufacturer's recommendations.
1. Applicator/installer shall be certified by the Manufacturer.
 2. Surfacers/Repair: Raven 710, 705CA or Raven 700 shall be spray applied or trowelled to repair/fill minor surface defects or applied as an underlayment.

3. Primer: Concrete exhibiting a moisture vapor emission rate greater than 3-lbs/1,000 square feet/24-hours, when tested according to ASTM F1869, shall be primed with Raven 155. Raven 155 primer (2 component waterborne epoxy) shall be applied at a maximum of 8-mil WFT (3-mil DFT). Recoat window minimum 2-4-hours at 72°F with maximum 72-hours at 72°F.
 4. Top Coat: Raven 405 shall be applied with an approved plural component airless spray system. Coating thickness shall be in relation to the profile of the surface to be coated as recommended by the coating product manufacturer. In all cases the coating shall be applied with minimum of 2 coats applied at 40-80-mils WFT/DFT each for minimum final film thickness at 125-mils DFT. Subsequent top coating or additional coats of the coating product(s) shall occur within the product's recoat window: minimum cure to a tacky state; maximum cure of 18-hrs at 72°F substrate temperature. Additional surface preparation procedures will be required if this recoat window is exceeded including inspection for and removal of amine blush and/or other potential contaminants.
 5. Holiday Testing: The protective lining/coating protection system shall be cured in accordance with the manufacturer's recommendations prior to holiday testing at a minimum of 12,500 volts.
- F. SC-5: Spectrashield Multicomponent Liner System. Spectrashield multi-component stress panel liner system composed of moisture barrier (modified polymer), surfaces (polyurethane/polymeric blend foam) and final barrier coat (modified polymer). The system is applied in three-steps and the applicator/installer shall be certified by the Manufacturer.
1. Application
 - a. Moisture barrier: Silicone Modified Polyurea Minimum 40-mils DFT
 - b. Surfacer: Polyurethane/Polymeric blend foam
 - c. Final corrosion barrier: Silicone Modified Polyurea Minimum 60-mils DFT
 2. Film Thickness: Final installation shall be a minimum of 500-mils. A permanent identification and date of work performed shall be affixed to the structure in a readily visible location.
 3. Holiday Testing: The protective lining/coating protection system shall be cured in accordance with the manufacturer's recommendations prior to holiday testing at a minimum of 50,000 volts.

PART 3 - EXECUTION

3.01 QUALITY ASSURANCE

- A. All materials shall be delivered to the job in original sealed and labeled containers of the coating manufacturer, and shall be subject to inspection by the County. Labels shall show name of manufacturer, type of coating, formulation, date, color and manufacturers recommendations. Coatings manufacturer date shall not exceed the manufacturer's recommendations for storage and useful life and Coatings manufactured in excess of 1-year prior to application shall be rejected.

- B. Oil and grease shall be completely removed in accordance with SSPC-SP1 before beginning any other surface preparation method. Surfaces of welds shall be scraped and ground as necessary to remove all slag and weld spatter.
- C. All components of equipment that can be properly prepared and coated after installation shall be installed prior to surface preparation. Components that will be inaccessible after installation shall have the surfaces prepared and coated before installation.
- D. All ferrous metal surfaces shall be free of all defects and have all sharp edges, welds, slag, defects and weld splatter ground smooth in accordance with NACE Standard RPO178.
- E. Edges, corners, crevices, welds, and bolts shall be given a brush coat (stripe coat) for each coating. The stripe coat shall be applied by a brush and worked in both directions. Special attention shall be given to filling all crevices with coating.
- F. Coating shall be applied in a neat manner that will produce an even film of uniform and proper thickness, with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be carefully examined and faulty material, poor workmanship, holidays, damaged areas and other imperfections shall be touched up prior to applying succeeding coats. Each coat shall be thoroughly dry and hard before the next coat is applied in accordance with the coating manufacturer's recommendations for drying time between coats. In no case shall coating be applied at a rate of coverage greater than the maximum rate recommended by the coating manufacturer. Each coat shall be uniform in coverage and color. Successive coats shall perceptibly vary in color.
- G. Coating failures will not be accepted and shall be entirely removed down to the substrate and the surface recoated. Failures include but are not limited to holidays, sags, checking, cracking, teardrops, fat edges, fisheyes, or delamination.
- H. Surfaces not required to be coated: Brass, Bronze, Stainless steel (Not including SS bolts and nuts)

3.02 INSPECTION FOR ACCEPTANCE

- A. The quality of materials, the process of manufacture and the finished sections shall be subject to inspection and approval by the County. Such inspection may be made at the place of manufacture, at the site after delivery or at both places and the sections shall be subject to rejection at any time due to failure to meet any of the specification requirements; even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. Sections that have been damaged after delivery will be rejected and if already installed removed and replaced, entirely at the Contractor's expense.

- B. At the time of inspection, the sections will be carefully examined for compliance with the specified ASTM designation and with the approved manufacturer's drawings. Sections shall be inspected for general appearance, dimension, "scratch-strength" blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.
- C. Precast concrete structures shall be inspected by the County and defective materials shall be replaced by the Contractor at the Contractor's expense.
- D. Any repairs made on surfaces shall be holiday detected. Areas found to have holidays shall be marked and repaired in accordance with the coating manufacturer's instructions. The County shall be notified of time of testing so that he might be present to witness testing.

3.03 FIBERGLASS LINER INSTALLATION

- A. Do not drop or impact the fiberglass liner. Use of chains or cables in direct contact with the liner is prohibited.
- B. The Contractor shall sequence the Work so that wastewater service is maintained to existing customers at all times.
- C. The interior of the wetwell shall be pressure washed with an 800 to 1,000-psi water blast, acid washed with a 20% muratic acid solution, and pressure washed a second time. All loose materials, grease/fats, and hydrogen sulfide contamination shall be removed. The existing bench/fillet areas in the wetwell/manhole shall be removed prior to pressure washing. An inspection of the structures shall be conducted by the County prior to the fiberglass liner installation.
- D. Exterior liner diameter shall be approximately 4-inches smaller than the inside diameter of the barrel section of the structure.
- E. Liner depth shall be from invert to top elevation of manhole and wetwell. The top 12-inches of the manhole liner shall be a fiberglass neck that extends from the liner corbel or cone section to the bottom of the ring and cover. The neck is used to protect the concrete grade rings or brick and mortar adjustments from the sewer environment.
- F. The wetwell top slab and manhole corbel or cone section shall be removed and discarded by the Contractor in accordance with all applicable regulations at the Contractor's expense.
- G. Measure and cut wetwell liner to exact length and invert configuration. Measure and cut all incoming and outgoing line openings.
- H. Lower wetwell liner into wetwell and level.
- I. Extend all incoming and outgoing lines inside the liner with PVC or other approved pipe.
- J. The existing concrete bench area of manholes and fillet areas of wetwells shall be removed

completely during initial preparation. Upon installation of the liner, a new bench/fillet shall be constructed with non-shrink grout and shall be field coated with resin and fiberglass in a dry environment after wastewater flows are diverted. The newly constructed bench shall sufficiently overlap the newly installed liner to prevent migration of fluids or gases between the liner and the bench. There shall be no exposed concrete between the factory manufactured fiberglass liner and the field installed fiberglass bench overlay.

- K. Pipe Penetrations: Piping shall extend past the liner into the fiberglass wetwell or flush with the liner. If the existing piping does not fully penetrate the fiberglass liner, the Contractor must extend similar material piping into the fiberglass wetwell. Any gaps on joints must be sealed with a non-shrink grout specified herein.
- L. Pour or pump 3,000-psi pump mix into the annular space between the liner and existing wet well.
- M. Use concrete grade rings on top of the liner cone section to bring ring and cover to finish grade. Manhole liner neck section shall extend from the ring and cover support area up to the ring and cover. The neck section shall be designed to protect the adjustment ring(s), brick and mortar used to bring the ring and cover to final grade
- N. A non-shrinking grout as specified herein shall be applied to areas that cannot be fiber-glassed due to water.
- O. Following installation, the Contractor shall determine soundness by applying air or water pressure (3-5-psi) to the wet well or manhole liner. While holding at the established pressure, inspect the entire wetwell and manhole for leaks, based on loss of measured pressure. Any leakage through the laminate is cause for failure of the task. The County shall be present during testing. The Contractor shall be responsible for isolating the work of this Contract from existing work and shall be solely responsible for the method of such isolation. Refer to ASTM D-3753 8.6. Any repairs required shall be repaired in accordance with the manufacturer's recommendations at the Contractor's expense.
- P. Prior to final acceptance and final inspection of the fiberglass liner installation, flush and clean all parts of the system. Remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the wetwell or manhole

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SECTION 09960
HIGH PERFORMANCE FERROUS METAL COATINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The scope of services includes surface preparation, coating systems and methods of application. All work shall be done in strict accordance with this specification, the Contract Documents, and the manufacturer's printed instructions.
- B. The Contractor shall provide all supervision, labor, tools, materials, equipment, maintenance of traffic, containment systems, scaffolding, other structures and incidentals required for mobilization, transportation, unloading, storage, surface preparation, protection of the public and environment, application of products, and cleanup necessary to complete this Contract in its entirety.
- C. The Contractor shall paint all exposed miscellaneous metal, pipe, fittings, valves, hangers, straps, support, hardware, equipment, appurtenances, and all other work required to be painted unless otherwise specified. The Contractor shall paint all surfaces he affects or damages during his performance of the Work, which may be exposed to view in the finished work including, but not limited to, metals, pipe, fittings, valves, equipment and all other existing items similar to proposed items specified for painting. Miscellaneous metal items to be painted shall be included in the Work of this Section where they come within the general intent of the Specifications or as stated herein.
- D. In general the following surfaces shall be painted:
 - 1. Pipe, fittings, flanges, appurtenances and other metal surfaces to 1-ft below grade. Pipe 1-ft below grade and within 6-inches above grade shall be considered immersion surface and shall be coated with the immersion surface high performance coating system.
 - 2. Metal or Galvanized materials including, but not limited to: pipe straps, hangers, pipe support floor stands, bypass piping, nuts, bolts, hardware and tapping saddles. Pipe straps shall be removed and coated on both sides.
 - 3. Pipe Surfaces under pipe straps. Pipe straps shall be removed and pipe coated underneath pipe straps regardless if pipe straps are to be coated. No more than two-thirds of the total number of pipe straps shall be removed at any given time unless the pipe is supported in a cradle.
 - 4. Incidentals within the limits of the project including but not limited to bollards, adjacent walkways, walls or supports containing graffiti.
 - 5. Contractor shall provide new ½-inch neoprene that shall be placed at contact interfaces between materials including, but not limited to, pipe support floor stands, pipe straps, and access barriers. The Contractor shall remove and replace existing neoprene where exposed with new material. In situations where ½-inch neoprene is not sized properly for existing conditions, the County, on a case by case basis may require a different thickness.

- E. The following surfaces or items are not generally required to be painted, unless noted otherwise. The Contractor shall properly protect these materials from surface preparation, coating application, or damage.
 - 1. Polished chrome, aluminum, nickel, stainless steel, brass, or bronze materials.
 - 2. Stainless steel hardware.
 - 3. Flexible couplings.
 - 4. Labels, signs or nameplates including but not limited to: UL, FM, equipment identification, performance rating, name and nomenclature plates shall not be coated.
 - 5. Aluminum handrails, walkways, window, louvers, and grating unless otherwise specified herein.

1.02 REFERENCES

- A. **SSPC** – Society for Protective Coatings
- B. **ASTM** – American Society of Testing Materials
- C. **NACE** – National Association of Corrosion Engineers
- D. **NSF** – National Sanitation Foundation (Standard 61)
- E. **AWWA** – American Water Works Association

1.03 DEFINITIONS

- A. Field Coating is the coating of new or rebuilt items at the job site. Field coating shall be the responsibility of the Contractor.
- B. Shop Coating is the coating of new or rebuilt items in the shop prior to delivery to the jobsite.
- C. Exterior – Outside, exposed to weather
- D. Interior – Inside, not subject to immersion service
- E. Immersion service – Material submerged or subject to splash or spray
- F. WFT – Wet Film Thickness
- G. DFT – Dry Film Thickness
- H. MDFT – average minimum dry film thickness
- I. SCARIFY – Roughen the entire existing coating surface by use of brush off blasting, hand tools, sanding, etc to provide an anchor profile for adhesion by new coating systems. Scarified surface shall be approved by the Coatings manufacturer and County prior to over-coating. Existing rust spots, weld slag, sharp edges, defects etc shall be removed by SSPC-SP11 Power tool cleaning to bare metal.

- J. General: The following referenced surface preparation specifications of the Joint Surface Preparation Standards from NACE International (NACE) and The Society for Protective Coatings (SSPC) shall form a part of this Specification:
1. SSPC-SP1 Solvent Cleaning. Remove all grease, oil, salt, acid, alkali, dirt, dust, wax, fat, foreign matter, and contaminants, etc. by one of the following methods: steam cleaning, alkaline cleaning, or volatile solvent cleaning. Rags and solvents must be replenished frequently to avoid spreading the contaminant rather than removing it. Low-pressure (1500-4000 psi) high volume (3-5 gal/min) water washing with appropriate cleaning chemicals is a recognized "solvent cleaning" method. All surfaces shall be cleaned per this Specification prior to using hand tools or blast equipment and between each coating application.
 2. SSPC-SP5 White Metal Blasting (NACE-1). Complete removal of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter, leaving the surface a uniform gray-white color.
 3. SSPC-SP6 Commercial Blast (NACE-3). Complete removal of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter, leaving only light shadows or discolorations from stains of rust, mill scale, or previous coating on 33% of the unit surface area. At least 66% of each unit surface area shall be free of all visible discoloration or staining.
 4. SSPC-SP 7 Brush-Off Blast (NACE 4). Complete removal of oil, grease, dust, dirt, loose rust, loose mill scale, and loose coatings, leaving tightly adherent mill scale, rust and previous coating. Tightly adherent rust, mill scale or paint may remain providing that it cannot be removed by lifting with a dull putty knife.
 5. SSPC-SP10 Near White Blast (NACE 2). Complete removal of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter, leaving only light shadows or discolorations from stains of rust, mill scale, or previous coating on 5% of the unit surface area. At least 95% of each unit surface area shall be free of all visible discoloration or staining.
 6. SSPC-SP 11 Power Tool Cleaning to Bare Metal. Complete removal of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide, corrosion products, and other foreign matter and retain or produce a minimum 1.0 mil surface profile. Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted.
 7. SSPC-SP 12 Waterjetting (NACE-5). Surfaces preparation by ultra-high pressure water jetting discharged from a nozzle at pressures of 70 MPa (10,000 psig) or greater to prepare a surface for coating or inspection. The difference in degrees of surface cleanliness is defined by the amount of pressure as follows:
 - a. Low Pressure Water Cleaning (LP WC) Less than 34 MPa (5,000 psi)
 - b. High Pressure Water Cleaning (HP WC) 34 to 70 MPa (5,000-10,000 psi)
 - c. High Pressure Water Jetting (HP WJ) 70 to 210 MPa (10,000-30,000 psi)
 - d. Ultra-High Pressure Water Jetting (UHP WJ) Above 210 MPa (30,000 psi)
 - e. WJ-1 Clean to Bare Substrate: Complete removal of all visible rust, dirt, previous coatings, mill scale, and foreign matter. Discoloration of the surface may be present.
 - f. WJ-2 Very Thorough or Substantial Cleaning: Complete removal of all visible oil, grease, dirt, and rust except for randomly dispersed stains of rust, tightly adherent thin coatings, and other tightly adherent foreign matter limited to a maximum of 5% of the surface.

- g. WJ-3 Thorough Cleaning: A WJ-3 surface shall be cleaned to a matte (dull, mottled) finish is free of all visible oil, grease, dirt, and rust except for randomly dispersed stains of rust, tightly adherent thin coatings, and other tightly adherent foreign matter limited to a maximum of 33% of the surface.
- h. WJ-4 Light Cleaning: A WJ-4 surface shall be cleaned to a finish which is free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose coating. Any residual material shall be tightly adherent.
- 8. SSPC-SP13 Surface Preparation of Concrete (NACE-6). Complete removal of contaminants, laitance, form oils, dust, dirt, loosely adhering concrete, and previous coating. Blasting, High-pressure water cleaning or waterjetting methods should be performed sufficiently close to the surface so as to open up surface voids, bug holes, air pockets, and other subsurface irregularities, but so as not to expose underlying aggregate.
- 9. SSPC-SP 14 Industrial Blast Cleaning (NACE-8). Complete removal of oil, grease, dust, dirt, loose rust, loose mill scale, and loose coatings, leaving tightly adherent mill scale, rust and previous coating evenly distributed on 10% of the unit surface area. Stains and discolorations may be present on 90% of the unit area. Tightly adherent rust, mill scale or paint cannot be removed by lifting with a dull putty knife.
- 10. SSPC-SP 15 Commercial Grade Power Tool Cleaning. Complete removal of all visible oil, grease, dirt, rust, coating, oxides, mill scale, corrosion products, and other foreign matter, except random staining shall be limited to no more than 33% of each unit area of surface. Staining may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating. Slight residues of rust and paint may also be left in the bottoms of pits if the original surface is pitted. (Equivalent standard as SSPC-SP6 Commercial Grade Blast Cleaning NACE-3).

1.04 SUBMITTALS

- A. Submit to the Engineer as provided in the General Conditions and Division 1, shop drawings, manufacturer's specifications and data on the proposed paint systems and detailed surface preparation, application procedures and dry film thickness.
- B. Contractor / Applicator Qualifications as listed below shall be submitted prior to the WORK.
 - 1. The Contractor's Project Superintendent / Project Manager shall be at minimum certified NACE Level 1 and be in good standing with NACE International prior to the WORK. The Contractor shall have a Competent Person onsite as defined by OSHA. Certification credentials shall be provided to the County and verifiable through the NACE.org certification search website.
 - 2. The Contractor must show proof that all employees associated with this project shall have been employed by the Contractor for a period not less than six (6) months.
 - 3. Coating shall be performed by experienced painters in accordance with the recommendations of the coating manufacturer and the Contract Documents. All paint shall be uniformly applied without sags, runs, spots, or other blemishes. Work that shows carelessness, lack of skill, or is defective in the opinion of the County, shall be corrected at the expense of the Contractor.

4. The applicator shall have practical experience and successful history in the application of the specified products to surfaces of water supply and wastewater collection and treatment facilities. A written list of references shall be provided to show experience and costs with high performance coatings on pipelines and aerial crossings as well with all other aspects with the defined Scope of Work.
 5. The Contractor shall provide a list of equipment owned and maintained by the Contractor that shall be utilized on the project.
 6. The Contractor shall provide their written QA / QC program.
 7. Contractors shall submit their protection and containment plan to prevent blasting debris, paint chips, paint overspray from entering water bodies, common areas or leaving the immediate work zone.
- C. Schedule of Painting Operations: The Contractor shall submit for approval a complete Schedule of Painting Operations within 30 days after the Notice to Proceed. The Contractor shall properly notify and coordinate with the County for schedule updates and site activities. This Schedule shall include for each surface to be painted, the brand name, the volume of solids, the coverage and the number of coats the Contractor proposes to use in order to achieve the specified dry film thickness. When the schedule has been approved, the Contractor shall apply all material in strict accordance with the approved Schedule and the manufacturer's instructions. Wet and dry paint film gauges shall be utilized by the County to verify the proper application while Work is in progress.
- D. Protection and Containment Plan: The Contractor shall submit for approval the process, equipment, design, materials, requirements, disposal and methods to provide for protection of the environment, collection of abrasive blasting material, collection of existing coatings, protection of the public and protection for public access.
- E. Maintenance of Traffic Plan (MOT): The Contractor shall prepare and submit a Traffic Control Plan to the Owner, and Orange County Public Works Department or Florida Department of Transportation for review and acceptance prior to commencing any Work on the site. The Traffic Control Plan shall detail procedures and protective measures proposed by the Contractor to provide protection and control of traffic affected by the Work consistent with the following applicable standards:
1. Standard Specifications for Road and Bridge Construction, Latest Edition including all subsequent supplements issued by the Florida Department of Transportation (FDOT Spec.).
 2. Manual of Traffic Control and Safe Practices for Street and Highway construction, Maintenance and Utility Operations, FDOT.
 3. Right-of-Way Utilization Regulations, Orange County, Florida, latest edition.
- F. Test panels/samples: At the request of the County, samples of the finished work prepared in strict accordance with these Specifications shall be furnished, and all painting shall be equal in quality to the approved samples. Finished areas shall be adequate for the purpose of determining the quality of workmanship. Experimentation with color tints shall be furnished to the satisfaction of the County where standard chart colors are not satisfactory.

- G. Equivalent materials of other manufacturers may be substituted on approval of the Engineer. Substitutions that decrease the film thickness, the number of coats applied, change the generic type of coating, or fail to meet the performance criteria of the specified materials will not be approved. Prime and finish coats of all surfaces shall be furnished by the same manufacturer. Requests for substitution shall include Manufacturer's literature for each product giving the name, generic type, descriptive information, evidence of satisfactory past performance, and an independent laboratory certification that their product meets the performance criteria of the specified materials including but not limited to the following:
1. Abrasion – Fed. Test Method Std. No. 141, Method 6192, CS-17 Wheel, 1,000 grams load
 2. Adhesion – Elcometer Adhesion Tester
 3. Exterior Exposure – Exposed at 45 degrees facing the ocean (South Florida Marine Exposure)
 4. Hardness – ASTM D3363-74
 5. Humidity – ASTM D2247-68
 6. Salt Spray (Fog) – ASTM B117-73

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. All paints and/or coatings applied in the performance of the Work shall be supplied by one paint supplier and be the product of one manufacturer; unless the County specifies or accepts a specialty paint not available from that manufacturer.
2. The paint manufacturer shall have supplied paint for water and wastewater facilities for a minimum of ten (10) years, and products supplied shall be contained within the manufacturer's standard water and wastewater brochure.
3. When the manufacturer's minimum recommendations exceed the specified requirements, Contractor shall comply with the manufacturer's minimum recommendations.

B. Safety and Health Requirements.

1. In accordance with the requirements of the OSHA Regulations for Construction, the Contractor shall provide and require the use of personal protective and lifesaving equipment for all persons working in or about the Project including, but not limited to, head and face protection, fall protection, safety harnesses and respiratory devices. Applicable health and safety precautions required by appropriate regulatory agencies such as OSHA, ANSI, etc., shall be followed.
2. Ventilation: Ventilation shall be adequate to reduce the concentration of air contaminants to the degree that a hazard to workers does not exist.
3. Sound Levels: Whenever the occupational noise exposure exceeds the maximum allowable sound levels, the Contractor shall provide and require the use of approved ear protective devices.
4. Illumination: Adequate illumination shall be provided while work is in progress. Whenever required by the County, the Contractor shall provide additional illumination and necessary support sufficient to cover all areas to be checked. The level of illumination required for observation purposes shall be determined by the County.

5. Temporary Ladders and Scaffolding: All temporary ladders and scaffolding shall conform to the applicable requirements of the OSHA Regulations for Construction. The Contractor shall provide access to the County for all areas of work during each phase of construction.
6. Safety of Public. Provide scaffolding, signage, temporary pedestrian access and barricades as required to protect the public from the work area. Areas to be closed off shall require public notice.

C. Pre-Job Meeting

1. A pre-job meeting shall be held prior to the commencement of the Work, prior to significant phases or per specific site location if the Work is not contiguous. Attendance shall include the County, Engineer, Contractor, and Painters Site Supervisor. The meeting will address site specific issues including but not limited to: schedule, access to the site, safety requirements, surface preparation, application, coating systems, inspection, quality control, MOT, protection of the public and protection of the environment as covered in the specifications.
2. Copies of all manufacturer's instructions and recommendations shall be furnished to the County and Engineer by the Contractor prior to the meeting.
3. It shall be the responsibility of the Coating Manufacturer to have their factory representative meet in person with the Contractor and Engineer a minimum of three times during the job as a consultant on surface preparation, mil thickness of coating and proper application of coating unless meeting is determined to be unnecessary by the Engineer.

D. Surface Preparation

1. Visual Standard SSPC-VIS-1 (Swedish SIS OS 5900), "Pictorial Surface Preparation Standards for Painting Steel Surfaces" and The National Association of Corrosion Engineers, "Blasting Cleaning Visual Standards" (TM-01-70 and TM-01-75) shall be the standards used to evaluate proper surface preparation.
2. To facilitate inspection, the Contractor shall on the first day of blasting operations, blast metal panels (12" x 12" x 1/4") to the degree called for in the Specifications and as noted above. Once a sample panel has been approved, it shall establish the quality of all subsequent Work by reference. The sample shall then be stored in a dry, sealed plastic container on the job site. Sample panels shall be prepared and approved for each type of sandblasting specified and shall be maintained and utilized by the County throughout the duration of sandblasting operations as reference standards of quality. Coatings shall be applied only at temperatures and conditions recommended by the paint manufacturer.

E. Inspection Devices:

1. The Contractor shall utilize, until final acceptance of the Work, inspection devices in good working condition for the detection of holidays, environmental conditions, and measurements of wet and dry-film thicknesses of protective coatings. Inspection devices shall be operated in strict accordance with the manufacturer's printed instructions and applicable SSPC and NACE standards and guidelines.

2. Thickness and Holiday Checking: Thickness of coatings shall be checked with a nondestructive, magnetic type thickness gauge. Coating integrity of coated surfaces shall be tested with an approved holiday detection unit per the paint manufacturer's recommendation. All pinholes shall be marked, repaired in accordance with the paint manufacturer's printed recommendations and re-tested. No pinholes or other irregularities will be permitted in the final coating. In cases of dispute concerning film thickness or holidays, the Contractor shall abide by the County's determination unless independent tests are performed by a certified lab at the Contractor's expense. Field measurements of film thickness shall not exceed the requirements of SSPC-PA 2 Measurement of Dry Coating Thickness with Magnetic Gages. Discrepancies shall be measured and verified with a micrometer or Tooke gauge if no other option is available.

1.06 PRODUCT DELIVERY STORAGE AND HANDLING

- A. Delivery: All materials shall be delivered to the job in undamaged, original packages with seals unbroken and in legible, labeled containers. Packages shall not be opened until the County inspects them and they are required for use. Labels shall show name of manufacturer, type of coating, formulation, date, color and manufacturers' recommendations and instructions for use.
- B. Storage: All painting materials shall be stored in a clean, dry, well-ventilated place, protected from sparks, flame, and direct rays of the sun or from excessive heat. Paint susceptible to damage from low temperatures shall be kept in a heated storage space when necessary. The Contractor shall be solely responsible for the protection of the materials he stores at the job site. Empty coating cans shall be neatly stacked in areas the Owner designates, and shall be removed from the job site on a schedule the Owner determines.
- C. Mixing: Mechanical mixers, capable of thoroughly mixing the pigment and vehicle together, shall mix the paint prior to use where required by manufacturer's instructions, however, thorough hand mixing will be allowed for small amounts up to one gallon. Pressure pots shall be equipped with mechanical mixers to keep the pigment in suspension, when required by manufacturer's instructions. Otherwise, intermittent hand mixing shall be done to assure that no separation occurs. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations.
- D. Thinning: Catalysts or thinners shall only be utilized as recommended by the manufacturer, and added or discarded strictly in accordance with the manufacturer's instruction. Unless the manufacturer specifically requires thinning for brush or roller application, no thinning shall be permitted.

1.07 PROJECT SITE CONDITIONS

- A. Application: Paint shall be applied only on thoroughly dry surfaces and during periods of favorable weather, unless specifically allowed by the paint manufacturer. Except as provided below, painting shall not be permitted when the atmospheric temperature is below 50° F, or when freshly painted surfaces may be damaged by rain, fog, dust, or condensation, and/or when it can be anticipated that these conditions will prevail during the drying period.
- B. No coatings shall be applied unless the relative humidity is below 85% unless recommended by the manufacturer.
- C. No coatings shall be applied unless surface temperature is a minimum of 5°F above dew point and temperature shall be maintained during curing.

1.08 WARRANTY

- A. Warranty Inspection: Warranty inspection shall be conducted during the eleventh month of the one (1) year warranty period following completion of all painting Work. All defective Work shall be repaired in strict accordance with this Specification, and to the satisfaction of the paint manufacturer and the County.
- B. Fluoropolymer / Fluorourethane. The Contractor shall warrant through the Manufacturer that the coating system shall not: check, crack, blister or delaminate from the substrate; change color more than 12 MacAdam units as determined in accordance with ASTM D2244; exhibit loss of gloss in excess of 24 units as measured by a gloss meter in accordance with ASTM D523-8; or chalk in excess of a rating of 8 as measured in accordance with ASTM D4214, Method A. Warranty coverage shall be effective for a period of 15 years from Final Completion depending on color. The Contractor shall notify the Manufacturer prior to ordering materials and begin the warranty process prior to starting the Work. The warranty information shall be provided to the County prior to ordering materials. Sample panels shall be obtained from the Manufacturer, and at least 2 sample panels shall be provided to the County in addition to the Manufacturers minimum requirements regarding the warranty process. The Contractor shall not be permitted to install the coating system until the Manufacturer has provided assurance that the color, substrate, surface preparation or existing conditions are in conformance with the Manufacturer's requirements for warranty.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The painting schedule has been prepared on the basis of Tnemec and Carboline products, and their recommendations for application.
- B. No paint containing lead shall be allowed.

2.02 COATING SYSTEMS

- A. The following summarizes the painting systems for various types of applications.
- B. The Contractor shall have the coating color matched or tinted by the coating supplier to exactly match Tnemec Color Codes as shown below. Manufacturers other than Tnemec shall submit a color matched swatch to the County for approval prior to ordering materials.

Generic Name	Application	Tnemec Color Codes
Safety Blue	Water Master Meters / Assemblies	True Blue / Safety 11SF
Safety Green	Wastewater Master Meters	Hunter Green 08SF
Safety Green	Pump Station Piping	Hunter Green 08SF
Safety Red	Fire Backflow Assemblies	Candy Apple Red / Safety 06SF
Pantone Purple 522C	Reclaimed Master Meters / Assemblies	Rec Water Purple 16SF
Safety Green	Hydrant Bonnet & Caps	Hunter Green 08SF
Safety Orange	Hydrant Bonnet & Caps	Tangerine Orange / Safety 04 SF
Safety Red	Hydrant Bonnet & Caps	Candy Apple Red / Safety 06SF
Aluminum	Hydrant Barrel	Aluminum 57GR

- C. Minimum film thickness shall be per manufacturer's recommendations unless a greater thickness is specified. The Contractor shall measure minimum film thickness in the field by utilizing a wet film gauge, which the County shall verify. Regardless of anchor profile, the Contractor shall utilize a wet film gauge to verify that the County-specified average minimum dry film thickness (MDFT) is being applied. The calculated value for wet film thickness (WFT) shall be derived from County's average MDFT unless the manufacturer's minimum range is greater. Following the manufacturer's recommended drying time, the Contractor shall measure and provide results to the County verifying that the average minimum dry film thickness meets the MDFT for each coat and final system, utilizing a dry film gauge. The County may conduct side-by-side verification.
- D. Coating systems shall incorporate the paints specified below, applied at the average dry film thickness (DFT) in mils per coat noted, and have the specified minimum average dry film thickness (MDFT) for each individual coat and total system.

HP – High Performance Coatings of FERROUS METALS

System HP-1 EXTERIOR EXPOSURE, UV EXPOSURE (NON-IMMERSION)

Complete removal of existing coating system

Coat	Tnemec	Carboline
Prime	Zinc Series 90-97 2.5 to 3.5 DFT Avg 3.0 MDFT	Carbozinc 621 3.0 to 8.0 DFT Avg 3.5 MDFT
Intermediate	Endura-Shield Series 73 2.0 to 3.0 DFT Avg 2.5 MDFT	Carbothane 133 HB 3.0 to 5.0 DFT Avg 3.5 MDFT
Finish	Hydroflon Series 700 2.0 to 3.0 DFT Avg 2.5 MDFT	Carboxane 950 2.0 to 3.0 DFT Avg 2.5 MDFT
Total	8 MDFT	9.5 MDFT

**System HP-2 EXTERIOR EXPOSURE, UV EXPOSURE (NON-IMMERSION)
Over-coating of localized inaccessible existing coatings and galvanized metal**

Coat	Tnemec	Carboline
Prime	Chembuild 135 4.0 to 9.0 DFT Avg 5.0 MDFT	Carboguard 553 3.0 to 4.0 DFT Avg 3.5 MDFT
Intermediate	Endura-Shield Series 73 2.0 to 3.0 DFT Avg 2.5 MDFT	Carbothane 133 HB 3.0 to 5.0 DFT Avg 3.5 MDFT
Finish	Hydroflon Series 700 2.0 to 3.0 DFT Avg 2.5 MDFT	Carboxane 950 2.0 to 3.0 DFT Avg 2.5 MDFT
Total	10.0 MDFT	9.5 MDFT

**System HP-5 EXTERIOR EXPOSURE, (IMMERSION)
Complete removal of existing coating system for immersion surfaces**

Coat	Tnemec	Carboline
Prime	Zinc Series 90-97 2.5 to 3.5 DFT Avg 3.0 MDFT	Carbozinc 621 3.0 to 8.0 DFT Avg 3.5 MDFT
Intermediate	Hi-Build Epoxoline II Series N69 4.0 to 8.0 DFT Avg 4.5 MDFT	Carboguard 60 4.0 to 6.0 DFT Avg 4.5 MDFT
Finish	Hi-Build Epoxoline II Series N69 4.0 to 8.0 DFT Avg 4.5 MDFT	Carboguard 60 4.0 to 6.0 DFT Avg 4.5 MDFT
Total	12.0 MDFT	12.5 MDFT

System HP-6 EXTERIOR EXPOSURE, UV EXPOSURE (NONIMMERSION)Over-coating of existing water based or unknown coating surface exposed to UV

Coat	Tnemec	Carboline
Existing	Existing coating system	Existing coating system
Spot Prime	Typoxy Series 27WB 4.0 to 14.0 DFT Avg 4.5 MDFT	NA
Prime	Typoxy Series 27WB 4.0 to 14.0 DFT Avg 4.5 MDFT	NA
Intermediate	Endura-Shield Series 73 2.0 to 3.0 DFT Avg 2.5 MDFT	NA
Finish	Hydroflon Series 700 2.0 to 3.0 DFT Avg 2.5 MDFT	NA
Total	9.5 MDFT	NA

DFT = Dry Film Thickness
MDFT = Minimum Dry Film Thickness

2.03 EQUIPMENT

- A. The Contractor's surface preparation, coating and painting equipment shall be designed and suitable for the application of the specific materials herein specified. The Contractor's equipment shall be subject to the approval of the County based on the manufacturer's data.
- B. Effective oil and water separators shall be used in all compressed air lines serving spray painting and sandblasting operations to remove oil or moisture from the air before it is used. Separators shall be placed as far as practical from the compressor.
- C. The Contractor shall furnish all equipment for application of the paint and the completion of the Work in first-class condition and shall comply with recommendations of the paint manufacturer.

PART 3 - EXECUTION

3.01 GENERAL

- A. All coating and painting shall conform to the applicable requirements of the Society for Protective Coatings (SSPC) Manual (most recent edition). Any material applied upon improperly prepared surfaces shall be removed and redone to the satisfaction of the Owner at the sole expense of the Contractor.
- B. All Work shall be performed by skilled craftsmen who are qualified to perform the required work and shall be done in a manner comparable to the best standards of practice found in that trade.
- C. The Contractor shall provide a supervisor to be at the work site during surface preparation, cleaning and coating operations. The supervisor shall have the authority to coordinate the work and make other decisions pertaining to the fulfillment of their contract.
- D. Prior to assembly, all surfaces that will be made inaccessible after assembly, shall be prepared as specified herein, and shall receive the paint or coating system as specified herein.
- E. Coating shall not be applied to wet or damp surfaces and shall not be applied in inclement weather. Do not apply when the surface temperature is less than 5° F above the dew point, or if relative humidity is greater than 85%. Dew or moisture condensation should be anticipated and if such conditions are prevalent, coating should be delayed until the surfaces are dry. Further, the day's coating should be completed well in advance of when condensation will occur, in order to permit the film a sufficient drying time prior to the formation of moisture.
- F. Any surfaces not specifically named in the Scope of Work, and not specifically exempted, shall be prepared, primed and painted in the manner and with materials consistent with these Specifications. The Owner shall select which of the manufacturer's products, whether the type is indicated herein or not, shall be used for such unnamed surfaces. No extra payment shall be made for this painting.

- G. Contractor shall inspect each pipe joint, pipe strap, personal barriers and appurtenances after providing access to the location but prior to commencing surface preparation activities. The Contractor shall immediately report leaks, damage, stripped bolts or nuts to the County.

3.02 SURFACE PREPARATION

- A. Solvent Cleaning: All dust, dirt, oil, or any contaminants that would affect the adhesion or durability of the finish coating shall be removed before hand tool cleaning, abrasive blasting and prior to each coating layer application by cleaning per SSPC-SP1 "Solvent Cleaning."
- B. Defects: All ferrous metal surfaces shall be free of all defects. The Contractor shall remove by chipping or grinding all sharp edges; other defects shall be ground smooth in accordance with NACE Standard RPO178, Appendix C. Weld flux, weld spatter, slag and excessive rust scale shall be removed by SSPC-SP 11 Power Tool Cleaning to Bare Metal. All weld seams, sharp protrusions, and edges shall be ground smooth prior to surface preparation or application of any coatings.
- C. Gaskets: Existing gaskets in between flanged joints shall be cut or ground flush with the existing flanged joint prior to surface preparation or field blasting operations. The Contractor shall not field blast into bell and spigot joints or under tapping saddles. Contractor shall blast perpendicular to the pipe surface. SSPC-SP3 Power Tool Cleaning shall be used inside bells and against tapping saddles to avoid damage to gaskets and locking mechanisms.
- D. Field blasting cleaning for all surfaces shall be accomplished by dry sandblasting method unless otherwise directed, or the County provides written approval
 1. The abrasive used in blast cleaning shall produce an anchor profile in accordance with the recommendations of the manufacturer of the protective coating, which is to be applied to the surface being cleaned.
 2. At all times during the blast cleaning operations, adequate means shall be employed to absolutely insure that existing protective coatings shall not be exposed to abrasion from blast cleaning operations.
 3. All blast cleaned surfaces shall be carefully dried and cleaned prior to application of specified coatings. No coatings or paint shall be applied over damp or moist surfaces.
 4. Field blasting and priming shall be completed on any particular area during the same workday, and the application of the primer shall follow immediately after surface preparation and cleaning prior to formation of any form of corrosion. If the surface is not primed within 8 hours, complete surface preparation shall be repeated.
 5. The Contractor shall at all times keep the work area in reasonably clean condition and shall not permit blasting materials to accumulate in an uncontrolled manner such as to constitute a nuisance or hazard to the satisfactory prosecution of the Work, operation of the existing facilities, public safety, environmental nuisances or public access.
 6. Touch-up systems shall be same as original specification except that approved manufacturer's organic zinc-rich shall be used in lieu of inorganic zinc where this system was originally used. Strict adherence to manufacturer's complete touch-up recommendations shall be followed. Any questions relative to compatibility of products shall be brought to the attention of the COUNTY and Coating Manufacturer; otherwise, Contractor assumes full responsibility.

7. Areas that are inaccessible to abrasive blasting, including adjacent to concrete pedestals, tapping saddles, pressure gauges or other appurtenances shall be cleaned in accordance with SSPC-SP 11 “Power Tool Cleaning to Bare Metal” immediately adjacent to the area as approved by the County.

E. Specified Surface Preparation: All surfaces shall be cleaned per SSPC-SP1 “Solvent Cleaning”. In addition to the surface preparation for the specific Service Condition, surface preparation shall be as follows:

Substrate	Condition	Surface Preparation
All Surfaces	All – Prior to Surface Preparation	SSPC-SP1 Solvent Cleaning
Steel	Exterior / Non-Immersion	SSPC-SP10 Near White Blast (NACE 2)
Steel	Exterior / Immersion	SSPC-SP5 White Metal Blasting (NACE-1)
Ductile Iron Pipe	Exterior / Non-Immersion	SSPC-SP6 Commercial Blast (NACE-3)
Ductile Iron Pipe	Exterior / Immersion	SSPC-SP10 Near White Blast (NACE 2)
Ferrous Metal	Exterior / Non-Immersion / Inaccessible to abrasive blasting	SSPC-SP 11 Power Tool Cleaning to Bare Metal
Galvanized Metals	Exterior / Non-Immersion	SSPC-SP 7 Brush-Off Blast (NACE 4)
PVC	Exterior / Non-Immersion	SSPC-SP1 Solvent Cleaning & Scarify by brush blast, power tools or hand sanding
Existing Coating System to be Over-Coated	Exterior / Non-Immersion	Scarify by brush blast or power tools

1. Exposed Pipe: Bituminous coated pipe shall not be used in above ground or exposed locations and shall be factory epoxy primed for all new pipe installations. After installation all exterior, exposed flanged joints shall have the gap between adjoining flanges sealed with a flexible caulking shall meet ASTM C-920 and shall be Sika Flex 1A or equal to prevent rust stains.
2. The Contractor shall not abrasive-blast or prepare more surface area than can be coated in the same day; prepare surfaces and apply prime coatings within an 8-hour period.
3. Contractor shall coordinate with the County prior to surface preparation. County approval shall be required prior to application of the prime coat.

3.03 APPLICATION EQUIPMENT

A. Brush and / or Rollers

1. Top quality, properly styled brushes and rollers shall be used. Rollers with a baked phenolic resin core shall be utilized.
2. The brushing or rolling shall be done so that a smooth coat, as nearly uniform in thickness as possible, is obtained. Brush or roller strokes shall be made to smooth the film without leaving deep or detrimental marks.
3. Surfaces not accessible to brushes or rollers may be painted by spray, by dauber or sheepskins, and paint mitt.

4. It may require 2 coats to achieve the specified dry film thickness if application is by brush and roller.

B. Air, Airless or Hot Spray

1. The equipment used shall be suitable for the intended purpose, capable of properly atomizing the paint to be applied, and equipped with suitable pressure regulators and gauges.
2. Paint shall be applied in a uniform layer, with a 50% overlap pattern. All runs and sags should be brushed out immediately or the paint shall be removed and the surface resprayed.
3. High build coatings should be applied by a crosshatch method of spray application to ensure proper film thickness of the coating.
4. Areas inaccessible to spray shall be brushed; if also inaccessible to brush, daubs or sheepskins shall be used, as the manufacturer authorizes.
5. Special care shall be taken with thinners and paint temperatures so that paint of the correct formula reaches the receiving surface.
6. Nozzles, tips, etc., shall be of sizes and designs as recommended by the manufacturer of the paint being sprayed.
7. Edges, corners, crevices, welds, and bolts shall be given a brush coat (stripe coat) of each coating. The stripe coat shall be applied by a brush and worked in both directions prior to spray application. Special attention shall be given to filling all crevices with coating.

3.04 WORKMANSHIP

A. General

1. Under no circumstances shall Asphaltic seal coats and mastics be overcoated.
2. Paints shall be mixed in proper containers of adequate capacity. All paints shall be thoroughly stirred before use and kept stirred while using. No unauthorized thinners or other materials shall be added to any paint.
3. Only skilled painters shall be used, and specialists shall be employed where required.
4. Extreme care shall be exercised in the painting of all operable equipment, such as valves, electric motors, etc., so that the proper functioning of the equipment will not be affected.
5. The Contractor's scaffolding shall be erected, maintained, and dismantled without damage to structures, machinery, equipment or pipe. Drop cloths shall be used where required to protect the environment, the public, buildings, equipment, and areas surrounding the Work. All surfaces required to be clear for visual observations shall be cleaned immediately after paint application.
6. The prime coat shall be applied immediately following surface preparation within 8 hours of the same working day. All paint shall be applied by brushing, paint mitt and roller, conventional spraying, or airless spraying, using equipment approved by the paint manufacturer.
7. Each coat of paint shall be recoated as per manufacturer's instructions. Paint shall be considered re-coatable when an additional coat can be applied without any detrimental film irregularities such as lifting or loss of adhesion.
8. Surfaces that will be inaccessible after assembly shall receive either the full specified paint system or three shop coats of the specified primer before assembly.

9. Finish colors shall be as specified per the color table in section 2.02 of this specification, and shall be factory mixed (i.e., the Contractor shall not tint the paint, unless the COUNTY and the Coating Manufacturer so authorizes.)
 10. All shop-coated surfaces shall be protected from damage and corrosion before and after installation by treating damaged area immediately upon detection. Abraded or corroded spots on shop-coated surfaces shall be cleaned per SSPC-SP1 Solvent Cleaning” and then touched up with the same materials as the shop coat in accordance with the manufacturers instruction. At the discretion of the Owner, all shop coated surfaces that are faded, discolored, or that require more than minor touch up shall be field blast cleaned and repainted.
- B. Field Coating: All painting at the site shall be designated “Field Coating”.
1. All paint shall be at ambient temperature before applying, and no painting shall be done when the temperature is below 50° F, in dust-laden air, when rain is falling, mist is present, when relative humidity exceeds manufacturer’s recommendation when temperature is less than 5° F above the dew point, or until all traces of moisture have completely disappeared from the surface to be painted.
 2. Protective coverings or drop cloths shall be used to protect existing appurtenances, concrete walkways, concrete structures, existing surfaces, the public, the environment and equipment. Care shall be exercised to prevent paint or coating overspray and spatter onto surfaces that are not to be painted. Surfaces from which such materials cannot be removed satisfactorily shall be painted or repainted, as required to produce, a finish satisfactory to the County.
 3. All edges, corners, crevices, welds, hardware and irregular surfaces shall receive a brush coat (stripe coat) of the specified product for each coat prior to application of each complete coat.
 4. Coating shall be applied in a neat manner that will produce an even film of uniform and proper thickness, with finished surfaces free from brush marks or other irregularities. Each coat shall be carefully examined and faulty material, poor workmanship, holidays, damaged areas and other imperfections shall be touched up prior to applying succeeding coats. Each coat shall be thoroughly dry and hard before the next coat is applied in accordance with the coating manufacturer's recommendations for drying time between coats. Coating shall be cleaned in accordance with SSPC-SP1 prior to the application of next coating. In no case shall coating be applied at a rate of coverage greater than the maximum rate recommended by the coating manufacturer.
 5. Coating failures shall not be accepted and shall be entirely removed down to the substrate and the surface recoated. Failures include, but are not limited to, holidays, sags, checking, cracking, teardrops, fat edges, fisheyes, or delamination. Any repairs made on surfaces shall be repaired in accordance with the coating manufacturer's instructions.
 6. Each coat shall be uniform in coverage and color. Successive coats of paint shall be tinted so as to make each coat easily distinguishable from each other with the final undercoat tinted to the approximate shade of the finished coat.
 7. Painting shall be continuous and accomplished in an orderly manner so as to facilitate inspection. Surfaces of exposed members that will be inaccessible after erection shall be cleaned and painted before erection.

8. All materials shall be applied in accordance with the manufacturer's instructions. If spray painting is required, Contractor shall accept all responsibility for any damage caused by overspray and/or drifting paint mist.
9. Caulking: The Contractor shall caulk all voids or interfaces including but not limited to: flanges, threads, nuts, saddles, gaps, voids or spaces between appurtenances and pipe to be coated immediately after the prime coat to prevent rust formation where ferrous metal is not accessible to surface preparation or blasting. Flexible caulking shall meet or exceed ASTM C-920 and shall be Sika Flex 1A or equal.

3.05 FIELD QUALITY CONTROL

At a minimum, the Contractor shall provide field quality control and verification of the coating film thickness utilizing the below methods.

- A. Wet Film Gauge. Both the Contractor and the County shall use a wet film gauge to verify the applied coating desired wet film thickness (WFT) to produce the required minimum DFT.

$$\text{Target WFT} = \text{County specified average MDFT} / \text{Volume Solids} \times 100\%$$

If thinner is applied per the manufacturer's recommendations, the volume of solids shall be reduced accordingly. Regardless of anchor profile, surface pattern or base metal calculation of the substrate, the gauge reported WFT shall meet the target WFT value for the substrate or previously coated surface to ensure the required average MDFT will be achieved.

- B. DFT Magnetic Gauge. Dry Film Magnetic Pull-Off Gauge (Type I) shall be utilized to determine DFT in accordance with SSPC-PA 2 "Measurement of Dry Coating Thickness with Magnetic Gages." The average of the readings shall meet the County-specified MDFT for each coating application. Electromagnetic Gauge (Type II) shall not be considered acceptable for use on ductile iron pipe.
- C. Holiday Testing: Each coating layer shall be holiday tested at the recommended 100-125 volts DC per mil in accordance with the latest edition of the following standards: NACE SP0188-2006, NACE Standard RP0490, ASTM G62 and per the manufacturer's recommendations. All low voltage holiday testing shall be performed using a Tinker & Rasor Model M-1 Holiday Detector, or equal. Areas found to have holidays shall be marked and repaired in accordance with the paint manufacturer's instructions.
- D. Destructive Testing: Destructive testing using a Tooke gauge shall only be utilized in cases of dispute regarding DFT. The County shall be permitted up to three (3) cuts per disputed area using the Tooke Gauge and the Contractor shall be responsible for repairing the areas examined at no additional cost.
- E. Environmental Testing: humidity, dew point and temperature shall be constantly measured and logged. Any electronic gauges shall be first calibrated against a sling psychrometer each day.

3.06 INSPECTION OF SURFACES

- A. Before application of the prime coat and each succeeding coat, all surfaces to be coated shall be subject to inspection and approval by the County. The Contractor shall correct any defects or deficiencies before application of any subsequent coating. Coatings applied without County approval shall be removed and reapplied at no cost to the County.
- B. The Contractor shall provide the County access to all areas of the Work. All scaffolding or lifts shall be in compliance with OSHA requirements.
- C. The Contractor shall furnish samples of surface preparation and of painting systems to be used as a standard throughout the job, unless omitted by the County.
- D. When any appreciable time has elapsed or has exceeded the manufactures recommendations between coatings, the County shall carefully inspect previously coated areas and surfaces that are damaged or contaminated, in the opinion of the County shall be cleaned and recoated at the Contractor's expense. Re-coating times of manufacturer's printed instructions shall be adhered to.
- E. Coating thickness shall be determined by the use of a properly calibrated "DeFelsko Positest FM" Type 1 Coating Thickness Gauge (or equal) for ferrous metal or a "Tooke" Paint Inspection gauge (or equal) for non-ferrous and cementitious surfaces. Please note that use of the "Tooke" gauge is classified as a destructive test.

3.07 PROTECTION, CONTAINMENT AND CLEAN-UP

- A. The premises shall at all times be kept free from accumulation of waste material and rubbish caused by employees or work. At the completion of the painting remove all tools, scaffolding, surplus materials, and all rubbish from and about the site and leave the area "broom clean" unless more exactly specified.
- B. The Contractor shall protect at all times, in areas where painting is being done, floors, sidewalks, walls, bridges, environment, public property, equipment, vehicles, appurtenances, and finished surfaces adjacent to paint work. Cover all electric plates, surface hardware, nameplates, gauge glasses, etc., before start of painting work.
- C. The Contractor shall contain all spent abrasives, old paint chips, paint overspray and debris by means suitable to the County, including but not limited to, full shrouding of the area. The Contractor shall provide a complete design and plan of the intended shroud or cover. Care must be taken not to modify or damage the structure during the use of the shroud. If damage should occur, the Contractor is held responsible for all repairs. The Contractor's containment shall be adequate enough to stop blasting residue from being released into the environment. There should be no visible emissions of particulate matter or visible deposits on the ground outside the containment area. Water jetting or wet abrasive blast cleaning for the purpose of removing paint and surface debris shall be conducted within a containment designed, installed, and maintained in order to capture paint chips and debris. Collection of the water is not required. Mesh containment materials that capture paint chips and debris while allowing the water to pass through

shall have openings a maximum of 25 mils (625 microns) in greatest dimension. Low Pressure Water Cleaning for the purpose of removing chalk, dirt, grease, oil and other surface debris can be performed without additional containment provided paint chips are removed and collected prior to Low Pressure Water Cleaning (LP WC).

- D. At completion of the work, remove all paint where spilled, splashed, splattered, sprayed or smeared on all surfaces, hardware, equipment, painted, and unpainted surfaces.
- E. After completion of all painting, the Contractor shall remove from job site all painting equipment, surplus materials, and debris resulting from this work.
- F. The Contractor shall remove and properly dispose of all hazardous materials from the jobsite in accordance with Local, State, and Federal requirements as outlined by the Environmental Protection Agency.

3.08 SCHEDULE OF WORK

Asset	Location	Description	Surface Prep	Coating System No.
All	All systems and sites shall receive Solvent Cleaning prior to surface prep & Coating.	All	SSPC-SP1	----
See Section 01010 For Surface Preparation and Coating System per Site Attach schedule of work to be painted				

END OF SECTION

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SECTION 15062
DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install, all ductile iron piping, ductile iron fittings, and appurtenances as shown on the Drawings and as specified herein.
- B. General Design: The equipment and materials specified herein are intended to be standard types of ductile iron pipe and cast or ductile iron fittings for use in transporting wastewater, potable water, and reclaimed water.

1.02 QUALITY ASSURANCE

- A. Qualifications: All of the ductile iron pipe and ductile or cast iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.
- B. Standards:
 - 1. ANSI A 21.50/AWWA C150
 - 2. ANSI A-21.51/AWWA C151
 - 3. ANSI A-21.41/AWWA C104
- C. Factory Tests: The manufacturer shall perform the factory tests described in ANSI A-21.51/AWWA C151.
- D. Quality Control
 - 1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards. All pipe on this Project shall be supplied by a single manufacturer unless otherwise accepted in writing by the County.
 - 2. In addition to the manufacturer's quality control procedures, the County may select an independent testing laboratory to inspect the material at the foundry for compliance with these specifications. The cost of foundry inspection requested by the County will be paid for by the County.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. Submit Shop Drawings and piping layouts, including areas within and under buildings and structures. Shop Drawings shall include dimensioning, methods and locations of supports and all other pertinent technical specifications. Show locations of all field cuts. Shop Drawings shall be prepared by the pipe manufacturer. Shop Drawings for piping within and under buildings and structures shall be submitted within 30-days of Execution of Contract.

B. Operating Instructions: Submit Operation and Maintenance Manuals in accordance with Section 01001 "General Work Requirements."

C. Manufacturer's Certification

1. Submit manufacturer's sworn certification of factory tests and test results.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

The Contractor shall be responsible for all materials furnished and stored until the date of project completion. The Contractor shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The Contractor shall, if requested by the County, furnish certificates, affidavits of compliance, test reports, samples or check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer's recommendations. Stored pipe shall be covered for protection against contamination and UV light. Joint gaskets shall be stored in clean, dark and dry location until immediately before use.

B. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe and fittings and their respective coatings. Pipe or fittings shall not be rolled off the carrier or dropped. Pipe shall be unloaded by lifting with a forklift or crane. All pipe or fittings shall be examined before installation and no piece shall be installed which is found to be defective. Pipe shall be handled to prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of the County or be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on level ground, graded to eliminate all rock points and to provide uniform support along the full pipe length. When being transported, the pipe shall be supported at all times in a manner which will not permit distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of the County, is damaged beyond repair by the Contractor shall be removed from the site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Ductile Iron Pipe

1. Standards: ANSI A-21.50, AWWA C150 and ANSI A-21.51, AWWA C151
2. Thickness/Pressure Class:
 - a. Below ground piping: Class 350 (4-inch to 12-inch), Class 250 (16-inch to 24-inch) and Class 200 (30-inch to 64-inch) unless otherwise noted or specified.
 - b. Above ground piping: Flanged, Class 350 (minimum) unless otherwise noted or specified.
3. Joints
 - a. Push-on or Mechanical Joints (below ground piping)
 - (1) Standards: ANSI A21.11, AWWA C111
 - (2) Class: 350-psi working pressure rating
 - (3) Gaskets
 - (a) Potable and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) ring type.
 - (b) Wastewater Service: Neoprene rubber ring type.
 - b. Flanged (above ground or inside below ground vaults)
 - (1) Standards: ANSI A21.15, ANSI B16.1
 - (2) Class: 125-pound factory applied screwed long hub flanges, plain faced without projection.
 - (3) Gaskets
 - (a) Spans less than 10-feet: full-face 1/8-inch thick neoprene rubber
 - (b) Spans greater than 10-feet: Toruseal gaskets as manufactured by American Cast Iron Pipe or acceptable equal.
 - c. Restrained Joints
 - (1) Manufacturers: Lok-Ring system (all sizes) or locking type gasket systems (for 16-inch diameter and smaller) as manufactured by American Ductile Iron Pipe; MEGALUG System as manufactured by EBBA Iron; or acceptable equal.
 - (2) Class: 250-psi minimum design pressure rating.
 - (3) Standard mechanical joint retainer glands shall not be acceptable.
 - d. Joint Accessories
 - (1) Mechanical joint bolts, washers and nuts: Ductile iron or Corten steel.
 - (2) Flanged joint bolts, washers and nuts: 316 stainless steel with bolts and nuts conforming to ASTM A193 Grade B8M.
 - e. Pipe Length (below ground installation): 20-foot maximum nominal length.
4. Pipe Identification
 - a. Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant, and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel. Pipe which is not clearly marked is subject to rejection. The Contractor shall remove all rejected pipe from the project site within five NORMAL WORKING DAYS.

B. Fittings

1. Ductile iron fittings 4-inch through 24-inch shall be pressure rated at 350-psi minimum, except flanged joint type fittings which shall be rated at 250-psi minimum. All 30-inch and larger fittings shall be pressure rated to 250-psi minimum. All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron only. All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline. All fittings shall be designed to be capable to withstand, without bursting, hydrostatic tests of three times the rated water working pressure. All fittings shall have a date code cast (not printed or labeled) with identification of date, factory, and the factory unit from which it was cast and machined. Fittings shall have the pressure rating, nominal diameter of openings, manufacturer's name, and the country where cast and number of degrees or fraction of the circle distinctly cast on them. Ductile iron fittings shall have the letter "DI" or "Ductile" cast on them.
2. Joints shall be as described for ductile iron pipe for above ground/exposed and buried service.
3. All potable water main fittings shall have NSF 61 certification, and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications.

2.02 COATINGS, LININGS AND IDENTIFICATION MARKINGS

A. Exterior Coatings

1. Below ground/buried or in a casing pipe:
 - a. Type: Asphaltic coating, 1.0-mil DFT in accordance with ANSI/AWWA A21.51/C151.
 - b. Markings: (continuous 3-inch wide strip within top 90 degrees of pipe - min. drying time 30-minutes before backfill).
 - c. Color:
 - (1) Raw Wastewater: Safety Green
 - (2) Reclaimed Water: Purple (Pantone 522C)
 - (3) Potable Water: Safety Blue
2. Above ground/Exposed/In vaults
 - a. Coatings and coating testing for ductile iron pipe and fittings for above ground/exposed applications shall be accordance with Division 9. Primer, intermediate and final coats whether shop or field applied shall be compatible and applied in accordance with the coating system manufacturer's recommendations. Refer to Appendix D "List of Approved Products" for approved coating system suppliers. Asphaltic seal coat applied to the exterior of above ground piping and fittings shall be blasted and completely removed prior to coating per NACE-3/SSPC-SP6 commercial blast cleaning minimum angular anchor profile of 1.5-mils.

- b. Color
 - (1) Raw Wastewater: Safety Green
 - (2) Reclaimed Water: Purple (Pantone 522C)
 - (3) Potable Water: Safety Blue
 - 3. Inside Wetwell
 - a. All piping inside of wastewater wetwell shall be 316 stainless steel.
- B. Interior Lining (Applied by pipe manufacturer)
- 1. Wastewater: Interior coating shall be Protecto 401 (amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment) for all pipe and fittings. All ductile iron pipe and fittings shall be delivered to the manufacturer certified applicator without asphalt, cement lining, or any other lining on the interior surface and no coating shall have been applied to the first 6-inches of the exterior of the DIP spigot ends. Minimum surface preparation shall be SSPC-SP 1 Solvent Cleaning method to remove oil and grease followed by NACE-4 / SSPC-SP7 Brush-Off Blast Cleaning. Protecto 401 shall be applied within 12-hours of surface preparation to the interior of the pipe and fittings so as to obtain a continuous and relatively uniform and smooth integral lining with a total minimum dry film thickness of 40-mils for the complete system. No lining shall take place when the substrate or ambient temperature is below 40°F. The lining shall not be used on the face of the flange of fittings or flanged pipe. The system shall be holiday free and holiday testing (minimum 2000 volts) shall be conducted and pinholes shall be repaired prior to shipping.
 - 2. Potable Water and Reclaimed Water: Interior coating shall be fusion-bonded epoxy (FBE) or Cement Mortar lined with asphaltic seal coat.
 - a. FBE for Fittings: Fittings shall be supplied with a FBE coating, both inside and outside for total protection including flanged and buried fittings. The exterior of flanged fittings for above ground assemblies shall adhere to final exterior coating requirements per 3119 2.04 A. The FBE coating system shall meet or exceed ANSI/AWWA C-550 and C116/A21.116 requirements and shall have NSF 61 certification. FBE coating thickness shall be 6 to 8-mils dry film thickness, shall be applied for secure adhesion, shall have a smooth surface and shall be holiday free.
 - b. Cement mortar lining with a seal coat of asphaltic material shall be in accordance with ANSI/AWWA A21.4/C104.
- C. Polyethylene Encasement is required when pipe is within 10-feet of a gas main or as indicated on the Drawings:
- 1. Standard: ANSI A 21.5/AWWA C105, 8-mil minimum thickness.

2.03 LOCATION MARKERS AND LOCATION WIRE

A. Electronic Markers and Locator System (for reclaimed water and wastewater ONLY)

1. Markers: Markers shall consist of a passive device capable of reflecting a specifically designated repulse frequency tuned to the utility (service) being installed. Markers shall be color coded in accordance with American Public Works Association's "Utility Locating and Coordinating Council Standards." Colors shall be: Wastewater and Reclaimed Water - #1404 Green. Markers shall be full range. Markers shall be installed directly above the centerline of the respective pipeline at intervals not to exceed 100-feet, at each fitting (tees, wyes, crosses, reducers, plugs, caps and bends) or change in horizontal direction and at each valve along the pipeline. Markers shall be hand backfilled to 1-foot above the pad and have a finished depth of burial of not less than 2-feet or more than 6-feet. No separate payment shall be made for furnishing and installing the respective frequency and color-coded electronic pad type marker.
2. Locator System: Marker locator set shall be the Scotch Mark EM II Electronic Marker Locator Path Tracing Receiver, or acceptable equal. The Contractor shall furnish 1-locator set for each type of service piping installed on the project (i.e.: reclaimed water, wastewater) to the County. Each unit shall incorporate the following features and accessories:
 - a. Unit(s) shall be tuned to the proper frequency for each type (service) of piping.
 - b. Field strength meter that provides visual indication of the return signal.
 - c. Function switch for selection of operation mode.
 - d. Sensitivity control to adjust the receiver gain.
 - e. Audio speaker for signal response.
 - f. Battery access panel containing condensed operating instructions.
 - g. Auxiliary headset and heads set jack.
 - h. Permanently attached shoulder straps.
 - i. Rugged shockproof and weatherproof storage/carrying case.
3. Manufacturer: System shall be Scotch Mark Locator System, or acceptable equal.

B. Location Detection Wire

1. Materials: Continuous, insulated 10-gauge copper wire (color to match pipe identification).
2. Installation: Directly above (1-inch maximum) centerline of pipe terminating at top of each valve box collar and be capable of extending 12-inches above top of box (stored inside the 2-inch brass pipe through the valve box collar) in a manner so as not to interfere with valve operation. For direction drilling installations, a minimum of 2 (two) 10-gauge wires shall be pulled along with the pipe.
3. Continuity: Continuity of wire to be tested using Metrotech 810/9860 or acceptable equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Ductile iron pipes shall be installed in accordance with AWWA C600 and AWWA Manual M-42. When a restraining type gasket is used, the bell shall be painted red.
- B. Underground Ductile Iron Pipe and Fittings.
 - 1. Bedding firm, dry and even bearing of suitable material. Blocking under the pipe will not be permitted.
 - 2. Placement
 - a. Alignment: In accordance with lines and grades shown on the Drawings. Deflection of joints shall not exceed 75% of the values recommended by the pipe manufacturer.
 - b. The Contractor shall provide line and grade stakes at a 100-foot maximum spacing and at all line and/or grade change locations. The Contractor shall provide temporary benchmarks at a maximum of 1,000-foot intervals. The minimum pipe cover shall be 30-inches below the finished grade surface or 30-inches below the elevation of the edge of pavement of the road surface whichever is greater.
 - c. All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken or otherwise defective materials are being used. All homing marks shall be checked for the proper length so as to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked greater than 1-inch shall result in rejection of pipe and removal from site. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.
 - d. Proper implements, tools and facilities shall be used for the safe and proper protection of the Work. Pipe shall be lowered into the trench in such a manner as to avoid any physical damage to the pipe. Pipe shall not be dropped or dumped into trenches under any circumstances.
 - e. Trench Dewatering and Drainage Control: Contractor shall prevent water from entering trench during excavation and pipe-laying operations to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.
 - f. Pipe Laying in Trench: Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and re-laid. Pigging of pipe may be used to remove foreign materials in lieu of flushing. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the County to ensure absolute cleanliness inside the pipe. The pipe shall be installed with the color stripe and pipe text on the top of pipe.

3. Cutting: When required, cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of the pipe to be used with a push-on bell shall be beveled. Bare metal exposed at ends of the pipe shall be field coated in accordance with pipe manufacturer's recommendations. Cut pipe for wastewater service shall have exposed bare metal ends repaired with Protecto 401 using the coating system manufacturer's field repair kit.

4. Joints

- a. Joint Placement

- (1) Push on joints: Pipe shall be laid with the bell facing upstream. The gasket shall be inserted and the joint surfaces cleaned and lubricated prior to placement of the pipe. After joining the pipe, a metal feeler shall be used to verify that the gasket is correctly located.

- (2) Mechanical Joints: Pipe and fittings shall be installed in accordance with the "Notes on Method of Installation" under ANSI A21.11/AWWA C111. The gasket shall be inserted and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.

- C. Thrust Restraint

1. General: Thrust restraint shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein.
 2. Length of Restrained Joints: In accordance with the lengths listed in the table as shown on the Drawings.

- D. Installation of Pipes on Curves

1. Maximum deflections at pipe joints, fittings and laying radius for the various pipe lengths shall not exceed 75% (percent) of the pipe manufacturer's recommendation.

3.02 CLEANING AND FIELD TESTING

- A. General: At the conclusion of the Work, the Contractor shall provide all associated cleaning and field testing as specified in other related sections of these specifications.

END OF SECTION

APPENDIX A

GEOTECHNICAL REPORT

Dated July 7, 2017

The attached Geotechnical Engineering Investigation and dewatering ground water sampling was accomplished for the utilization of the Design Engineer during the design phases of this project. The criteria and recommendations stated herein are not to be construed as direction from the Design Engineer to the Contractor and are hereby provided only as general information, furnished as a courtesy to the Contractor.

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Nadic Engineering Services, Inc.

**Preliminary Geotechnical Evaluation
Report for Northwest Water
Reclamation Facility
Rapid Infiltration Basin (RIB) Slope
Liners
Orange County, Florida
NES Project No.: C17003**

Prepared for:

**CPH, Inc.
1117 E. Robinson Street, Suite C
Orlando, FL 32801**

Prepared by:

**Nadic Engineering Services, Inc.
601 N. Hart Blvd
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407-521-4771**

Consultants in: Civil · Environmental · Geotechnical Engineering
Offices in: Orlando · Miami



NADIC ENGINEERING SERVICES, INC.
Civil, Environmental & Geotechnical Consultants

July 17, 2017

CPH, Inc.

1117 E. Robinson Street, Suite C
Orlando, Florida 32801

Attention: Mr. David E. Mahler, P.E.
Sr. Vice President

RE: Preliminary Geotechnical Evaluation Report for Northwest Water Reclamation Facility
Rapid Infiltration Basin (RIB) Slope Liners
Orange County, Florida
NES Proposal No.: C17003

Dear Mr. Mahler;

Nadic Engineering Services, Inc. (NES) is pleased to submit this Geotechnical Exploration and Evaluation Report for the above referenced project. The purpose of this investigation was to explore soil and groundwater conditions at the site and to use the information obtained to provide geotechnical recommendation for berm repair and liner construction recommendation. This Geotechnical Engineering evaluation was authorized through a subconsultant agreement between CPH and **NES**.

NES appreciates the opportunity to be of service to CPH and Orange County Utility Department on this project and looks forward to a continued association. Please contact us if you have any questions, or if we may be of further assistance to you as this project proceeds.

Sincerely,

NADIC ENGINEERING SERVICES, INC.

Mustafa Syed, B.Sc.
Staff Engineer

Godwin N. Nnadi, Ph.D., P.E.
Principal Engineer
FL Registration No. 50637

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1.0 PROJECT INFORMATION

Orange County Utility Department is planning to replace the existing liners in 15 Rapid Infiltration Basins (RIBs) in the Northwest Water Reclamation Facility (NWRf) in Apopka, Orange County, Florida. This project is located off of West McCormick Road near Lake Marden and Lake Cora Lee in Orange County, Florida. Ten of the 15 RIBs are located around Lake Marden at the west side of the NWRf, and five (5) RIBs are located on the east side of Lake Cora Lee.

The subject site is located within Sections 28, 29, 32 and 33, Township 21 South and Range 28 East in Orange County, Florida. The approximate site location is shown on **Figure 1** in **Appendix A**.

This report presents the findings of our subsurface exploration program; an evaluation of the soil and groundwater conditions encountered, and provides recommendations to support the design and construction recommendation for berm repair and liner replacement.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this exploration was to obtain information on the subsurface conditions at the 15 Rapid Infiltration Basins (RIBs) in order to provide recommendations relative to:

- Subsurface soil and groundwater conditions
- RIB Berm repairs
- RIB liner replacements
- Earthwork, including subgrade preparation.

The following services were provided in order to achieve the preceding objectives:

1. Reviewed readily available published geologic and topographic information. This published information will be obtained from the appropriate Quadrangle Map published by the United States Geological Survey (USGS) and the "Soil Survey of Orange County, Florida" published by the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS).
2. Site reconnaissance and meeting to evaluate existing conditions and drilling rig accessibility
3. Executed a program of subsurface soil investigation consisting of 30 Standard Penetration Test (SPT) borings to a depths ranging from 10 feet to 15 feet below existing grade. Two borings were performed at each RIB, one boring at the top behind the liner tie-in trench and the other at the RIB bottom just in front of the liner.

4. Measured encountered groundwater table in the borings and estimated normal wet seasonal high groundwater levels.
5. Visually examine all recovered soil samples and perform laboratory tests on selected representative soil samples.
6. Incorporate the results of the field and laboratory testing in a formal report with recommendations for berm repair and liner construction.

It should be noted that the subsurface exploration program was not designed to evaluate the potential for karst activity. This evaluation requires a more extensive field exploration, including geophysical studies and deep soil borings than those performed herein.

3.0 REVIEW OF PUBLISHED DATA

3.1 Topographic Survey Map

The "Apopka and Winter Garden, Florida" USGS Topographic Maps issued in 2015 were reviewed. The maps show the ground surface elevation in the project vicinity is range approximately from +100 to +150 feet, North American Vertical Datum of 1988 (NAVD'88). A reproduction of the USGS topography maps is provided in **Figure 2** in **Appendix A**.

3.2 USDA, NRCS Soil Survey of Orange County

The "Soil Survey of Orange County, Florida" published by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) was reviewed for general near surface soil information within the general project site. A brief summary of the mapped soil types is presented in Table 1 and a reproduction of the USDA/NRCS map for the project is presented on **Figure 3** in **Appendix A**.

Table 1: Orange County Soils Survey Summary

Soil Unit	Depth (in.)	Soil Description	USCS*	AASHTO**	USDA SHGWT*** (inches)
Basinger (3)	0-5	Fine sand	SP	A-3	3.5-6.0
	5-14	Sand, fine sand	SP, SP-SM	A-3, A-2-4	
	14-36	Sand, fine sand	SP, SP-SM	A-3, A-2-4	
	36-80	Sand, fine sand	SP, SP-SM	A-3, A-2-4	
Candler fine sand (4)	0-5	Fine sand	SP, SP-SM	A-3	>6.0
	5-74	Sand, fine sand	SP, SP-SM	A-3	
	74-80	Sand, fine sand	SP-SM	A-3, A-2-4	

Soil Unit	Depth (in.)	Soil Description	USCS*	AASHTO**	USDA SHGWT*** (inches)
Candler fine sand (5)	0-4	Fine sand	SP, SP-SM	A-3	>6.0
	4-61	Sand, fine sand	SP, SP-SM	A-3	
	61-80	Sand, fine sand	SP-SM	A-3, A-2-4	
Candler-Apopka fine sand (6)	0-6	Fine sand	SP, SP-SM	A-3	>6.0
	6-69	Sand, fine sand	SP, SP-SM	A-3	
	69-80	Sand, fine sand	SP-SM	A-3, A-2-4	
Tavares (46)	0-5	Fine sand	SP, SP-SM	A-3	3.5-6.0
	5-80	Sand, fine sand	SP, SP-SM	A-3	
Tavares-Millhopper Complex (47)	0-6	Fine sand	SP, SP-SM	A-3	3.5-6.0
	6-80	Sand, fine sand	SP, SP-SM	A-3	

*USCS: Unified Soil Classification System

**AASHTO: American Association of State Highway and Transportation Officials

***SHGWT: Seasonal High Groundwater Table

Information contained in the USDA/NRCS Soil Survey is very general and may be outdated due to recent development in the site vicinity. Therefore, it may not reflect the actual soil and ground water conditions, particularly if developments may have modified the natural soil conditions or surface/subsurface drainage.

3.4 Potentiometric Surface Map

The map "Potentiometric Surface of the Upper Floridian Aquifer in the St. Johns River Water Management District and Vicinity, Florida, September 2009" by the USGS was reviewed in the vicinity of the site. The potentiometer surface elevation in the vicinity of the proposed project area is approximately ranging from +50 to +60 feet, NGVD-88. A reproduction of the potentiometric map is included in **Figure 4 in Appendix A.**

3.5 Area Geology

The geology of Central Florida area is characterized by sedimentary strata formed during three distinct geologic periods. The surficial stratum is composed of undifferentiated Holocene/Pleistocene/Pliocene age sands containing varying amounts of silt and clay, which extend typically to depths on the order of 40 to 60 feet below the ground surface. This upper, mostly sandy zone contains the surficial aquifer (water table). A Miocene age deposit, the Hawthorn Formation, frequently underlies the surficial sands and is typically composed of clay, clayey sands and sandy limestone sometimes containing appreciable amounts of phosphate. This stratum extends to, typically, a depth of 80 to 120 feet beneath the existing ground surface and serves as the confining layer for the underlying Floridian Aquifer.

The Eocene age Ocala and Avon Park limestone formations are contained in the Floridian Aquifer, which is one of the most productive aquifers in the world. The extremely high productivity of this

aquifer is directly related to its numerous cavities and interconnected channels. The deepest formation of the Eocene age is the Avon Park limestone. The Avon Park limestone consists mostly of hard brown dolostone and tan, granular limestone. In Orange County, the Avon Park limestone formation is approximately 300 to 350 feet thick. Above the Avon Park limestone is the Ocala limestone. The Ocala limestone is a loose to moderate well cemented mass of very small to large microfossils with much less dolostone than the Avon Park limestone. Typically, the Ocala limestone contains almost pure limestone with no dolostone, although the lower few feet can be partly dolomitized in some areas.

3.6 Sinkhole Potential

The geology of the area, as described above, is conducive to the development of sinkholes. The solution features within the limestone can collapse or can allow the downward movement of overlying soils, known as raveling, to produce depressions at the surface which are typically circular in shape (sinkholes). Sinkholes can occur nearly anywhere in Central Florida, but are more likely to occur in areas characterized by thin confining beds, large differences between the surface water table elevation and the Floridian Aquifer potentiometric level, high recharge characteristics and the presence of limestone in relatively close proximity to the ground surface.

4.0 FIELD EXPLORATION PROGRAM AND METHODS

4.1 Field Exploration Program

To evaluate the subsurface conditions at the 15 RIB locations, two (2) Standard Penetration Test (SPT) borings were drilled; one 15-foot boring at the top behind the liner tie-in trench and a 10-foot boring at the bottom of RIB.

The boring locations were staked in the field by **NES** on April 18, 2017 during field meeting with CPH and Orange County Utilities Department personal. The boring locations were not established by survey but rather by taping the distance from the existing landmarks and with the aid of Global Positioning system (GPS) device. The method used to locate the borings is, in **NES's** opinion, sufficient to meet the intent of our study. The approximate boring locations are shown on the **Boring Location Maps** on **Figures 5A** through **5C** in **Appendix A**.

4.2 Field Exploration Methods

4.2.1 Standard Penetration Test Borings

The Standard Penetration Test (SPT) boring procedure was conducted in general conformance with American Society for Testing of Materials (ASTM) test designation D-1586. The borings were advanced by the rotary wash method with bentonite based mud as the circulation fluid to stabilize the borehole. The SPT borings were performed continuously from the ground surface to 10 feet and at 5-foot depth interval thereafter. After seating the sampler 6 inches, the number of successive blows required to drive the sampler 12 inches into the soil constitutes the test result commonly referred

to as the “N” value. The “N” value has been empirically correlated with various soil properties and is considered indicative of the relative density of cohesionless soils and the consistency of cohesive soils. Adjacent to the SPT boring profile on **Sheets 1 through 8** in **Appendix B** are the “N” values.

The recovered split-barrel samples were visually classified in the field with representative portions of the samples placed in airtight containers and transported to our Orlando office for review by a geotechnical engineer and confirmation of the field classification.

Soil borings were performed with the using automatic drop hammer as noted on the SPT boring profile sheets. At the completion of drilling and after measuring the encountered groundwater table, the SPT borings were backfilled to the surface for safety.

5.0 LABORATORY TESTING

Representative soil samples were retained from the strata observed in each boring and returned to NES's laboratory for visual classification and stratification in accordance with ASTM D 2487 “Standard Classification of Soils for Engineering Purposes” (Unified Soil Classification System). Selected soil samples were tested to aid in classifying the soils and to help in evaluating the general engineering characteristics of the recovered soils. A summary of the tests performed is shown in **Table 2** below.

Table 2: Laboratory Testing Methodology

Test Type	FDOT	ASTM
Grain Size Analysis	FM 1-T 088	D-422
-200 Sieve	FM 1-T 011	D-1140
Moisture Content	FM 1-T 265	D-2216
Atterberg Limits	FM 1-T 089 and FM 1-T 090	D-4318

The results of our laboratory testing are presented on **Table 3** in **Appendix A** and **Sheet 1** through **8** in **Appendix B** respectively.

6.0 SUBSURFACE CONDITIONS

6.1 General

The soil stratification presented in this report is based on visual observation of recovered soil samples, limited number of laboratory tests and interpretation of the field boring logs by a geotechnical engineer. The stratification lines shown on the boring profiles represent approximate boundaries between soil types of significantly different engineering properties. The actual

transition may be gradual. The soil profiles presented on **Sheets 1** through **8** in **Appendix B** represent the conditions at the particular boring locations and variations do occur among and between the borings. Subsurface conditions, including groundwater conditions may differ from the conditions we encountered at the boring location at other locations within the project site. In addition, subsurface conditions at the boring location can change over time.

A specific description of the soil conditions and relative density is provided by the soil boring profiles on **Sheets 1** through **8** in **Appendix B**.

6.2 Boring Results

A total of 30 SPT borings were completed to a depths ranging from 10 feet to 15 feet below existing grade at 15 RIB locations. Two (2) borings were completed on each RIB, one 15-foot boring on top behind the liner tie-in trench and the other 10-foot boring at the bottom in front of the liner tie-in trench. The boring IDs are allotted as RIB#-T for top borings and RIB#-B for bottom borings.

6.2.1 Rapid Infiltration Basin 1 (RIB1)

SPT borings RIB1-T and RIB1-B encountered brown fine sand (SP) (A-3) from existing ground surface to boring termination depth of 15 feet and 10 feet, respectively.

The SPT “N”-values in SPT boring RIB1-T ranged from 5 to 21 blows per foot indicating loose to medium dense relative density. For SPT boring RIB1-B ranged from 8 to 20 indicating medium dense relative density.

Ground water was not encountered.

6.2.2 Rapid Infiltration Basin 2 (RIB2)

SPT borings RIB2-T and RIB2-B encountered brown fine sand (SP) (A-3) from existing ground surface to boring termination depth of 15 feet and 10 feet, respectively.

The SPT “N”-values in SPT boring RIB2-T ranged from 6 to 24 blows per foot indicating loose to dense relative density. For SPT boring RIB2-B ranged from 6 to 10 indicating loose to medium dense relative density.

Ground water was not encountered.

6.2.3 Rapid Infiltration Basin 3 (RIB3)

SPT borings RIB3-T and RIB3-B encountered light brown to brown fine sand (SP) (A-3) from existing ground surface to boring termination depth of 15 feet and 10 feet, respectively.

The SPT “N”-values in SPT boring RIB3-T ranged from 6 to 23 blows per foot indicating loose to dense relative density. For SPT boring RIB3-B ranged from 7 to 13 indicating loose to medium dense relative density.

Ground water was not encountered.

6.2.4 Rapid Infiltration Basin 4 (RIB4)

SPT borings RIB4-T and RIB4-B encountered light brown to brown fine sand (SP) (A-3) from existing ground surface to boring termination depth of 15 feet and 10 feet, respectively.

The SPT “N”-values in SPT boring RIB4-T ranged from 7 to 15 blows per foot and for SPT boring RIB4-B ranged from 6 to 18 indicating loose to medium dense relative density.

Ground water was encountered only in SPT boring RIB4-B at 6 feet below the ground surface.

6.2.5 Rapid Infiltration Basin 5 (RIB5)

SPT borings RIB5-T and RIB5-B encountered brown fine sand (SP) (A-3) to brown fine sand with silt (SP-SM) (A-3) from existing ground surface to boring termination depth of 15 feet and 10 feet, respectively.

The SPT “N”-values in SPT boring RIB5-T ranged from 4 to 21 blows per foot and for SPT boring RIB5-B ranged from 5 to 24 indicating loose to medium dense relative density.

Ground water was not encountered.

6.2.6 Rapid Infiltration Basin 6 (RIB6)

SPT boring RIB6-T encountered light brown fine sand (SP) (A-3) to brown fine sand with clay (SP-SC) (A-3) to a depth of 7 feet below the ground surface. Beneath fine sand with clay to 13 feet below the existing grade is brown clayey sand (SC) (A-2-6) followed by light brown fine sand trace clay (SP) (A-3) to boring termination depth.

SPT boring RIB6-B encountered brownish orange clayey sand (SC) (A-2-6) to boring termination depth.

The SPT “N”-values in SPT boring RIB6-T ranged from 4 to 26 blows per foot indicating loose to dense relative density. For SPT boring RIB6-B ranged from 9 to 20 indicating medium dense relative density.

Ground water was not encountered.

6.2.7 Rapid Infiltration Basin 7 (RIB7)

SPT borings RIB7-T and RIB7-B encountered brown to light brown fine sand (SP) (A-3) from existing ground surface to boring termination depth of 15 feet and 10 feet, respectively.

The SPT “N”-values in SPT boring RIB7-T ranged from 7 to 16 blows per foot and for SPT boring RIB7-B ranged from 6 to 20 indicating loose to medium dense relative density.

Ground water was not encountered.

6.2.8 Rapid Infiltration Basin 9 (RIB9)

SPT borings RIB9-T and RIB9-B encountered dark brown to light brown fine sand, trace silt (SP) (A-3) from existing ground surface to boring termination depth of 15 feet and 10 feet, respectively.

The SPT “N”-values in SPT boring RIB9-T ranged from 6 to 24 blows per foot indicating loose to dense relative density. For SPT boring RIB9-B ranged from 6 to 13 indicating loose to medium dense relative density.

Ground water was not encountered.

6.2.9 Rapid Infiltration Basin 10 (RIB10)

SPT boring RIB10-T encountered brown to light brown fine sand (SP) (A-3) to a depth of 8 feet and followed by brownish orange clayey sand (SC) (A-2-6) to boring termination depth of 15 feet.

SPT boring RIB10-B encountered brownish orange fine sand with clay (SP-SC) (A-3) to a depth of 8 feet and followed by brownish orange clayey sand (SC) (A-2-6) to boring termination depth of 10 feet.

The SPT “N”-values in SPT boring RIB10-T ranged from 2 to 24 blows per foot indicating very loose to dense relative density. For SPT boring RIB10-B ranged from 6 to 13 indicating dense to very dense relative density.

Ground water was encountered only in SPT boring RIB10-B at 5 feet below the ground surface.

6.2.10 Rapid Infiltration Basin 11 (RIB11)

SPT borings RIB11-T and RIB11-B encountered light brown to brown fine sand (SP) (A-3) to a depth of 4 feet and followed by brown to brownish orange clayey sand (SC) (A-2-6) to boring termination depth of 15 feet and 10 feet, respectively.

The SPT “N”-values in SPT boring RIB11-T ranged from 2 to 27 blows per foot indicating very loose to dense relative density. For SPT boring RIB11-B ranged from 9 to 19 indicating medium dense relative density.

Ground water was encountered only in SPT boring RIB11-B at 5 feet below the ground surface.

6.2.11 Rapid Infiltration Basin 14A (RIB14A)

SPT boring RIB14A-T encountered brown to light brown fine sand (SP) (A-3) to a depth of 6 feet and followed by orange brown to brown clayey sand (SC) (A-2-6) to a depth of 13 feet. Beneath clayey sand brown fine sand (SP) (A-3) was encountered to boring termination depth of 15 feet.

SPT boring RIB 14A-B encountered brown fine sand (SP) (A-3) to boring termination depth of 10 feet.

The SPT “N”-values in SPT boring RIB14A-T ranged from 9 to 26 blows per foot indicating medium dense to dense relative density. For SPT boring RIB14A-B ranged from 5 to 16 indicating medium dense relative density.

Ground water was not encountered.

6.2.12 Rapid Infiltration Basin 14B (RIB14B)

SPT borings RIB14B-T and RIB 14B-B encountered dark brown to brown fine sand (SP) (A-3) to fine sand with silt (SP-SM) (A-3) to boring termination depth of 15 feet and 10 feet respectively.

The SPT “N”-values in SPT boring RIB14B-T ranged from 9 to 40 blows per foot indicating medium dense to very dense relative density. For SPT boring RIB14B-B ranged from 5 to 8 indicating loose to medium dense relative density.

Ground water was not encountered.

6.2.13 Rapid Infiltration Basin 14C (RIB14C)

SPT borings RIB14C-T and RIB 14C-B encountered brown fine sand (SP) (A-3) to fine sand with silt (SP-SM) (A-3) to boring termination depth of 15 feet and 10 feet respectively.

The SPT “N”-values in SPT boring RIB14B-T ranged from 8 to 39 blows per foot indicating medium dense to very dense relative density. For SPT boring RIB14B-B ranged from 7 to 20 indicating loose to medium dense relative density.

Ground water was not encountered.

6.2.14 Rapid Infiltration Basin 14D (RIB14D)

SPT borings RIB14D-T and RIB 14D-B encountered brown fine sand to fine sand with roots (SP) (A-3) to boring termination depth of 15 feet and 10 feet respectively.

The SPT “N”-values in SPT boring RIB14D-T ranged from 3 to 22 blows per foot and for SPT boring RIB14D-B ranged from 4 to 28 indicating loose to medium dense relative density.

Ground water was not encountered.

6.2.15 Rapid Infiltration Basin 15 (RIB15)

SPT borings RIB15-T and RIB15-B encountered dark brown fine sand to fine sand trace silt (SP) (A-3) to a depth of 13 feet and 6 feet below the existing ground surface. Then SPT boring RIB15-T encountered brown sandy clay (CH) (A-6) to boring termination depth of 15 feet and SPT boring RIB15-B encountered brownish orange clayey sand (SC) (A-2-6) to boring termination depth of 10 feet.

The SPT “N”-values in SPT boring RIB15-T ranged from 15 to 28 blows per foot and for SPT boring RIB15-B ranged from 5 to 23 indicating loose to medium dense relative density.

Ground water was encountered 4 feet below the existing ground surface at SPT borings RIB15-T and RIB15-B.

6.3 Groundwater

Groundwater was not encountered in most of the borings except in borings RIB4-B, RIB11-B, RIB10-B, RIB15-T and RIB15-B where groundwater table was encountered between elevation +105.3 and +93.5 feet, NAVD’88 at the time of our exploration (May 2017). Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences, such as swales, drainage ponds, underdrains, and areas of covered soil (roadways, sidewalks, etc.).

For the purposes of this report, estimated seasonal high groundwater levels are defined as groundwater levels that are anticipated at the end of the wet season of a “normal rainfall year” under current site conditions. “Normal rainfall year” is defined as a year in which rainfall quantity and distribution were at or near historical rainfall averages. The estimated seasonal high groundwater levels presented next to the boring profiles (**Sheet 1 through 8 in Appendix B**) are based on the soil stratigraphy, measured groundwater levels, USDA/NRCS information, review of roadway plans, and past experience with similar soil conditions. In general, the estimated seasonal high groundwater level is not intended to define a limit or ensure future seasonal fluctuations in groundwater levels will not exceed the estimated levels. Post-development groundwater levels could exceed the seasonal high groundwater level estimates as a result of a series of rainfall events, changed conditions at the site which alter surface water drainage characteristics, or variations in the duration, intensity, or total volume of rainfall.

7.0 EVALUATION AND RECOMMENDATIONS

7.1 General

The evaluation and recommendations contained in this report are based in part on the data obtained from our limited field exploration and experience with similar subsurface conditions and types. The exploration methods used indicate subsurface conditions at specific boring locations, only at the time they were performed and to the depths penetrated. Borings cannot be relied upon to accurately reflect the variations that usually exist between boring locations and these variations may not become evident until construction. If variations from the conditions described in this report become evident during the course of construction, or project characteristics described in this report change, **NES** should be retained to re-evaluate the conclusions and recommendations contained in this report in light of such changes.

7.2 RIB Global Stability

Global or rotational slope stability analysis was performed on the interior slope of some selected RIBs. Slope stability analyses were performed the critical sections of the RIBs. The slope stability analysis was performed using STABL6, a slope stability program developed by Purdue University, and generally used on Florida Department of Transportation (FDOT) and other transportation projects. The analyses were performed for a Steady State Seepage (Long Term) condition adapted from EM1110-2-1902 Slope Stability, dated October 31, 2003. The results of the global stability analysis are summarized in **Table 4** below and sample calculations are available in **Appendix C**.

Table 4: Global (Rotational Slope) Stability Analysis Results

RIB No.	Boring No.	Northing (ft.)	Easting (ft.)	RIB Top Elevation (NAVD88)	RIB Bottom Elevation (NAVD88)	Water Level Elevation (NAVD88)	Approx. Embankment slope	Factor of Safety (1.5 min.)
RIB -1	RIB1-T	1564634.0	484819.1	145.7'	-	Groundwater Not Encountered (GNE)	3H:1V	2.3
	RIB1-B	1564715.1	484757.1	-	139.2'			
RIB -6	RIB6-T	1563431.9	484867.2	126.5'	-		3.6H:1V	4.5
	RIB6-B	1563371.5	484804.6	-	119.3'			
RIB -7	RIB7-T	1562725.0	484837.4	120.3'	-		3.6H:1V	1.9
	RIB7-B	1562714.6	484890.8	-	113.7'			
RIB -9	RIB9-T	1561965.6	485248.3	95.2'	-		4.6H:1V	1.8
	RIB9-B	1561895.0	485243.6	-	89.5'			

The soil parameters used in the analyses are based on the result of our exploration and laboratory tests. The boundary conditions included slope configuration, bench width and phreatic surface. Detailed assumptions of soil parameters are provided in **Appendix C**.

7.3 RIB Liners

We understand the Orange County will replace the existing 60mil HDPE smooth liner with 60 mil HDPE textured liners. All HDPE liners installation shall be performed in accordance with the HDPE liner manufacturer's guidelines and recommendations.

It is recommended that the following notes be added to the plans:

- *There should be no rocks, roots or any other protruding objects in the top 3 inches of the slope surface. If there is any potential for vegetation growth, a suitable sterilant should be applied to the surface layer prior to final compaction*
- *The slope surface should be compacted to at least 95 percent of the material's ASTM D-1557 Modified Proctor maximum dry density*
- *Continuous liner shall be installed for all interior embankments*
- *All HDPE liners installation shall be performed in accordance with HDPE liner manufacturer's guidelines and recommendations to meet warranty requirement.*

Material labeling, delivery, storage, handling, welding equipment, installation and field seaming of liner shall be in accordance with the HDPE liner manufacturer's guidelines and recommendations.

7.4 Site Preparation

Prior to installation of the textured HDPE liners, the existing smooth HDPE liners should be removed. The exposed liner foundation area should be smooth and free of projections that may damage the liner. Rocks, coarse gravel and other such material should be removed or rolled so as to provide smooth surface and/or covered with a cushion of fine soil.

An effective sterilant should be applied to the subgrade to prevent growth of vegetation, especially where seed and/or plant roots are present.

Any failed section of the existing slope should be filled with clean sand free of organics, debris, rocks and vegetation and compacted. Fill placement should be in 12-inch lifts as measured in loose thickness. Each lift should be uniformly compacted to at least 95 percent of the material's ASTM D-1557 Modified Proctor maximum dry density, prior to placement of the next lift. The entire exposed slope should also be compacted to 95 percent of the material's ASTM D-1557 Modified Proctor maximum dry density.

The anchor trench should be excavated completely around the area to be lined at the top of the berm. The trench should be at least 24 inches from the top edge of the slope. The trench should be 24 inches deep and about 12 inches wide, or according to the project plans specifications. Care should be taken to avoid construction equipment from coming in direct contact with the HDPE liner.

7.5 RIB Access Concrete Slab Construction Considerations

Based on our visual observation, it appears that most of the access concrete slabs are in relatively good condition. However, RIB 9 access slab appears to have some washout below it. The slab or portion of it should be removed and the subgrade backfilled and compacted at least 98 percent of the ASTM D-1557 maximum dry density. For all access concrete slab construction, we recommend subgrades should be maintained in a relatively moist condition prior to RIB access concrete slab construction. If the subgrade should become desiccated, saturated or disturbed the area should be scarified, moisture conditioned, and recompacted prior to floor slab.

RIB access concrete slab bearing soils should be compacted to a density of at least 98 percent of the ASTM D-1557 maximum dry density. The required compaction should be achieved for a depth of at least one foot below the bottom of the bearing surface. Any soft/ loose soil or unsuitable materials should be excavated and backfilled with suitable material. Sand backfill should be compacted to a density of at least 98 percent of the material's modified Proctor maximum dry density (ASTM D-1557), as previously described.

The concrete RIB access slab design should include at least 6 inches of free drainage compacted granular material with less than 5 percent fines as a capillary break.

8.0 CONSTRUCTION RELATED SERVICES

We recommend the owner retain **Nadic Engineering Services, Inc.** to perform construction inspection services, including materials tests and observations for confirmation adequacy of the earthwork operations. Field tests and observations include verification of foundation and pavement subgrades and performing quality assurance tests of compacted structural fill placement. The geotechnical engineering services does not end with advertisement of the construction documents, but is an on-going process throughout construction phase. Because of **NES's** involvement in the design stage, **NES** is most qualified to address subsurface related questions that might arise during construction in a timely and cost effective manner.

9.0 REPORT LIMITATIONS

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. We are not responsible for the conclusions, opinions or recommendations made by others based on these data.

The scope of this report was intended to evaluate soil conditions within the influence of the proposed RIB liner foundations and allow design and construction to commence. The analysis and recommendations submitted in this report are based upon the data obtained from the borings performed at the date of the subsoil exploration. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be

CPH Engineers, Inc.

Northwest Water Reclamation Facility
Rapid Infiltration Basin (RIB) Slope Liners
NES Project No. C17003

July 17, 2017
Page 14 of 14

necessary after **NES** has had an opportunity to observe the characteristics of the conditions encountered.

The scope of services did not include an environmental assessment for determining the absence or presence of wetlands or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air, on or below this site. Any statements in this report or on the soil profiles regarding odors, colors, unusual or suspicious items or conditions are strictly for the information of the client.

NES appreciates the opportunity to provide our services on this project and we trust that the information presented is sufficient for your immediate needs. If you have any questions concerning the contents of this report, or as we may be of further service, please contact the undersigned.

APPENDIX A

Figure 1	Aerial Map
Figure 2	USGS Topographic Map
Figure 3	USDA/NRCS Soils Map
Figure 4	Potentiometric Surface Map
Figures 5A through 5C	Boring Location Map
Table 3	Summary of Laboratory Test Results



NOT TO SCALE

REFERENCE	PROJECT LOCATION	U.S.G.S QUADRANGLE MAP	ISSUED	PHOTO REVISED
Google Earth Aerial Map, 2016	S28& 29; T21S; R28E S32& 33; T21S; R28E	APOPKA, FL WINTER GARDEN, FL	2015	

NADIC ENGINEERING SERVICES, INC. 601 N. HART BOULEVARD ORLANDO, FL 32818 PH (407) 521-4771 FAX (407) 521-4772	
DATE:	05-08-2017
DRAWN:	MS
CHECKED:	GNN



ORANGE COUNTY
PUBLIC WORKS

PROJECT NAME: AERIAL MAP NORTH WEST RECLAMATION FACILITY RAPID INFILTRATION BASIN (RIB) SIDE SLOPE LINERS REPLACEMENT		NES PROJECT No. C17003
COUNTY ORANGE	CONTRACT No. -	FIGURE 1



REFERENCE	PROJECT LOCATION	U.S.G.S QUADRANGLE MAP	ISSUED	PHOTO REVISED
United States Geological Survey (USGS)	S28& 29; T21S; R28E S32& 33; T21S; R28E	APOPKA, FL WINTER GARDEN, FL	2015	

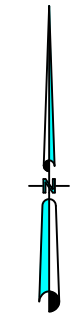
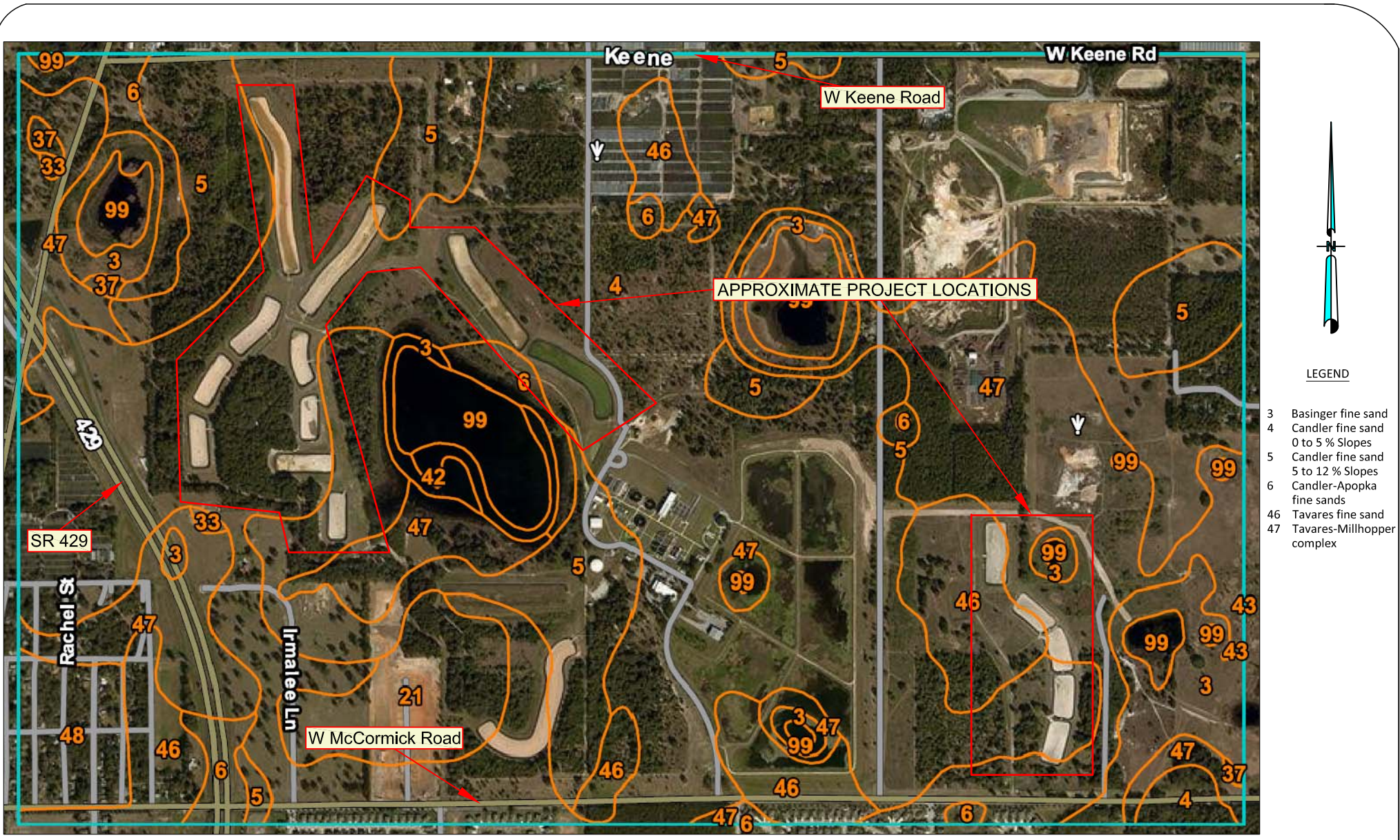
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601 N. HART BOULEVARD
ORLANDO, FL 32818
PH (407) 521-4771 FAX (407) 521-4772

DATE: 05-08-2017
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PUBLIC WORKS

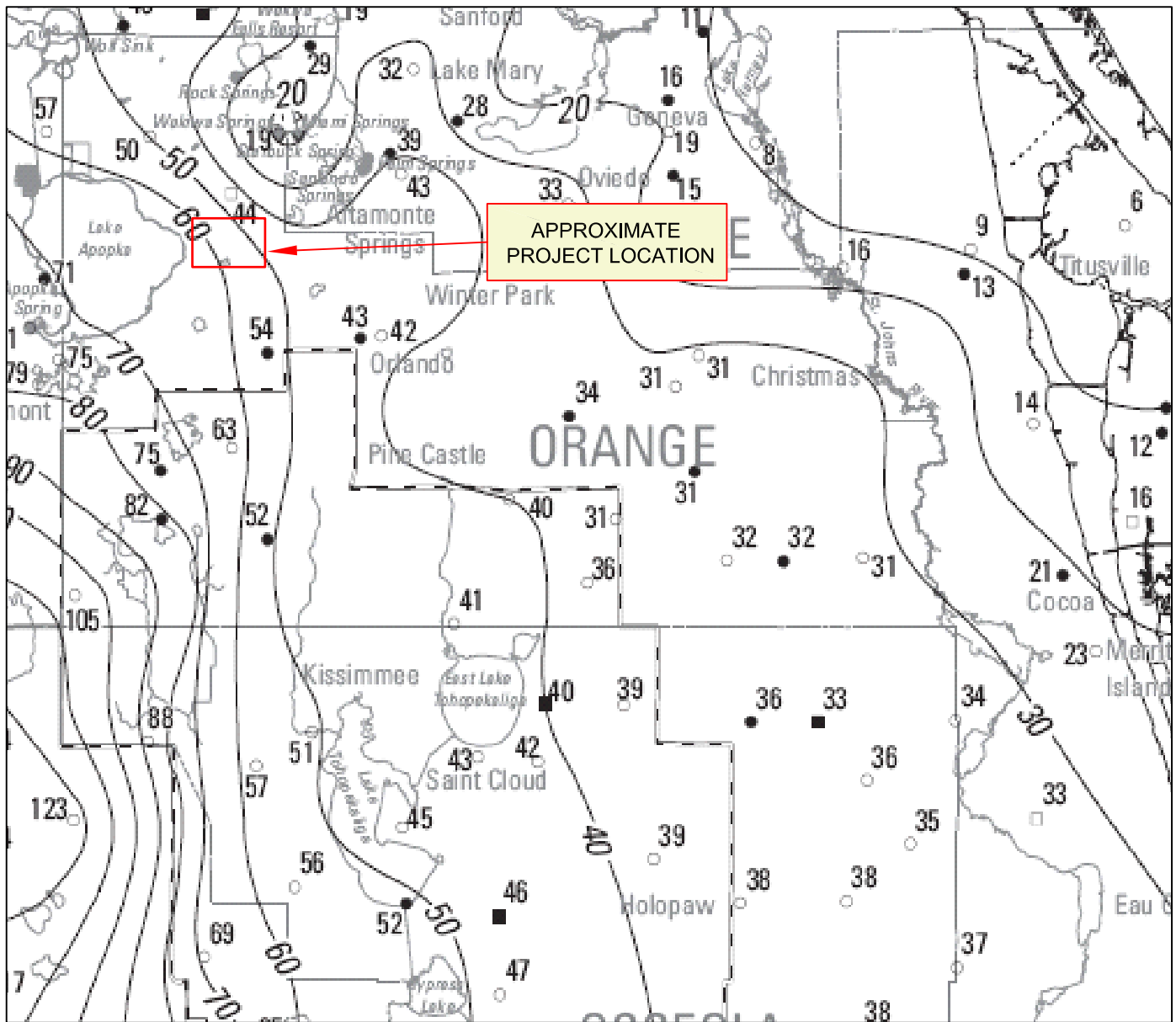
PROJECT NAME: USGS TOPOGRAPHIC MAP NORTH WEST RECLAMATION FACILITY RAPID INFILTRATION BASIN (RIB) SIDE SLOPE LINERS REPLACEMENT		NES PROJECT No. C17003
COUNTY ORANGE	CONTRACT No. -	FIGURE 2



LEGEND

- 3 Basinger fine sand
- 4 Candler fine sand
0 to 5 % Slopes
- 5 Candler fine sand
5 to 12 % Slopes
- 6 Candler-Apopka
fine sands
- 46 Tavares fine sand
- 47 Tavares-Millhopper
complex

REFERENCE	PROJECT LOCATION	U.S.G.S QUADRANGLE MAP	ISSUED	PHOTO REVISED	NADIC ENGINEERING SERVICES, INC. 601 N. HART BOULEVARD ORLANDO, FL 32818 PH (407) 521-4771 FAX (407) 521-4772			ORANGE COUNTY PUBLIC WORKS		PROJECT NAME: USDA/NRCS SOIL MAP NORTH WEST RECLAMATION FACILITY RAPID INFILTRATION BASIN (RIB) SIDE SLOPE LINERS REPLACEMENT	NES PROJECT No.
USDA/NRCS	S28& 29; T21S; R28E S32& 33; T21S; R28E	APOPKA, FL WINTER GARDEN, FL	2015		DATE: 05-08-2017 DRAWN: MS CHECKED: GNN			COUNTY	CONTRACT No.	FIGURE 3	
							ORANGE	-			



REFERENCE: "Potentiometric Surface of the Upper Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida, 2009," published by the United States Geological Survey (USGS).

QUAD: APOPKA, FL & WINTER GARDEN, FL (Issued 2015)

SECTIONS: 28 & 29 32 & 33

TOWNSHIPS: 21 SOUTH

RANGES: 28 EAST

LEGEND

— 40 — POTENTIOMETRIC CONTOUR-Shows altitude at which water level would have stood in tightly cased wells. Contour interval is 10 feet.

POTENTIOMETRIC SURFACE MAP
 NORTH WEST RECLAMATION FACILITY
 RAPID INFILTRATION BASIN (RIB) SIDE SLOPE
 LINERS REPLACEMENT
 ORANGE COUNTY, FLORIDA





Note: Elevations shown on map are in feet, National Geodetic Vertical Datum of 1929 (NGVD-29)

DRAWN: MS	SCALE: N.T.S.	PROJECT NO. C17003
CHECKED: GNN	DATE: 05-08-17	FIGURE 4



LEGEND

RIB4-T  Approximate Boring Location on Top of RIB

RIB4-B  Approximate Boring Location at Bottom of RIB

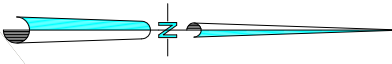
QUADRANGLE: WINTER GARDEN & AOPKA, FL
 SECTION: 28, 29, 32 & 33
 TOWNSHIP: 21 SOUTH
 RANGE: 28 EAST

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REVISIONS						NAMES		DATES		ORANGE COUNTY PUBLIC WORKS		SHEET TITLE:		FIGURE NO.	
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	Drawn by:	MS	06/21/17	NADIC ENGINEERING SERVICES, INC. 601 N. HART BOULEVARD ORLANDO, FL 32818 PH (407) 521-4771 FAX (407) 521-4772		COUNTY	CONTRACT NO.	BORING LOCATION MAP		
						Checked by:	GNN	06/21/17			ORANGE	--	PROJECT NAME: NORTH WEST RECLAMATION FACILITY RAPID INFILTRATION BASIN (RIB) SIDE SLOPE LINERS REPLACEMENT		5A
						Designed by:	N/A	N/A							
						Checked by:	N/A	N/A							
						Approved by:	GNN								


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LEGEND

RIB4-T  Approximate Boring Location on Top of RIB

RIB4-B  Approximate Boring Location at Bottom of RIB

QUADRANGLE: WINTER GARDEN & AOPKA, FL
 SECTION: 28, 29, 32 & 33
 TOWNSHIP: 21 SOUTH
 RANGE: 28 EAST

REVISIONS					
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NAMES	DATES
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ORANGE COUNTY PUBLIC WORKS

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ORANGE	--

SHEET TITLE:
 BORING LOCATION MAP

PROJECT NAME:
 NORTH WEST RECLAMATION FACILITY RAPID INFILTRATION BASIN (RIB) SIDE SLOPE LINERS REPLACEMENT

FIGURE NO.
 5B



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NAMES	DATES
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Checked by: GNN	06/21/17
Designed by: N/A	N/A
Checked by: N/A	N/A
Approved by: GNN	

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ORANGE COUNTY PUBLIC WORKS
 COUNTY: ORANGE CONTRACT NO.: --

SHEET TITLE:
 BORING LOCATION MAP
 PROJECT NAME:
 NORTH WEST RECLAMATION FACILITY RAPID INFILTRATION BASIN (RIB) SIDE SLOPE LINERS REPLACEMENT

FIGURE NO.
 5C

CPH, Inc.

North West Reclamation Facility
 Rapid Infiltration Basin (RIB) Slope Liners
 NES Project No. C17003

July 14, 2017

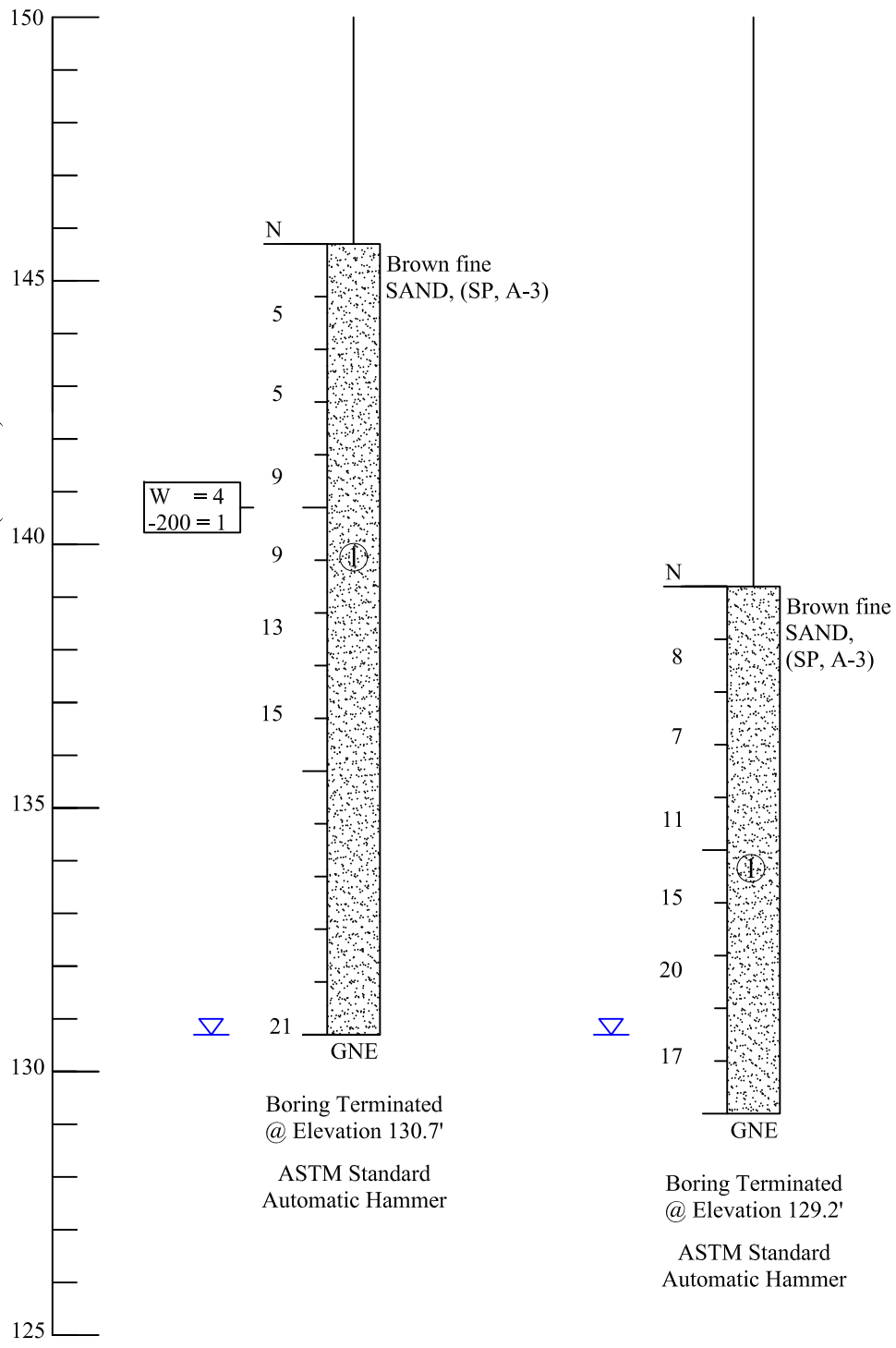
**TABLE 3
 SUMMARY OF LABORATORY TEST RESULTS**

Location	Boring Number	Sample Depth (feet)	Moisture Content (%)	Organic Content (%)	Sieve Analysis (Percent Passing)					Atterberg Limits (%)		AASHTO	Unified Soil Classification (USCS)
					#10	#40	#60	#100	#200	Liquid Limit	Plasticity Index		
North West Reclamation Facility	RIB1-T	5	4	-	100	85	40	6	1	-	-	A-3	SP
	RIB2-B	5	3	-	96	86	53	21	3	-	-	A-3	SP
	RIB3-T	6	2	-	100	91	57	21	4	-	-	A-3	SP
	RIB 4-T	8	4	-	100	91	56	19	3	-	-	A-3	SP
	RIB 5-B	7	5	-	100	84	40	12	7	-	-	A-3	SP-SM
	RIB 6-T	10	14	-	100	97	88	64	28	-	-	A-2-6	SC
	RIB 7-T	10	3	-	100	94	69	27	3	-	-	A-3	SP
	RIB 9-T	4	3	-	100	93	68	26	3	-	-	A-3	SP
	RIB 10-T	10	12	-	100	84	50	27	21	-	-	A-2-6	SC
	RIB 10-B	9	16	-	100	94	76	40	19	-	-	A-2-6	SC
	RIB 11-T	7	18	-	100	93	79	48	31	16	17	A-2-6	SC
	RIB 14A-T	7	14	-	100	100	93	46	22	-	-	A-2-6	SC
	RIB 14B-T	9	6	-	100	100	71	22	7	-	-	A-3	SP-SM
	RIB 14C-T	10	7	-	100	94	69	20	3	-	-	A-3	SP
	RIB 14D-B	5	1	-	100	92	63	15	1	-	-	A-3	SP
RIB 15-T	14	26	-	-	-	-	-	62	22	35	A-6	CH	
RIB 15-B	7	19	-	100	99	96	72	39	-	-	A-2-6	SC	

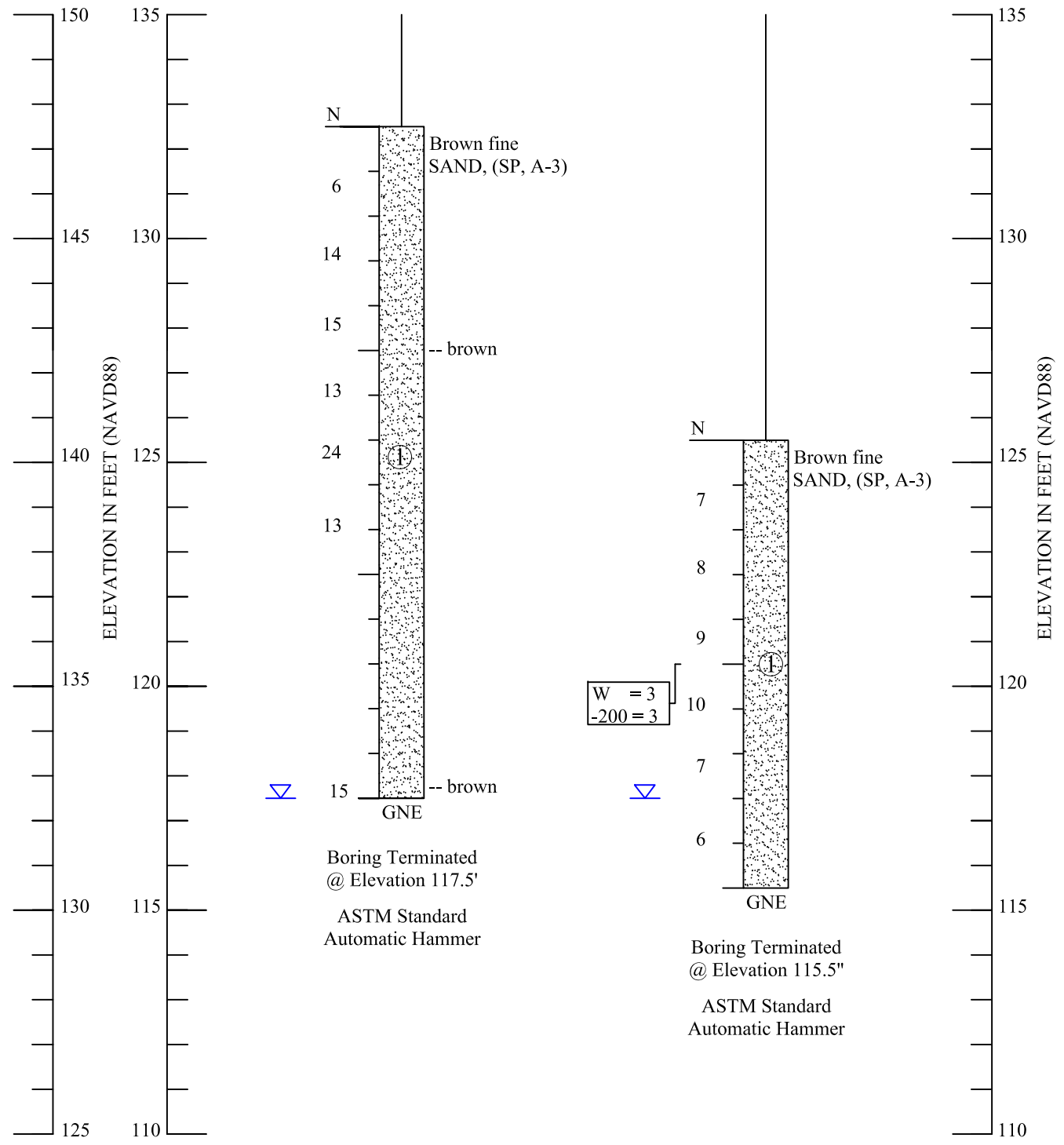
APPENDIX B

Sheets 1 through 8 Report of SPT Borings

Boring No: RIB1-T 1564634.0' RIB1-B 1564715.1'
 Northing: 484819.1' 484757.1'
 Easting: 145.7' 139.2'
 Elevation: 145.7' 139.2'
 Date Drilled: 05-09-2017 05-10-2017



Boring No: RIB2-T 1563322.4' RIB2-B 1563352.9'
 Northing: 484510.3' 484448.1'
 Easting: 132.5' 125.5'
 Elevation: 132.5' 125.5'
 Date Drilled: 05-05-2017 05-10-2017



LEGEND

- SAND
- Dark brown to orange brown fine SAND, occasional trace silt clay to fine sand with clay/silt/roots, (A-3)
- (A-3) A.A.S.H.T.O.: Soil Classification group symbol as determined by visual examination
- (SP) Unified soil classification group symbol
- Estimated seasonal high groundwater level
- Groundwater level encountered on date shown
- GNE Groundwater not encountered
- | | |
|--------|--|
| W = | Natural moisture content (%) (FM 1-T 265) |
| -200 = | Percent passing no. 200 U.S. standard sieve (%) (FM 1-T 088) |

N Standard Penetration Test Data
 Standard penetration resistance in blows per foot (18" spoon ASTM D-1586)
 Spoon Inside Diameter 1 3/8 in.
 Spoon Outside Diameter 2 in.
 ASTM Standard Automatic Hammer Drop 30 in.
 Hammer Weight 140 lbs
 ASTM Standard Drop Safety Hammer (Rope-Cathead) Drop 30 in.
 Hammer Weight 140 lbs.

- NOTES**
- Standard Penetration Test borings were performed in accordance with ASTM D-1586. Standard Penetration Resistance are shown on the borings at the test depths in blows per foot unless otherwise noticed
 - Subsurface conditions shown on the boring do not represent conditions between boring locations. Actual conditions between the borings may vary from those shown.
 - Unified Soil Classifications shown on the boring are based on visual examination and limited laboratory testing

GRANULAR MATERIALS			
RELATIVE DENSITY	Drop Safety Hammer	Automatic Hammer	
	SPT (BLOWS/FT.)	SPT (BLOWS/FT.)	
Very loose	Less than 4	Less than 3	
Loose	4-10	3-7	
Medium Dense	10-30	7-21	
Dense	30-50	21-35	
Very Dense	Greater than 50	Greater than 35	

SILTS AND CLAYS			
CONSISTENCY	Drop Safety Hammer	Automatic Hammer	
	SPT (BLOWS/FT.)	SPT (BLOWS/FT.)	
Very soft	Less than 2	Less than 1	
Soft	2-4	1-3	
Firm	4-8	3-6	
Stiff	8-15	6-11	
Very Stiff	15-30	11-21	
Hard	Greater than 30	Greater than 21	

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 Designed by: N/A N/A
 Checked by: N/A N/A
 Approved by: GNN

NADIC ENGINEERING SERVICES, INC.
 601 N. HART BOULEVARD
 ORLANDO, FL 32818
 PH (407) 521-4771 FAX (407) 521-4772

ORANGE COUNTY UTILITIES DEPARTMENT

COUNTY: ORANGE CONTRACT NO.: --

SHEET TITLE: REPORT OF SPT BORINGS
 PROJECT NAME: NORTH WEST RECLAMATION FACILITY RAPID INFILTRATION BASIN (RIB) SIDE SLOPE LINERS REPLACEMENT

SHEET NO. _____

Boring No:
 Northing:
 Easting:
 Elevation:
 Date Drilled:

RIB 3

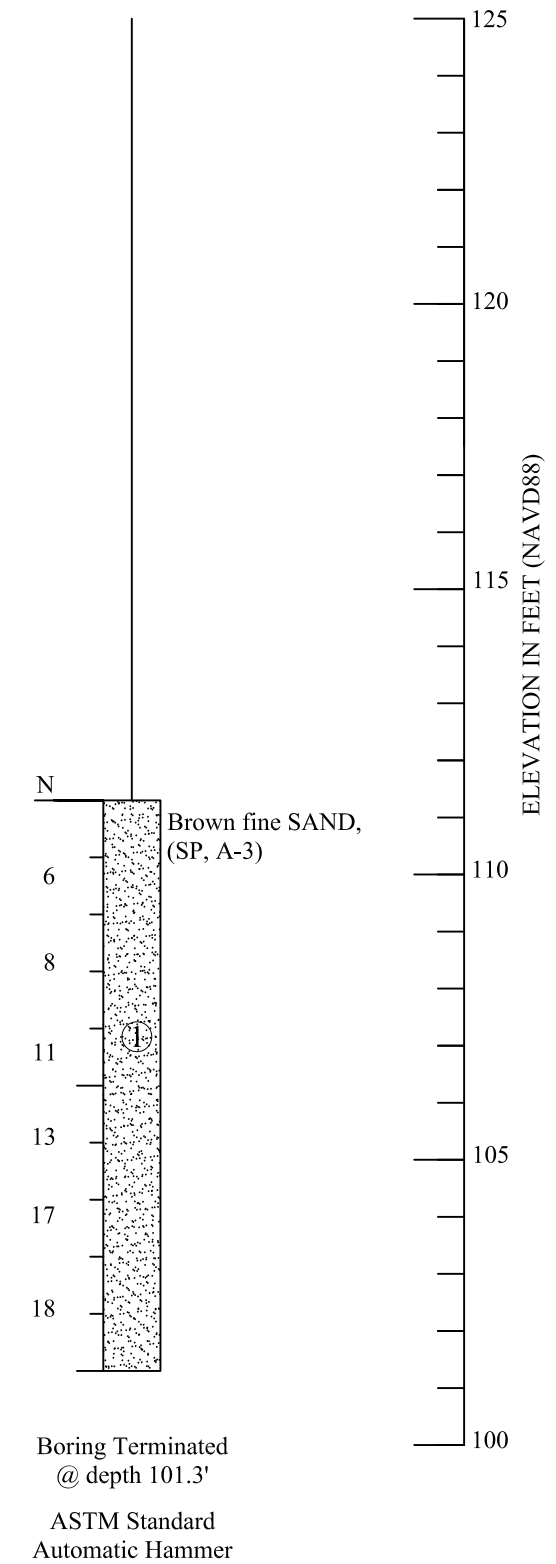
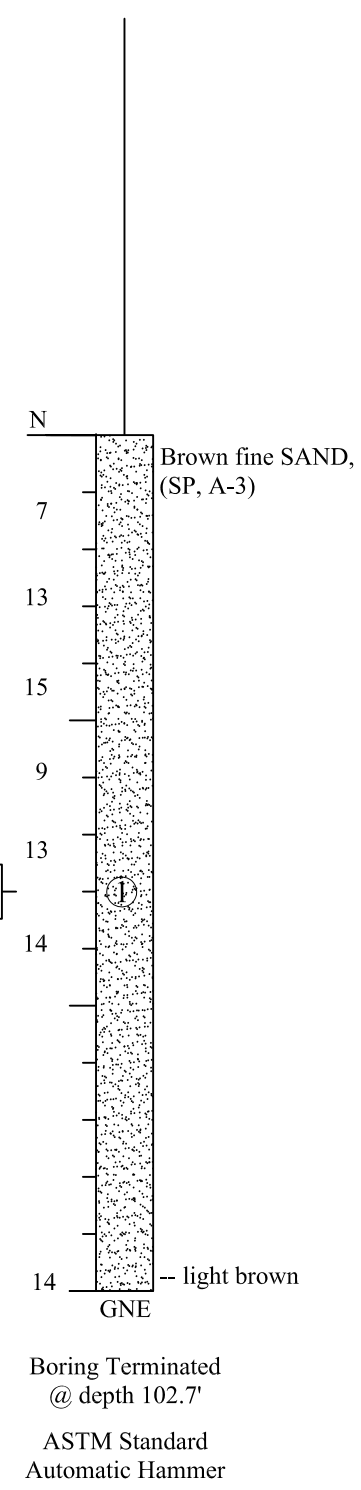
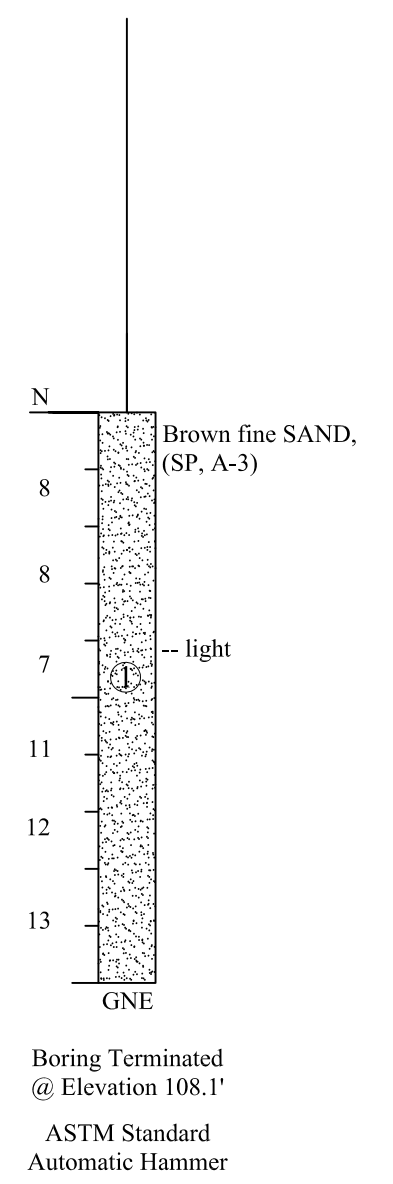
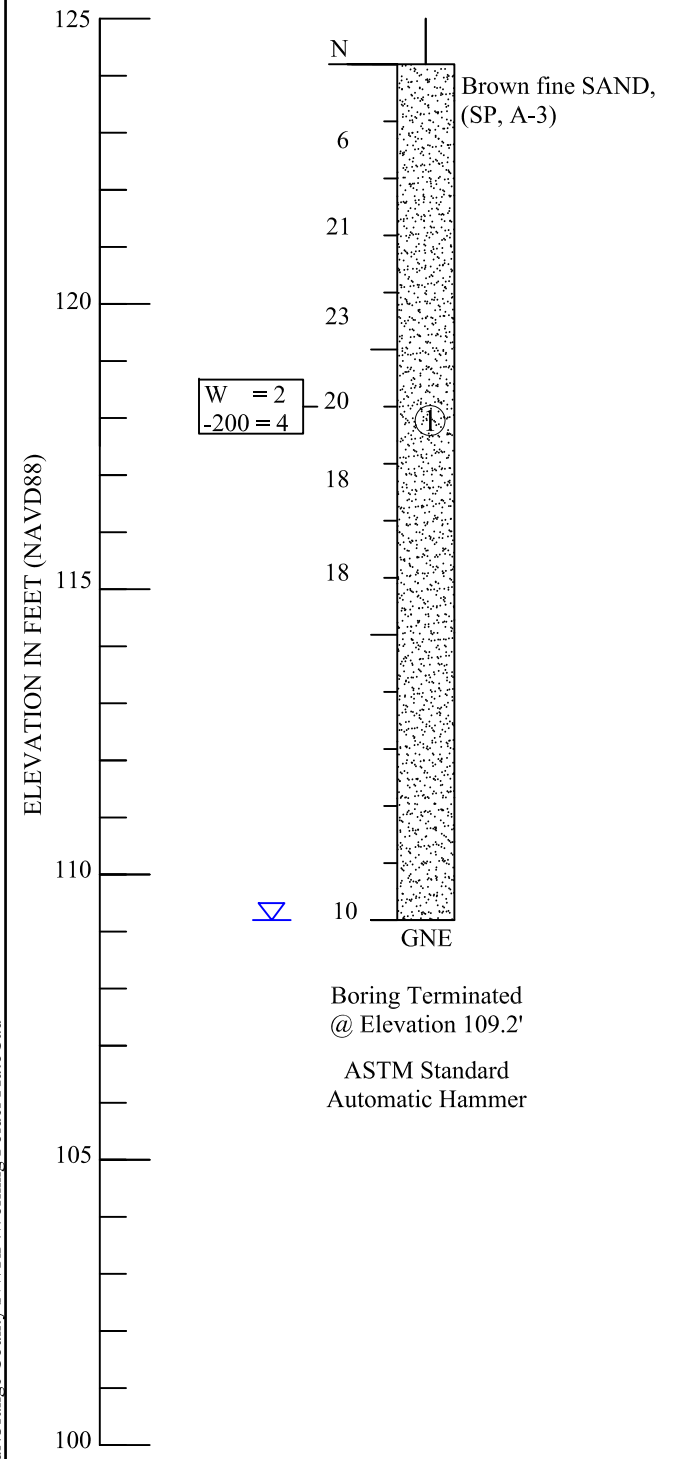
RIB3-T	RIB3-B
1562971.3'	1562960.9'
483965.2'	484027.5'
124.2'	118.1'
05-05-2017	05-10-2017

RIB 4

RIB4-T	RIB4-B
1562385.1'	1562455.0'
484051.6'	484002.05'
117.7'	111.3'
05-05-2017	05-10-2017

LEGEND

- SAND
- Dark brown to orange brown fine SAND, occasional trace silt clay to fine sand with clay/silt/roots, (A-3)
- (A-3) A.A.S.H.T.O.: Soil Classification group symbol as determined by visual examination
- (SP) Unified soil classification group symbol
- Estimated seasonal high groundwater level
- Groundwater level encountered on date shown
- GNE Groundwater not encountered
- $W =$ Natural moisture content (%) (FM 1-T 265)
- $-200 =$ Percent passing no. 200 U.S. standard sieve (%) (FM 1-T 088)



- ### NOTES
- Standard Penetration Test borings were performed in accordance with ASTM D-1586. Standard Penetration Resistance are shown on the borings at the test depths in blows per foot unless otherwise noticed
 - Subsurface conditions shown on the boring do not represent conditions between boring locations. Actual conditions between the borings may vary from those shown.
 - Unified Soil Classifications shown on the boring are based on visual examination and limited laboratory testing

RELATIVE DENSITY	GRANULAR MATERIALS	
	Drop Safety Hammer SPT (BLOWS/FT.)	Automatic Hammer SPT (BLOWS/FT.)
Very loose	Less than 4	Less than 3
Loose	4-10	3-7
Medium Dense	10-30	7-21
Dense	30-50	21-35
Very Dense	Greater than 50	Greater than 35

CONSISTENCY	SILTS AND CLAYS	
	Drop Safety Hammer SPT (BLOWS/FT.)	Automatic Hammer SPT (BLOWS/FT.)
Very soft	Less than 2	Less than 1
Soft	2-4	1-3
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Stiff	8-15	6-11
Very Stiff	15-30	11-21
Hard	Greater than 30	Greater than 21

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 Checked by: N/A N/A
 Approved by: GNN

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 601 N. HART BOULEVARD
 ORLANDO, FL 32818
 PH (407) 521-4771 FAX (407) 521-4772

ORANGE COUNTY UTILITIES DEPARTMENT
 COUNTY: ORANGE CONTRACT NO.: --

SHEET TITLE:
 REPORT OF SPT BORINGS

PROJECT NAME:
 NORTH WEST RECLAMATION FACILITY RAPID INFILTRATION BASIN (RIB) SIDE SLOPE LINERS REPLACEMENT

SHEET NO.:

RIB 5

RIB 6

LEGEND

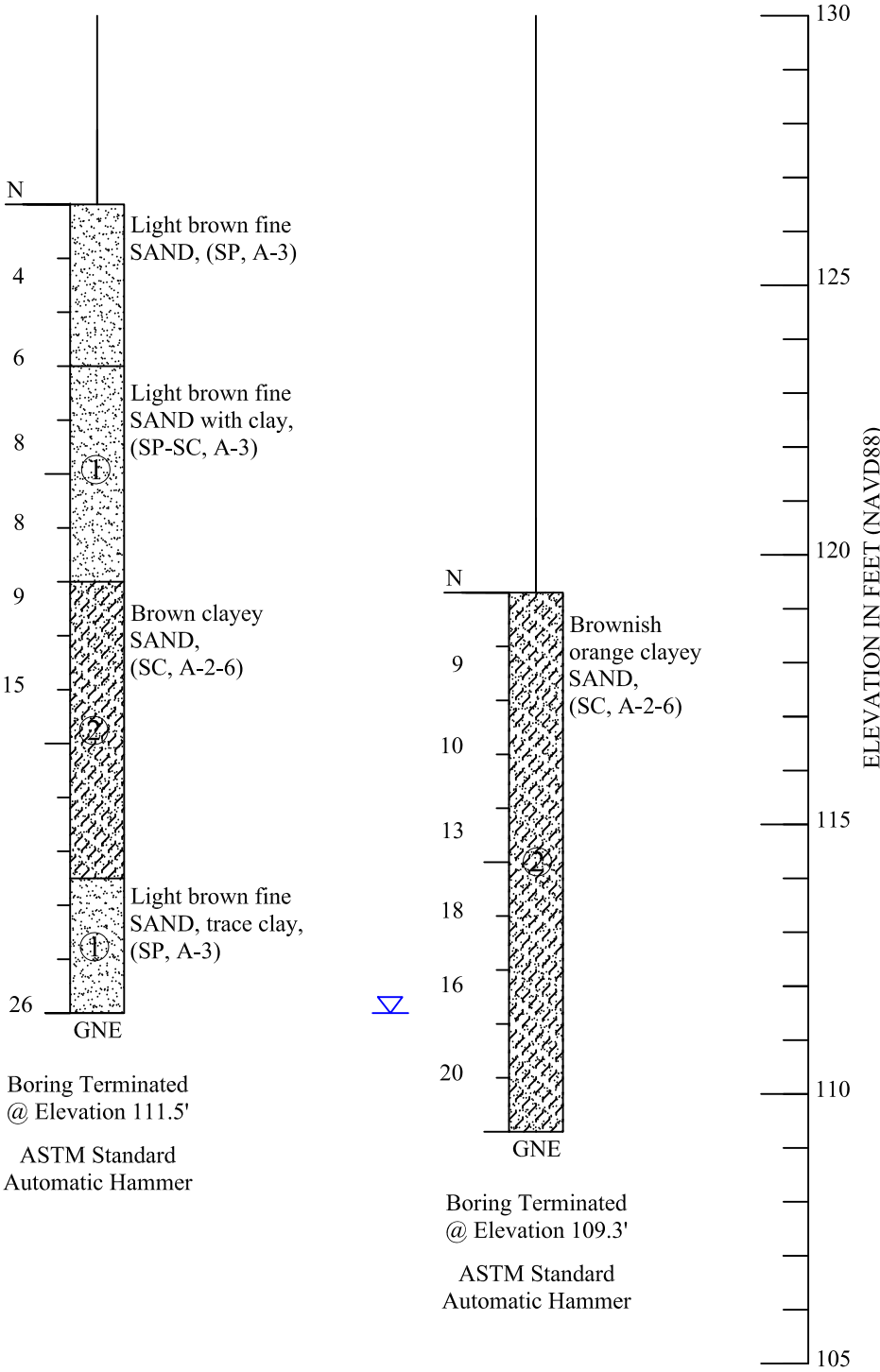
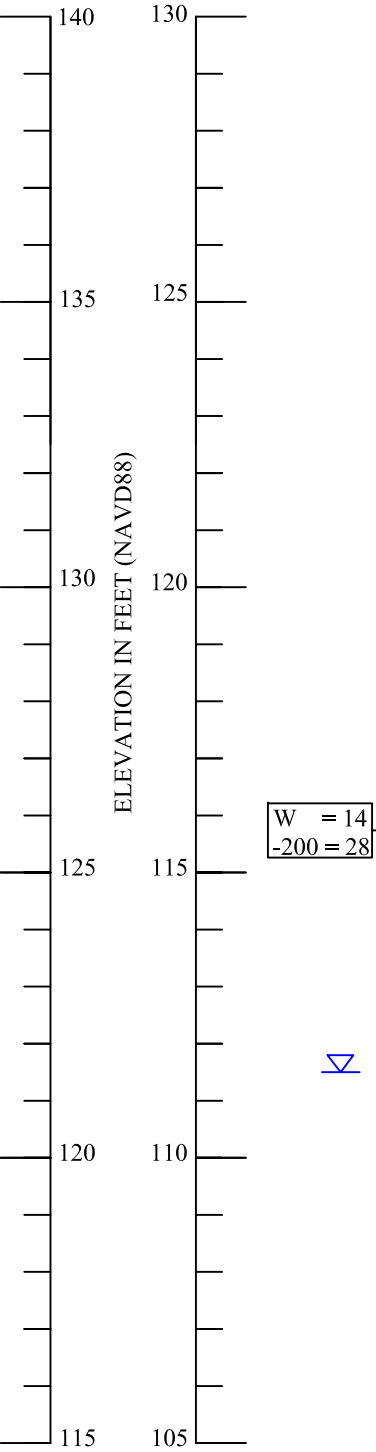
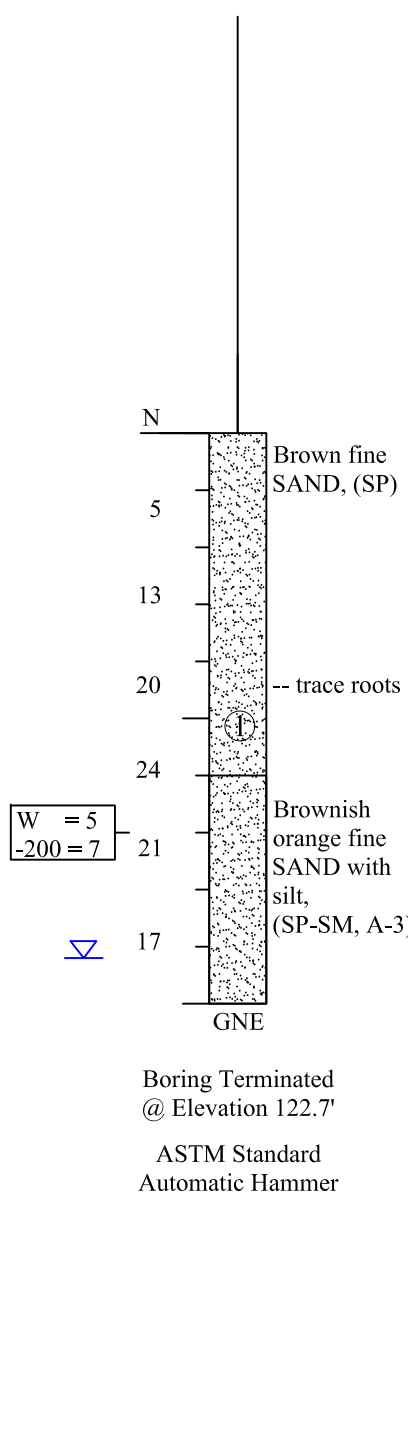
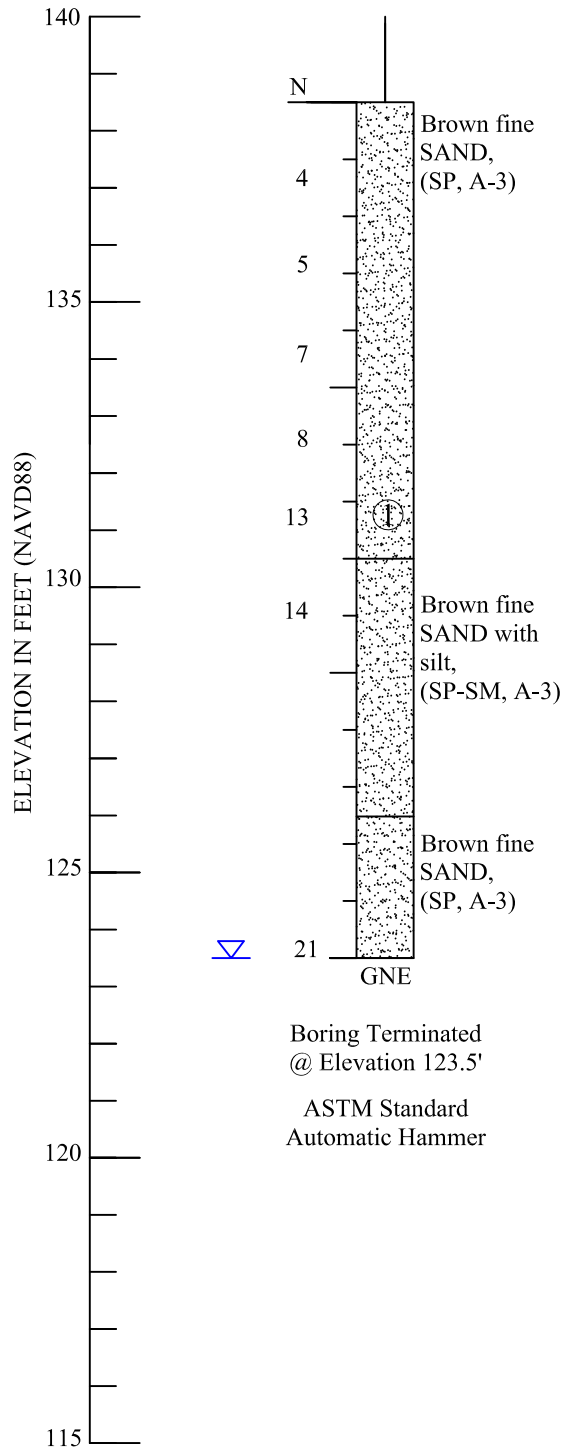
Boring No: RIB5-T
 Northing: 1564076.8'
 Easting: 485190.9'
 Elevation: 138.5'
 Date Drilled: 05-09-2017

Boring No: RIB5-B
 Northing: 1564096.7'
 Easting: 485262.3'
 Elevation: 132.7'
 Date Drilled: 05-10-2017

Boring No: RIB6-T
 Northing: 1563431.9'
 Easting: 484867.2'
 Elevation: 126.5'
 Date Drilled: 05-05-2017

Boring No: RIB6-B
 Northing: 1563371.5'
 Easting: 484804.6'
 Elevation: 119.3'
 Date Drilled: 05-10-2017

- SAND
- CLAYEY SAND
- ① Dark brown to orange brown fine SAND, occasional trace silt clay to fine sand with clay/silt/roots, (A-3)
- ② Brown to brownish orange clayey SAND, (A-2-6)
- (A-3) A.A.S.H.T.O.: Soil Classification group symbol as determined by visual examination
- (SP) Unified soil classification group symbol
- ▽ Estimated seasonal high groundwater level
- 04/20/17 ▼ Groundwater level encountered on date shown
- GNE Groundwater not encountered
- W = Natural moisture content (%) (FM 1-T 265)
- 200 = Percent passing no. 200 U.S. standard sieve (%) (FM 1-T 088)



- N Standard Penetration Test Data
 Standard penetration resistance in blows per foot (18" spoon ASTM D-1586)
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- NOTES
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Dense	30-50	21-35
Very Dense	Greater than 50	Greater than 35

SILTS AND CLAYS		
CONSISTENCY	Drop Safety Hammer SPT (BLOWS/FT.)	Automatic Hammer SPT (BLOWS/FT.)
Very soft	Less than 2	Less than 1
Soft	2-4	1-3
Firm	4-8	3-6
Stiff	8-15	6-11
Very Stiff	15-30	11-21
Hard	Greater than 30	Greater than 21

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REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

NAMES	DATES
Drawn by: MS	06/29/17
Checked by: GNN	06/29/17
Designed by: N/A	N/A
Checked by: N/A	N/A
Approved by: GNN	

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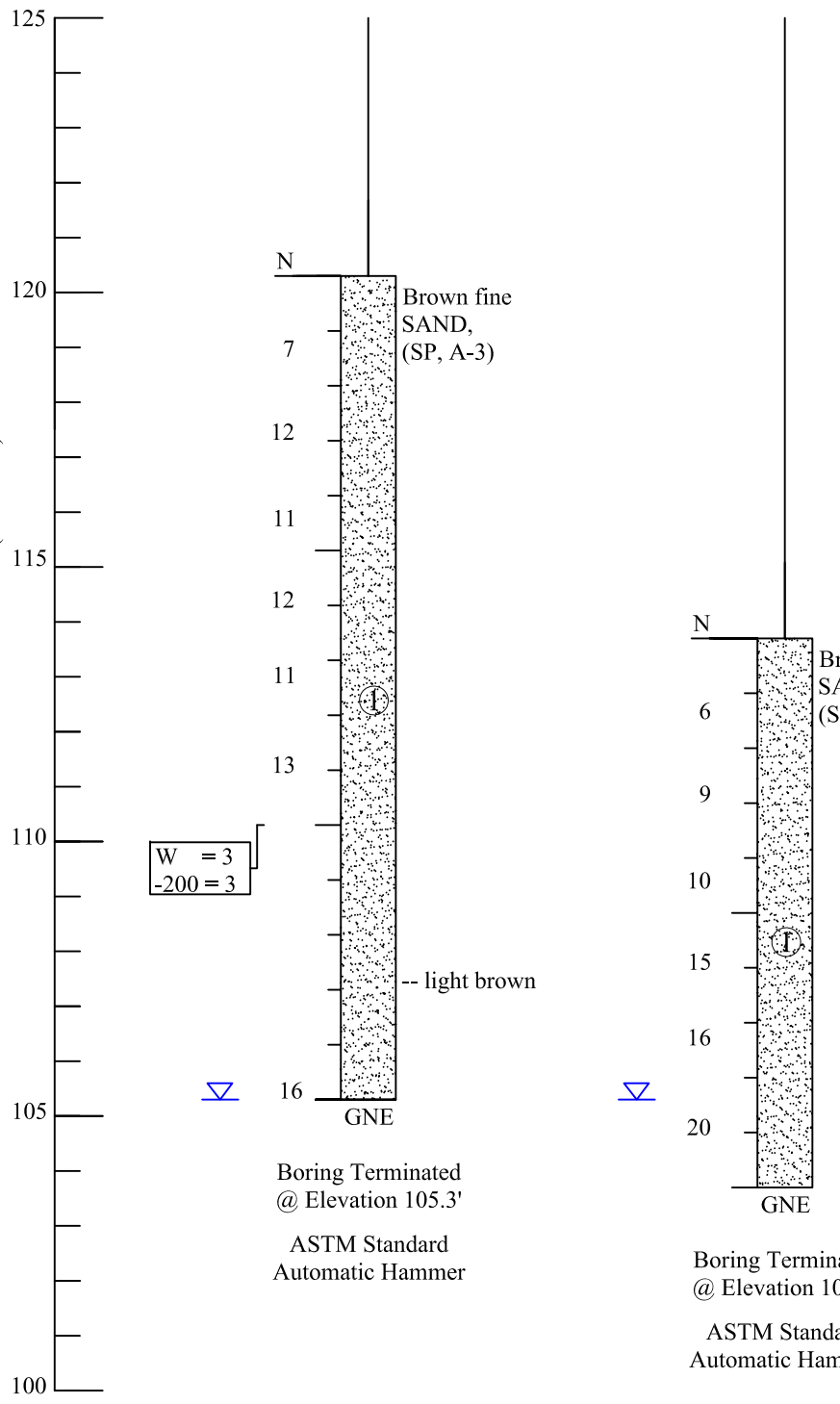
ORANGE COUNTY UTILITIES DEPARTMENT
 COUNTY ORANGE CONTRACT NO. --

SHEET TITLE: REPORT OF SPT BORINGS
 PROJECT NAME: NORTH WEST RECLAMATION FACILITY RAPID INFILTRATION BASIN (RIB) SIDE SLOPE LINERS REPLACEMENT

SHEET NO.

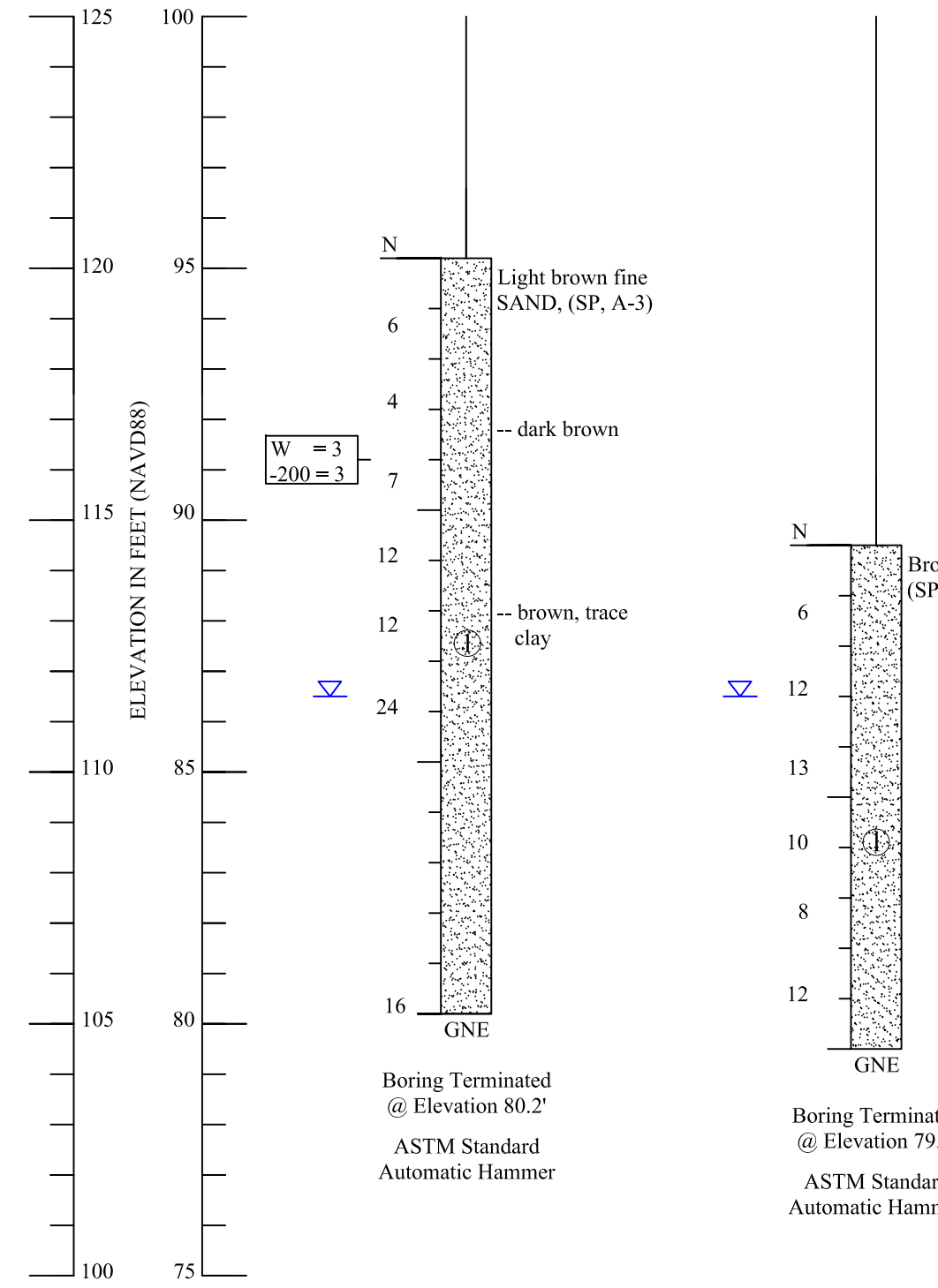
RIB 7

Boring No: RIB7-T RIB7-B
 Northing: 1562725.0' 1562714.6'
 Easting: 484837.4' 484890.8'
 Elevation: 120.3' 113.7'
 Date Drilled: 05-05-2017 05-10-2017



RIB 9

Boring No: RIB9-T RIB9-B
 Northing: 1561965.6' 1561895.6'
 Easting: 485248.3' 485243.6'
 Elevation: 95.2' 89.5'
 Date Drilled: 05-05-2017 05-10-2017



LEGEND

- SAND
- Dark brown to orange brown fine SAND, occasional trace silt clay to fine sand with clay/silt/roots, (A-3)
- (A-3) A.A.S.H.T.O.: Soil Classification group symbol as determined by visual examination
- (SP) Unified soil classification group symbol
- Estimated seasonal high groundwater level
- Groundwater level encountered on date shown
- GNE Groundwater not encountered
- Natural moisture content (%) (FM 1-T 265)
Percent passing no. 200 U.S. standard sieve (%) (FM 1-T 088)

NOTES

- Standard Penetration Test borings were performed in accordance with ASTM D-1586. Standard Penetration Resistance are shown on the borings at the test depths in blows per foot unless otherwise noticed
- Subsurface conditions shown on the boring do not represent conditions between boring locations. Actual conditions between the borings may vary from those shown.
- Unified Soil Classifications shown on the boring are based on visual examination and limited laboratory testing

GRANULAR MATERIALS		
RELATIVE DENSITY	Drop Safety Hammer SPT (BLOWS/FT.)	Automatic Hammer SPT (BLOWS/FT.)
Very loose	Less than 4	Less than 3
Loose	4-10	3-7
Medium Dense	10-30	7-21
Dense	30-50	21-35
Very Dense	Greater than 50	Greater than 35

SILTS AND CLAYS		
CONSISTENCY	Drop Safety Hammer SPT (BLOWS/FT.)	Automatic Hammer SPT (BLOWS/FT.)
Very soft	Less than 2	Less than 1
Soft	2-4	1-3
Firm	4-8	3-6
Stiff	8-15	6-11
Very Stiff	15-30	11-21
Hard	Greater than 30	Greater than 21

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 Approved by: GNN

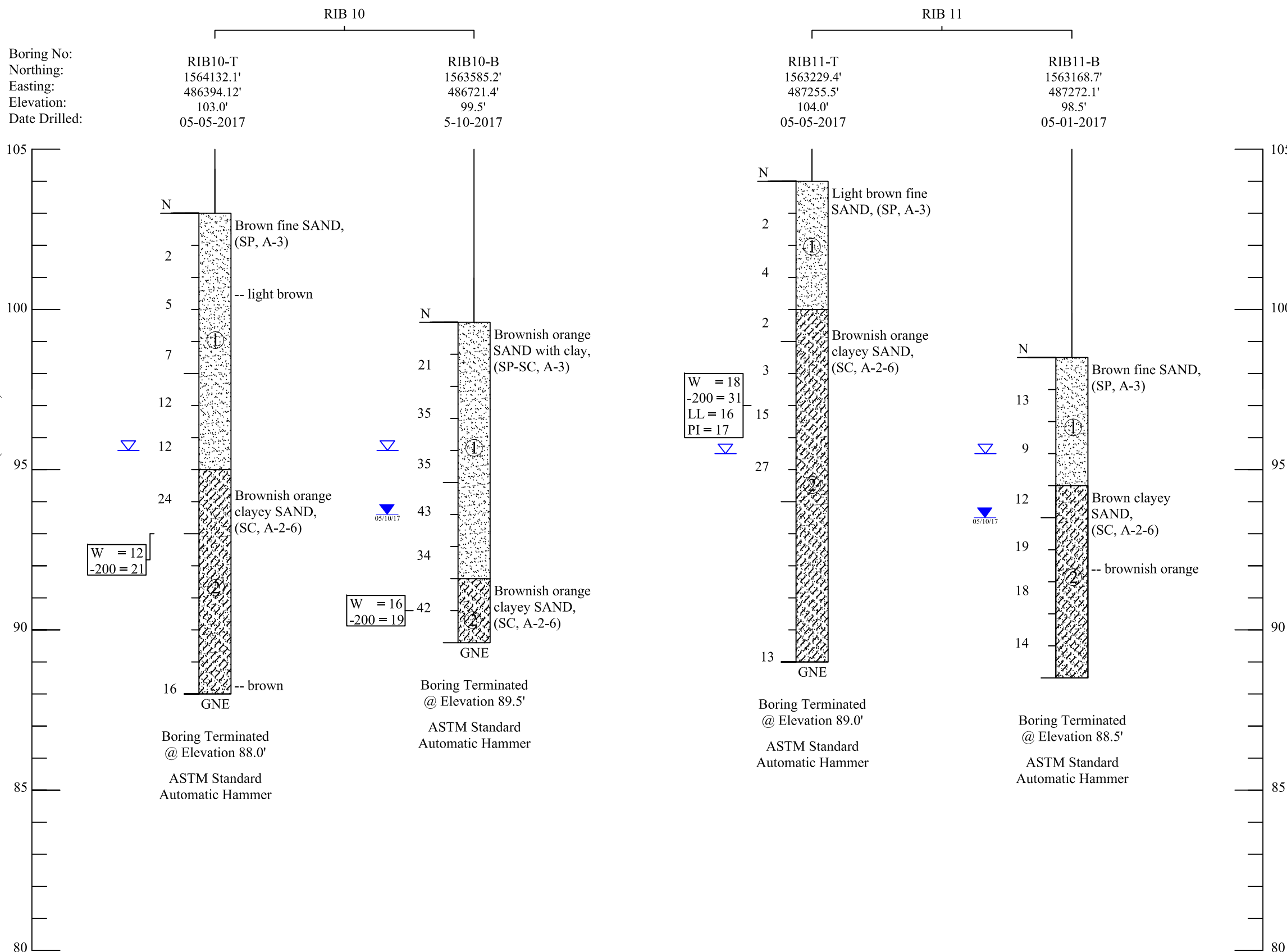
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SHEET TITLE:
 REPORT OF SPT BORINGS

PROJECT NAME:
 NORTH WEST RECLAMATION FACILITY RAPID INFILTRATION BASIN (RIB) SIDE SLOPE LINERS REPLACEMENT

SHEET NO.
 SHEET 4



LEGEND

	SAND		CLAYEY SAND
①	Dark brown to orange brown fine SAND, occasional trace silt clay to fine sand with clay/silt/roots, (A-3)		
②	Brown to brownish orange clayey SAND, (A-2-6)		
(A-3)	A.A.S.H.T.O.: Soil Classification group symbol as determined by visual examination		
(SP)	Unified soil classification group symbol		
	Estimated seasonal high groundwater level		
	Groundwater level encountered on date shown		
GNE	Groundwater not encountered		
$W =$	Natural moisture content (%) (FM 1-T 265)		
$-200 =$	Percent passing no. 200 U.S. standard sieve (%) (FM 1-T 088)		

NOTES

- Standard Penetration Test borings were performed in accordance with ASTM D-1586. Standard Penetration Resistance are shown on the borings at the test depths in blows per foot unless otherwise noticed
- Subsurface conditions shown on the boring do not represent conditions between boring locations. Actual conditions between the borings may vary from those shown.
- Unified Soil Classifications shown on the boring are based on visual examination and limited laboratory testing

RELATIVE DENSITY	GRANULAR MATERIALS	
	Drop Safety Hammer SPT (BLOWS/FT.)	Automatic Hammer SPT (BLOWS/FT.)
Very loose	Less than 4	Less than 3
Loose	4-10	3-7
Medium Dense	10-30	7-21
Dense	30-50	21-35
Very Dense	Greater than 50	Greater than 35

CONSISTENCY	SILTS AND CLAYS	
	Drop Safety Hammer SPT (BLOWS/FT.)	Automatic Hammer SPT (BLOWS/FT.)
Very soft	Less than 2	Less than 1
Soft	2-4	1-3
Firm	4-8	3-6
Stiff	8-15	6-11
Very Stiff	15-30	11-21
Hard	Greater than 30	Greater than 21

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SHEET TITLE:
REPORT OF SPT BORINGS

PROJECT NAME:
NORTH WEST RECLAMATION FACILITY RAPID INFILTRATION BASIN (RIB) SIDE SLOPE LINERS REPLACEMENT

SHEET NO.
 5

RIB 14A

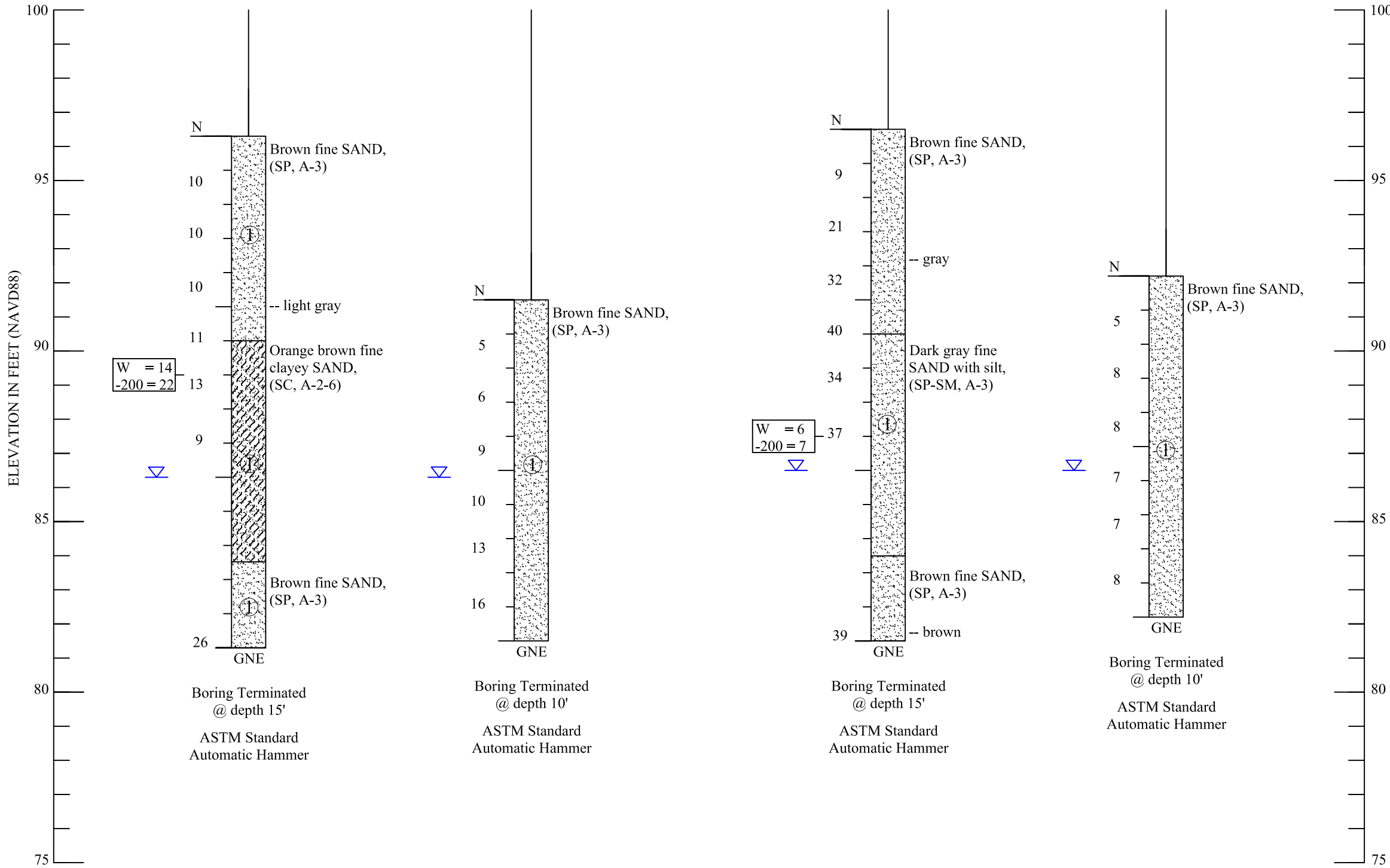
RIB 14B

LEGEND

Boring No: RIB14A-T 1559816.7' 491633.0' 96.3' 05-09-2017
 RIB14A-B 1559816.3' 491731.0' 91.5' 05-10-2017

Boring No: RIB14B-T 1560128.6' 491901.7' 96.5' 05-09-2017
 RIB14B-B 1560128.8' 491857.1' 92.2' 05-10-2017

- SAND
- CLAYEY SAND
- ① Dark brown to orange brown fine SAND, occasional trace silt clay to fine sand with clay/silt/roots, (A-3)
- ② Brown to brownish orange clayey SAND, (A-2-6)
- (A-3) A.A.S.H.T.O.: Soil Classification group symbol as determined by visual examination
- (SP) Unified soil classification group symbol
- ▽ Estimated seasonal high groundwater level
- 04/20/17 ▽ Groundwater level encountered on date shown
- GNE Groundwater not encountered
- W = Natural moisture content (%) (FM 1-T 265)
-200 = Percent passing no. 200 U.S. standard sieve (%) (FM 1-T 088)



- N Standard Penetration Test Data
 Standard penetration resistance in blows per foot (18" spoon ASTM D-1586)
 Spoon Inside Diameter 1 3/8 in.
 Spoon Outside Diameter 2 in.
 ASTM Standard Automatic Hammer Drop 30 in.
 Hammer Weight 140 lbs
 ASTM Standard Drop Safety Hammer (Rope-Cathead) Drop 30 in.
 Hammer Weight 140 lbs.
- NOTES
- Standard Penetration Test borings were performed in accordance with ASTM D-1586. Standard Penetration Resistance are shown on the borings at the test depths in blows per foot unless otherwise noticed
 - Subsurface conditions shown on the boring do not represent conditions between boring locations. Actual conditions between the borings may vary from those shown.
 - Unified Soil Classifications shown on the boring are based on visual examination and limited laboratory testing

GRANULAR MATERIALS			
RELATIVE DENSITY	Drop Safety Hammer	Automatic Hammer	
	SPT (BLOWS/FT.)	SPT (BLOWS/FT.)	
Very loose	Less than 4	Less than 3	
Loose	4-10	3-7	
Medium Dense	10-30	7-21	
Dense	30-50	21-35	
Very Dense	Greater than 50	Greater than 35	

SILTS AND CLAYS			
CONSISTENCY	Drop Safety Hammer	Automatic Hammer	
	SPT (BLOWS/FT.)	SPT (BLOWS/FT.)	
Very soft	Less than 2	Less than 1	
Soft	2-4	1-3	
Firm	4-8	3-6	
Stiff	8-15	6-11	
Very Stiff	15-30	11-21	
Hard	Greater than 30	Greater than 21	

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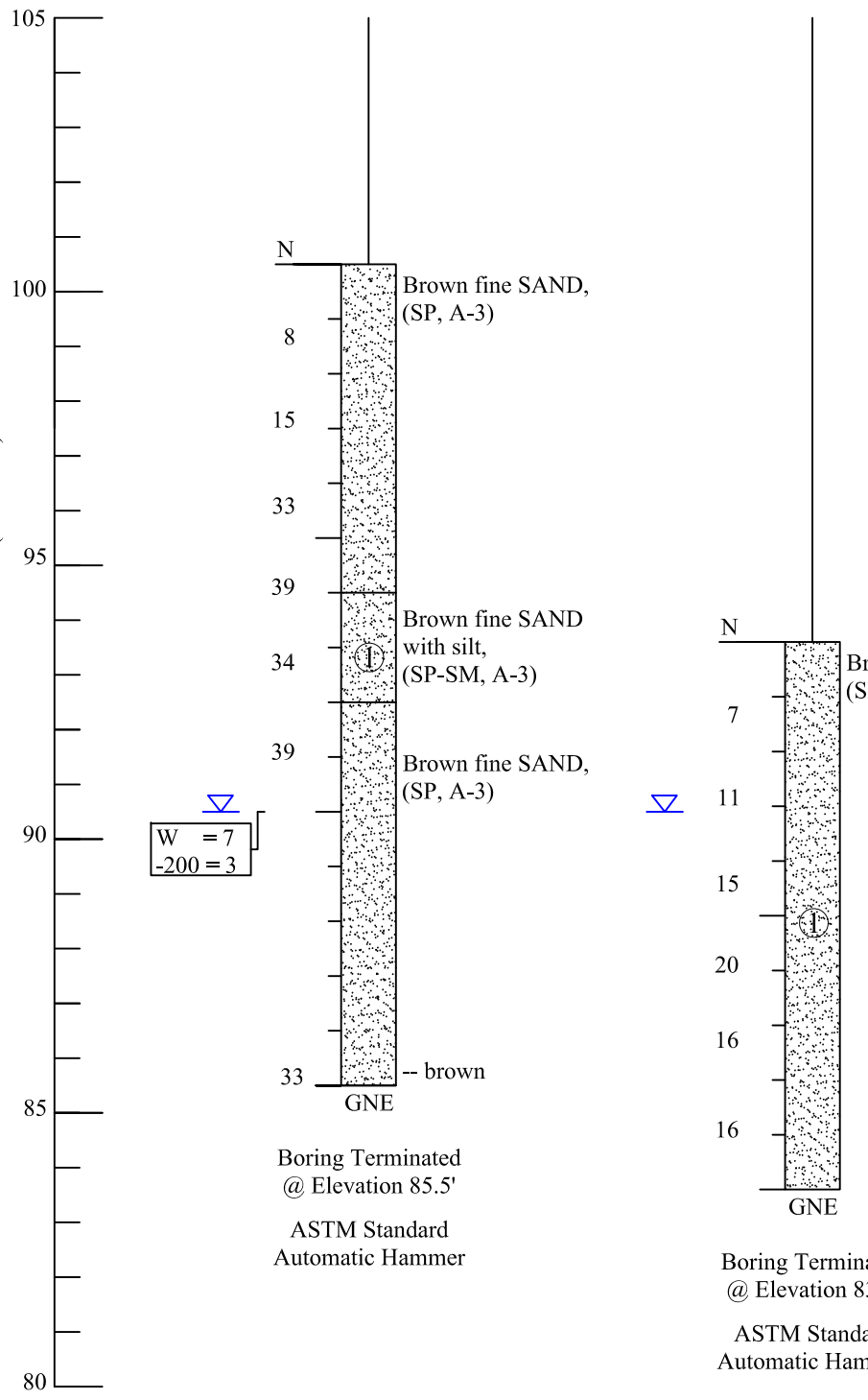
ORANGE COUNTY UTILITIES DEPARTMENT
 COUNTY ORANGE CONTRACT NO. --

SHEET TITLE: REPORT OF SPT BORINGS
 PROJECT NAME: NORTH WEST RECLAMATION FACILITY RAPID INFILTRATION BASIN (RIB) SIDE SLOPE LINERS REPLACEMENT

SHEET 6

RIB 14C

Boring No:	RIB14C-T	RIB14C-B
Northing:	1560656.1'	1560614.5'
Easting:	491618.8'	491654.3'
Elevation:	100.5'	93.6'
Date Drilled:	05-09-2017	5-10-2017

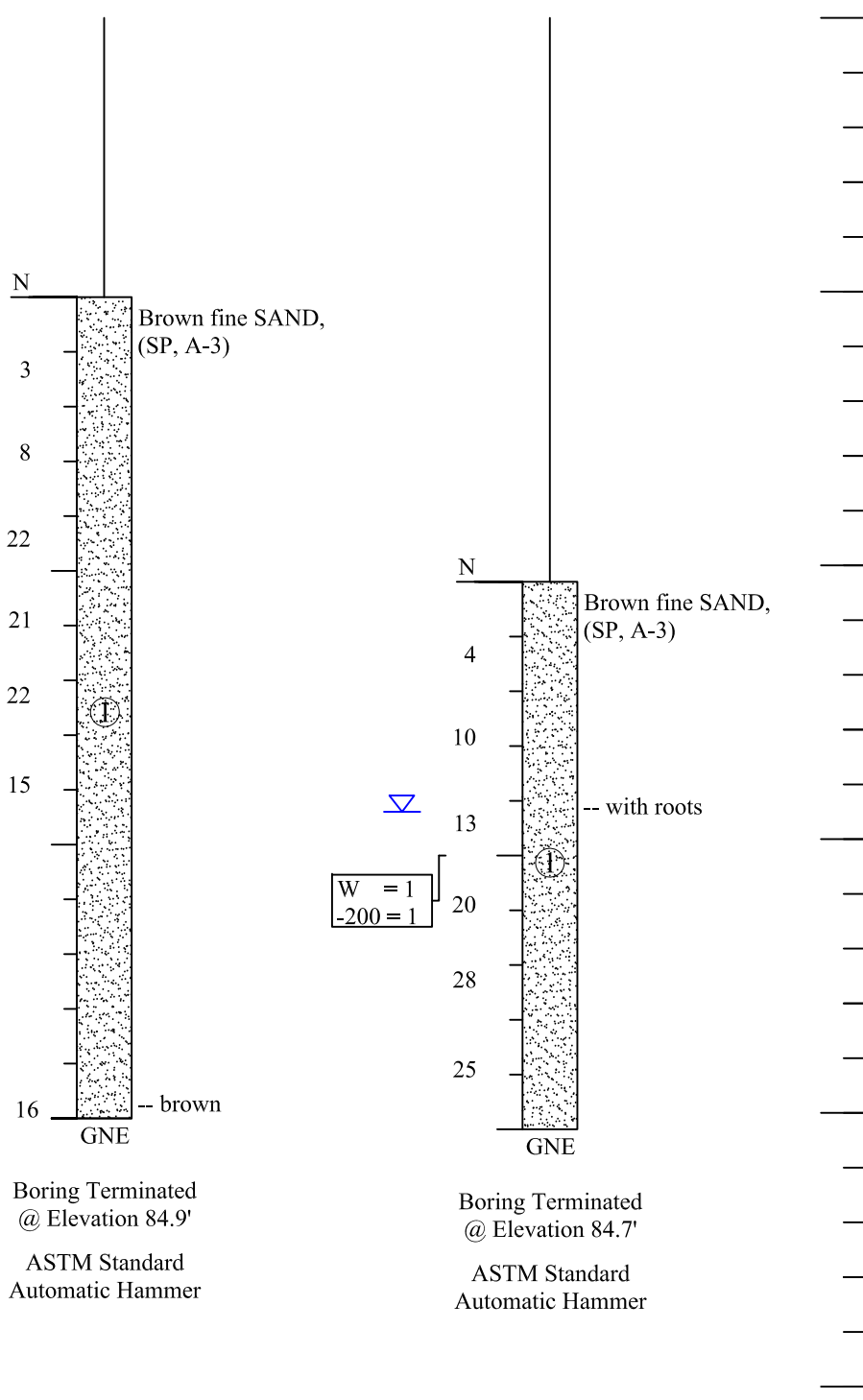


Boring Terminated @ Elevation 85.5'
ASTM Standard Automatic Hammer

Boring Terminated @ Elevation 83.6'
ASTM Standard Automatic Hammer

RIB 14D

Boring No:	RIB14D-T	RIB14D-B
Northing:	1560999.0'	1560958.9'
Easting:	491486.6'	491432.9'
Elevation:	99.9'	94.7'
Date Drilled:	05-10-2017	05-10-2017



Boring Terminated @ Elevation 84.9'
ASTM Standard Automatic Hammer

Boring Terminated @ Elevation 84.7'
ASTM Standard Automatic Hammer

LEGEND

- SAND
- Dark brown to orange brown fine SAND, occasional trace silt clay to fine sand with clay/silt/roots, (A-3)
- (A-3) A.A.S.H.T.O.: Soil Classification group symbol as determined by visual examination
- (SP) Unified soil classification group symbol
- Estimated seasonal high groundwater level
- Groundwater level encountered on date shown
- GNE Groundwater not encountered
- | | |
|--------|--|
| W = | Natural moisture content (%) (FM 1-T 265) |
| -200 = | Percent passing no. 200 U.S. standard sieve (%) (FM 1-T 088) |

NOTES

- Standard Penetration Test borings were performed in accordance with ASTM D-1586. Standard Penetration Resistance are shown on the borings at the test depths in blows per foot unless otherwise noticed
- Subsurface conditions shown on the boring do not represent conditions between boring locations. Actual conditions between the borings may vary from those shown.
- Unified Soil Classifications shown on the boring are based on visual examination and limited laboratory testing

GRANULAR MATERIALS			
RELATIVE DENSITY	Drop Safety Hammer	Automatic Hammer	
	SPT (BLOWS/FT.)	SPT (BLOWS/FT.)	
Very loose	Less than 4	Less than 3	
Loose	4-10	3-7	
Medium Dense	10-30	7-21	
Dense	30-50	21-35	
Very Dense	Greater than 50	Greater than 35	

SILTS AND CLAYS			
CONSISTENCY	Drop Safety Hammer	Automatic Hammer	
	SPT (BLOWS/FT.)	SPT (BLOWS/FT.)	
Very soft	Less than 2	Less than 1	
Soft	2-4	1-3	
Firm	4-8	3-6	
Stiff	8-15	6-11	
Very Stiff	15-30	11-21	
Hard	Greater than 30	Greater than 21	

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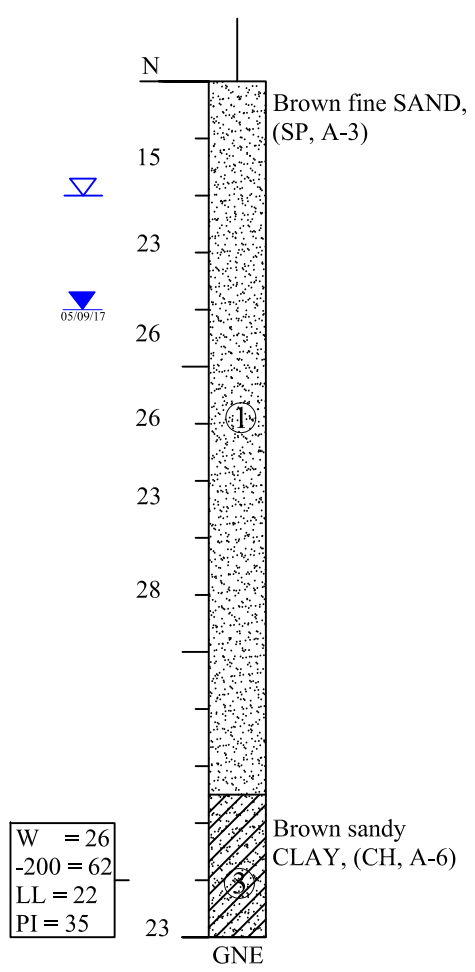
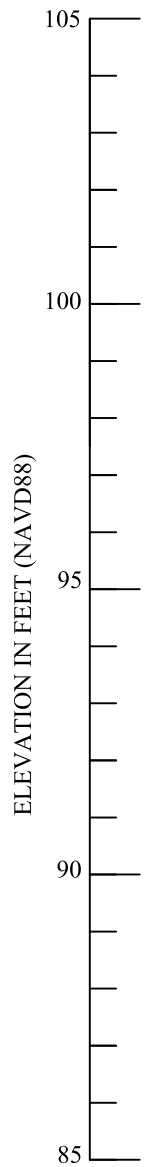
SHEET 7

RIB 15

Boring No:
 Northing:
 Easting:
 Elevation:
 Date Drilled:

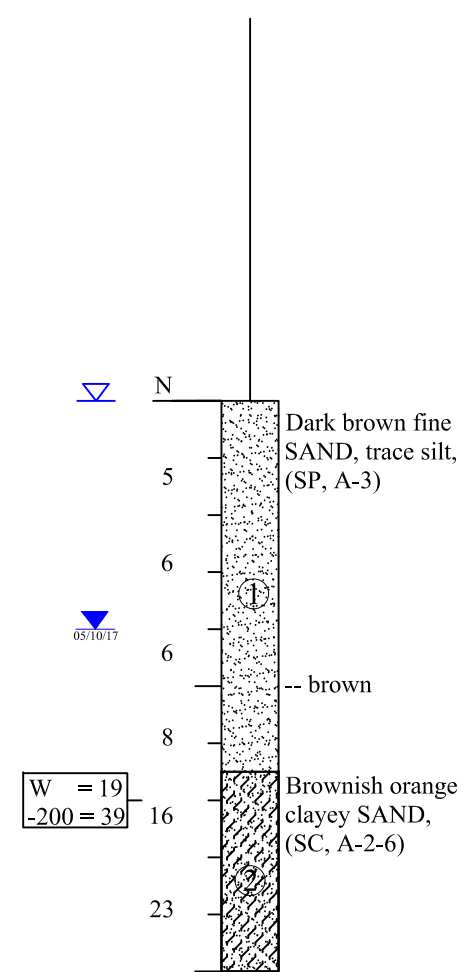
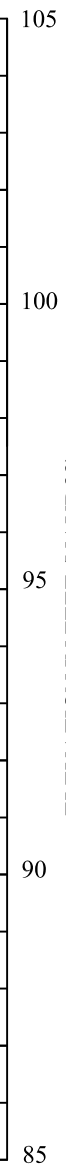
RIB15-T
 1561374.5'
 491069.4'
 103.9'
 05-09-2017

RIB15-B
 1561384.3'
 491140.7'
 98.3'
 05-10-2017



Boring Terminated
 @ Elevation 88.9'

ASTM Standard
 Automatic Hammer



Boring Terminated
 @ Elevation 88.3'

ASTM Standard
 Automatic Hammer

LEGEND

- SAND
- CLAYEY SAND
- SANDY CLAY
- ① Dark brown to orange brown fine SAND, occasional trace silt clay to fine sand with clay/silt/roots, (A-3)
- ② Brown to brownish orange clayey SAND, (A-2-6)
- ③ Brown sandy CLAY, (A-6)
- (A-3) A.A.S.H.T.O.: Soil Classification group symbol as determined by visual examination
- (SP) Unified soil classification group symbol
- Estimated seasonal high groundwater level
- 04/20/17 Groundwater level encountered on date shown
- GNE Groundwater not encountered
- W = Natural moisture content (%) (FM 1-T 265)
- 200 = Percent passing no. 200 U.S. standard sieve (%) (FM 1-T 088)
- LL = Liquid Limit (%) (FM 1-T089)
- PI = Plasticity Index (%) (FM 1-T 090)

NOTES

1. Standard Penetration Test borings were performed in accordance with ASTM D-1586. Standard Penetration Resistance are shown on the borings at the test depths in blows per foot unless otherwise noticed
2. Subsurface conditions shown on the boring do not represent conditions between boring locations. Actual conditions between the borings may vary from those shown.
3. Unified Soil Classifications shown on the boring are based on visual examination and limited laboratory testing

GRANULAR MATERIALS

RELATIVE DENSITY	Drop Safety Hammer	Automatic Hammer
	SPT (BLOWS/FT.)	SPT (BLOWS/FT.)
Very loose	Less than 4	Less than 3
Loose	4-10	3-7
Medium Dense	10-30	7-21
Dense	30-50	21-35
Very Dense	Greater than 50	Greater than 35

SILTS AND CLAYS

CONSISTENCY	Drop Safety Hammer	Automatic Hammer
	SPT (BLOWS/FT.)	SPT (BLOWS/FT.)
Very soft	Less than 2	Less than 1
Soft	2-4	1-3
Firm	4-8	3-6
Stiff	8-15	6-11
Very Stiff	15-30	11-21
Hard	Greater than 30	Greater than 21

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DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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ORANGE COUNTY UTILITIES DEPARTMENT
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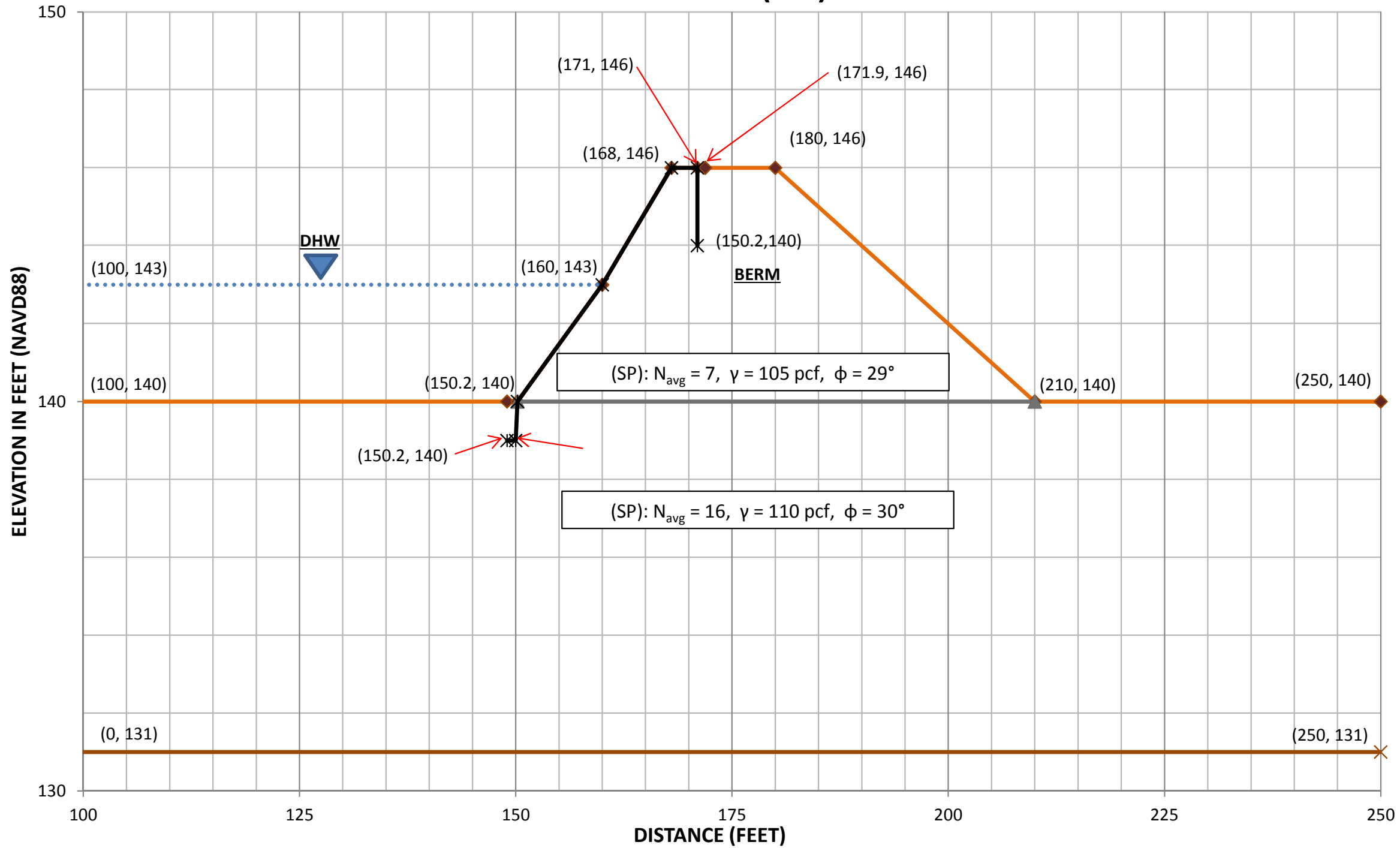
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APPENDIX C

Sample Calculation Slope Stability Analysis

NORTHWEST WATER RECLAMATION FACILITY

RAPID INFILTRATION BASIN (RIB) SLOPE LINER: RIB -1



Project Name: Northwest Water Reclamation Facility
Rapid Infiltration Basin (RIB) Side Slope Liners Replacement

Project Number: C17003

Subject: Existing Slope Stability Analysis
Boring # RIB1-T
Approx Top Elevation: 146.0' (NAVD88)
Approx Bottom Elevation: 140.0' (NAVD88)

Legend

- ◆ Fine Sand (SP)
- ✕ Fine Sand (SP)
- ✱ HDPE 60 mil (Liner)
- ⋯ Domestic Hot Water (DHW)

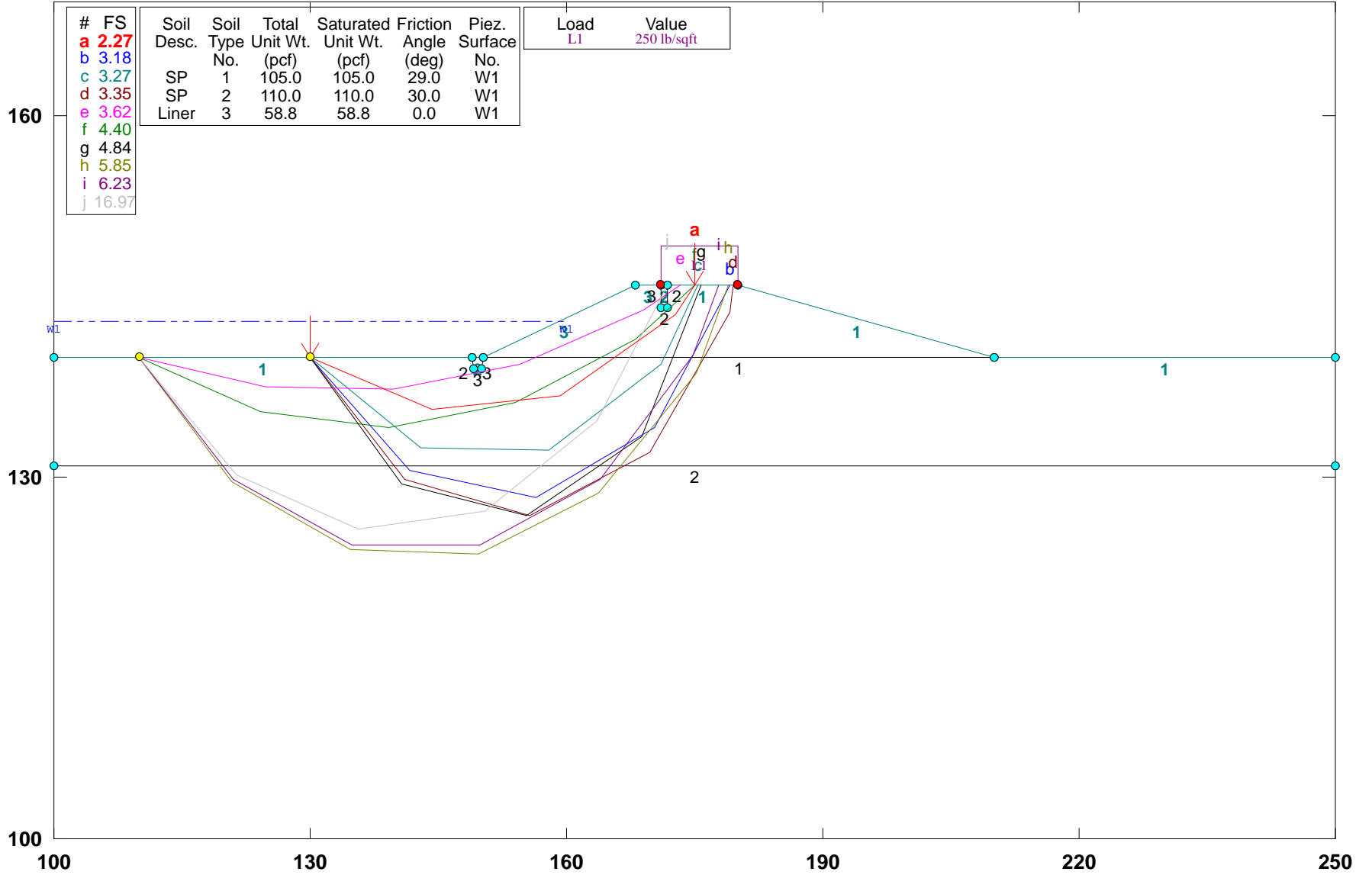
Drawn By: MS

Checked By: GNN

Date: 07/14/17

NWRP Rapid Infiltration Basin Liners RepRIB -1 (Boring RIB1-T)

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STABL6H FSmin=2.27
Safety Factors Are Calculated By The Modified Bishop Method

**** STABL6H ****

by
 Purdue University
 --Slope Stability Analysis--
 Simplified Janbu, Simplified Bishop
 or Spencer`s Method of Slices

Run Date: 7/17/2017
 Time of Run: 11:26AM
 Run By: MS
 Input Data Filename: Z:rib -1 (boring rib1-t) open2.in
 Output Filename: Z:rib -1 (boring rib1-t) open2.OUT
 Plotted Output Filename: Z:rib -1 (boring rib1-t) open2.PLT
 PROBLEM DESCRIPTION NWRP Rapid Infiltration Basin Liners Rep
 RIB -1 (Boring RIB1-T)

BOUNDARY COORDINATES

Note: User origin value specified.
 Add 100.00 to X-values and 100.00 to Y-values listed.

8 Top Boundaries
 16 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	40.00	49.00	40.00	1
2	49.00	40.00	50.20	40.00	2
3	50.20	40.00	68.00	46.00	3
4	68.00	46.00	71.00	46.00	3
5	71.00	46.00	71.90	46.00	2
6	71.90	46.00	80.00	46.00	1
7	80.00	46.00	110.00	40.00	1
8	110.00	40.00	150.00	40.00	1
9	71.00	46.00	71.10	44.00	3
10	71.10	44.00	71.80	44.00	2
11	71.80	44.00	71.90	46.00	2
12	49.00	40.00	49.10	39.00	2
13	49.10	39.00	50.10	39.00	3
14	50.10	39.00	50.20	40.00	3
15	50.20	40.00	110.00	40.00	1
16	0.00	31.00	150.00	31.00	2

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param. (psf)	Pressure Constant (psf)	Piez. Surface No.
1	105.0	105.0	0.0	29.0	0.00	0.0	1
2	110.0	110.0	0.0	30.0	0.00	0.0	1
3	58.8	58.8	0.0	0.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	43.00
2	60.00	43.00

BOUNDARY LOAD(S)

1 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (lb/sqft)	Deflection (deg)
1	71.00	80.00	250.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
 10 Trial Surfaces Have Been Generated.

5 Surfaces Initiate From Each Of 2 Points Equally Spaced

Along The Ground Surface Between X = 10.00 ft.
 and X = 30.00 ft.

Each Surface Terminates Between X = 71.00 ft.
 and X = 80.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.
 Following Are Displayed The Ten Most Critical Of The Trial
 Failure Surfaces Examined. They Are Ordered - Most Critical
 First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	40.00
2	44.34	35.59
3	59.29	36.79
4	72.74	43.43
5	75.06	46.00

Circle Center At X = 48.7 ; Y = 75.2 and Radius, 39.9
 *** 2.270 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	40.00
2	41.65	30.55
3	56.49	28.40
4	70.34	34.16
5	79.14	46.00

Circle Center At X = 53.0 ; Y = 56.4 and Radius, 28.2
 *** 3.177 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	40.00
2	42.97	32.46
3	57.97	32.24
4	71.16	39.39
5	75.32	46.00

Circle Center At X = 50.9 ; Y = 61.0 and Radius, 29.6
 *** 3.267 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	40.00
2	41.02	29.82
3	55.73	26.88
4	69.82	32.02
5	79.16	43.76
6	79.44	46.00

Circle Center At X = 53.6 ; Y = 54.5 and Radius, 27.7
 *** 3.348 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00	40.00
2	24.78	37.46
3	39.78	37.25
4	54.63	39.39
5	68.96	43.82
6	73.40	46.00

Circle Center At X = 33.6 ; Y = 132.9 and Radius, 95.8
 *** 3.619 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00	40.00
2	24.27	35.37
3	39.21	34.05
4	54.07	36.11
5	68.09	41.44
6	74.92	46.00

Circle Center At X = 37.6 ; Y = 100.7 and Radius, 66.6
 *** 4.398 ***

Failure Surface Specified By 5 Coordinate Points

Point	X-Surf	Y-Surf
-------	--------	--------

No.	(ft)	(ft)		
1	30.00	40.00		
2	40.61	29.39		
3	55.40	26.90		
4	68.90	33.44		
5	75.77	46.00		
Circle Center	At X =	51.9 ; Y =	51.3	and Radius, 24.6
	***	4.837	***	

Failure Surface Specified By 7 Coordinate Points

Point	X-Surf	Y-Surf		
No.	(ft)	(ft)		
1	10.00	40.00		
2	20.86	29.65		
3	34.73	23.93		
4	49.72	23.61		
5	63.82	28.73		
6	75.11	38.61		
7	78.98	46.00		
Circle Center	At X =	43.1 ; Y =	63.8	and Radius, 40.8
	***	5.854	***	

Failure Surface Specified By 7 Coordinate Points

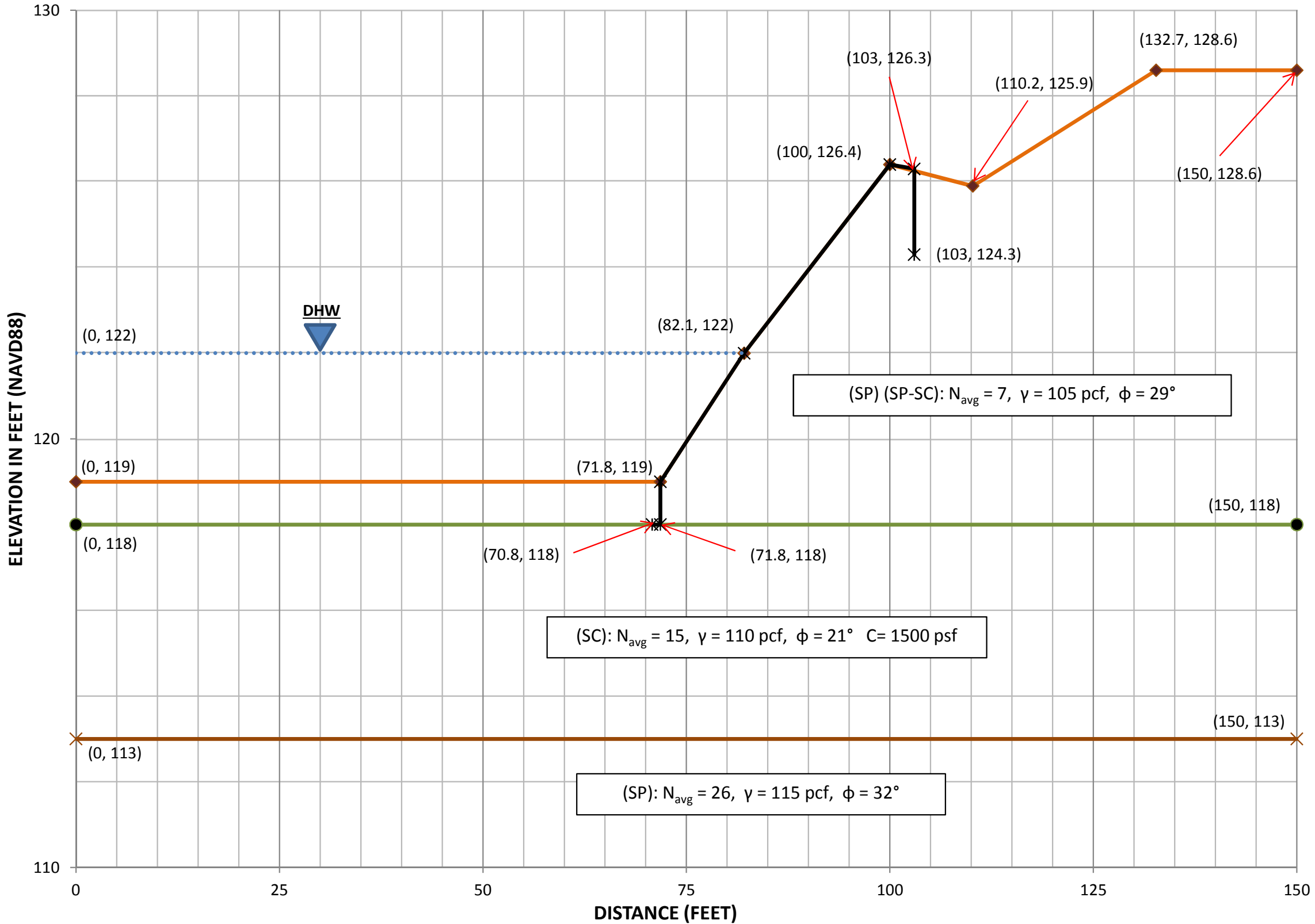
Point	X-Surf	Y-Surf		
No.	(ft)	(ft)		
1	10.00	40.00		
2	20.99	29.79		
3	34.95	24.31		
4	49.95	24.33		
5	63.91	29.83		
6	74.88	40.06		
7	77.72	46.00		
Circle Center	At X =	42.4 ; Y =	63.9	and Radius, 40.3
	***	6.226	***	

Failure Surface Specified By 6 Coordinate Points

Point	X-Surf	Y-Surf		
No.	(ft)	(ft)		
1	10.00	40.00		
2	21.30	30.13		
3	35.61	25.63		
4	50.52	27.24		
5	63.53	34.70		
6	71.91	46.00		
Circle Center	At X =	39.2 ; Y =	62.1	and Radius, 36.6
	***	16.972	***	

NORTHWEST WATER RECLAMATION FACILITY

RAPID INFILTRATION BASIN (RIB) SLOPE LINER: RIB -6



Project Name: Northwest Water Reclamation Facility Rapid Infiltration Basin (RIB) Side Slope Liners Replacement

Project Number: C17003

Subject: Existing Slope Stability Analysis
 Boring # RIB6-T
 Approx Top Elevation: 126.4' (NAVD88)
 Approx Bottom Elevation: 119.0' (NAVD88)

Legend

- ◆ Fine Sand with clay (SP)
- Clayey Sand (SC)
- × Fine Sand (SP)
- ✱ HDPE 60 mil (Liner)
- ⋯ Domestic Hot Water (DHW)

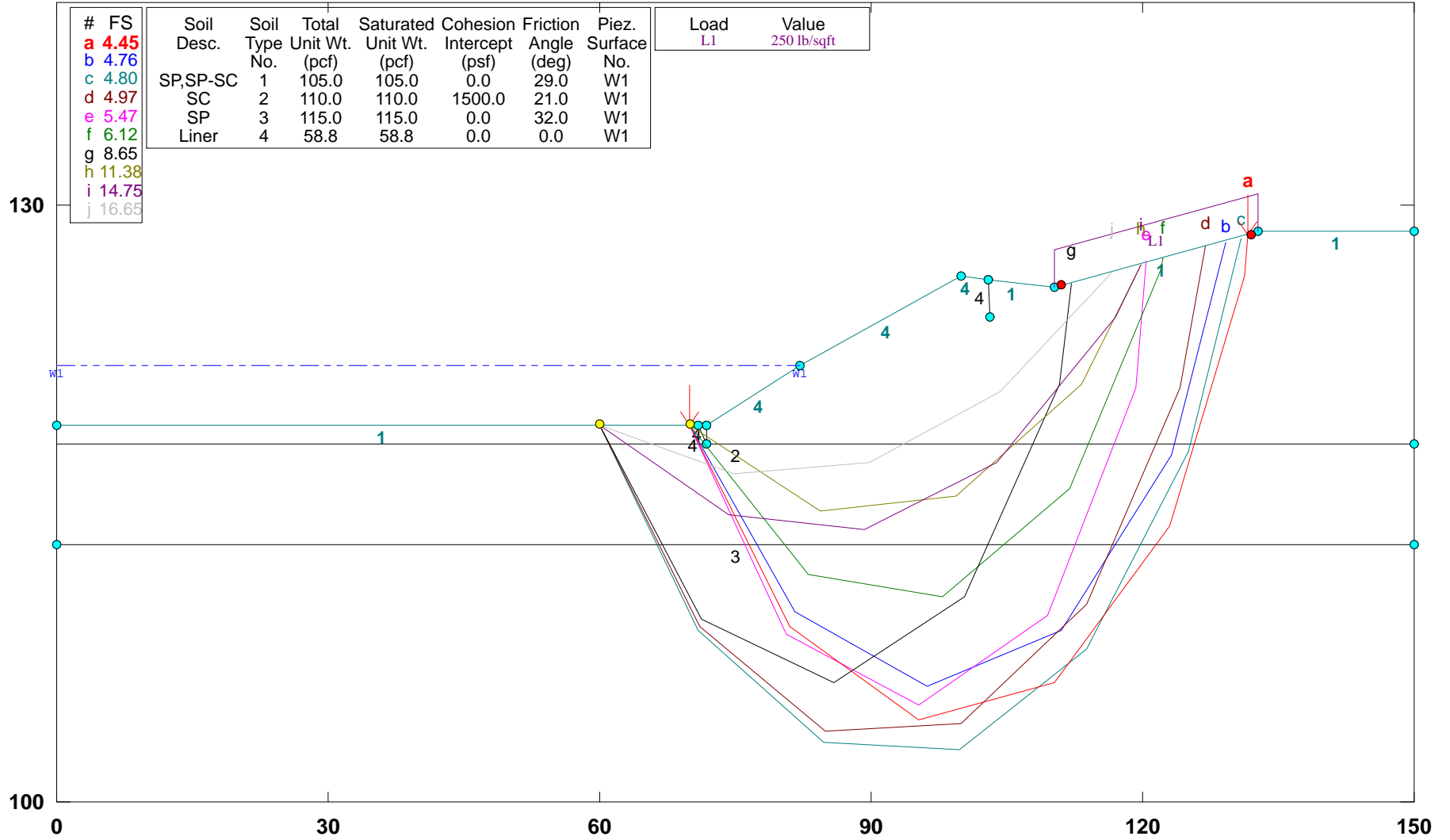
Drawn By: MS

Checked By: GNN

Date: 07/14/17

NWRP Rapid Infiltration Basin Liners RepExisting slope RIB -6 (Boring RIB6-T)

z:\engineering\civil\gnadi\orange county\nwrf\working folder\slope stability analysis\rib-6\rib -6 (boring rib6-t)2.pl2 Run By: MS 7/17/2017 04:42PM



STABL6H FSmin=4.45
Safety Factors Are Calculated By The Modified Bishop Method

**** STAB6H ****

by
 Purdue University
 --Slope Stability Analysis--
 Simplified Janbu, Simplified Bishop
 or Spencer`s Method of Slices

Run Date: 7/17/2017
 Time of Run: 04:42PM
 Run By: MS
 Input Data Filename: Z:rib -6 (boring rib6-t)2.in
 Output Filename: Z:rib -6 (boring rib6-t)2.OUT
 Plotted Output Filename: Z:rib -6 (boring rib6-t)2.PLT
 PROBLEM DESCRIPTION NWRP Rapid Infiltration Basin Liners Rep
 Existing slope RIB -6 (Boring RIB6-T)

BOUNDARY COORDINATES

Note: User origin value specified.
 Add 0.00 to X-values and 100.00 to Y-values listed.

7 Top Boundaries
 12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below	End
1	0.00	19.00	71.80	19.00	1	
2	71.80	19.00	82.10	22.00	4	
3	82.10	22.00	100.00	26.40	4	
4	100.00	26.40	103.00	26.30	4	
5	103.00	26.30	110.20	25.90	1	
6	110.20	25.90	132.70	28.60	1	
7	132.70	28.60	150.00	28.60	1	
8	103.00	26.30	103.10	24.30	4	
9	71.80	19.00	71.81	18.00	4	
10	70.80	19.00	71.81	18.00	4	
11	0.00	18.00	150.00	18.00	2	
12	0.00	13.00	150.00	13.00	3	

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param. (psf)	Pressure Constant (psf)	Piez. Surface No.
1	105.0	105.0	0.0	29.0	0.00	0.0	1
2	110.0	110.0	1500.0	21.0	0.00	0.0	1
3	115.0	115.0	0.0	32.0	0.00	0.0	1
4	58.8	58.8	0.0	0.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	22.00
2	82.10	22.00

BOUNDARY LOAD(S)

1 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (lb/sqft)	Deflection (deg)
1	110.20	132.70	250.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

10 Trial Surfaces Have Been Generated.

5 Surfaces Initiate From Each Of 2 Points Equally Spaced

Along The Ground Surface Between X = 60.00 ft.
 and X = 70.00 ft.

Each Surface Terminates Between X = 111.00 ft.
 and X = 132.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial

Failure Surfaces Examined. They Are Ordered - Most Critical

First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	70.00	19.00
2	81.02	8.82
3	95.29	4.21
4	110.18	6.00
5	122.95	13.88
6	131.23	26.39
7	131.55	28.46

Circle Center At X = 98.7 ; Y = 39.0 and Radius, 34.9
 *** 4.450 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	70.00	19.00
2	81.65	9.55
3	96.19	5.88
4	110.93	8.69
5	123.11	17.44
6	129.15	28.17

Circle Center At X = 97.2 ; Y = 40.6 and Radius, 34.8
 *** 4.757 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	19.00
2	70.86	8.65
3	84.72	2.93
4	99.72	2.60
5	113.82	7.71
6	125.12	17.57
7	130.79	28.37

Circle Center At X = 93.1 ; Y = 42.9 and Radius, 40.8
 *** 4.799 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	19.00
2	70.99	8.79
3	85.03	3.51
4	100.02	3.93
5	113.74	10.00
6	124.13	20.82
7	126.94	27.91

Circle Center At X = 91.4 ; Y = 41.8 and Radius, 38.9
 *** 4.966 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	70.00	19.00
2	80.61	8.39
3	95.19	4.87
4	109.47	9.46
5	119.26	20.82
6	120.29	27.11

Circle Center At X = 94.2 ; Y = 32.6 and Radius, 27.7
 *** 5.465 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	70.00	19.00
2	82.97	11.46
3	97.93	10.32
4	111.89	15.80
5	122.08	26.81
6	122.24	27.34

Circle Center At X = 92.9 ; Y = 43.6 and Radius, 33.6

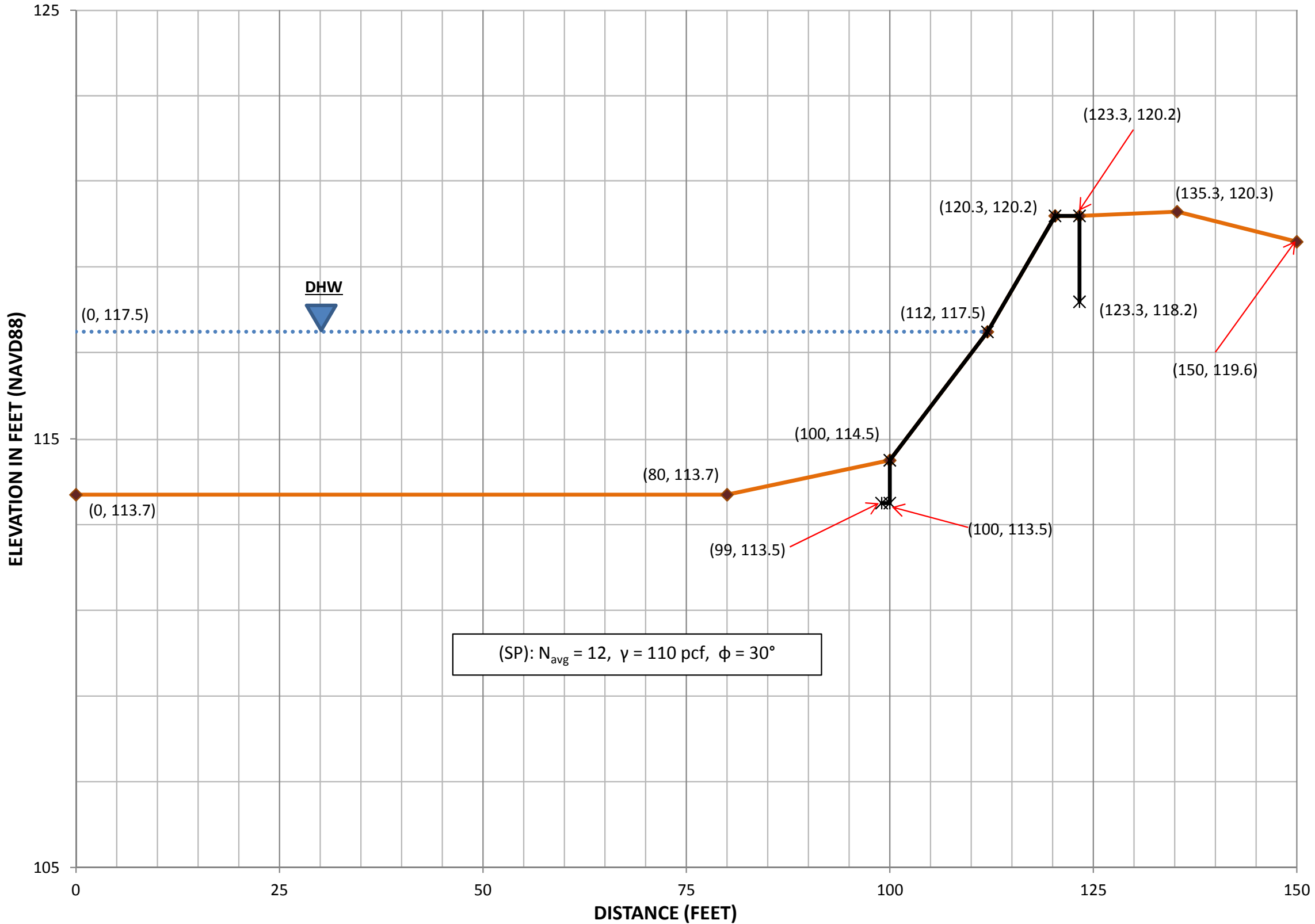

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***      6.120      ***
Failure Surface Specified By 6 Coordinate Points
Point      X-Surf      Y-Surf
No.        (ft)         (ft)
1          60.00         19.00
2          71.30         9.13
3          85.96         5.98
4          100.32        10.33
5          110.77        21.08
6          112.14        26.13
Circle Center At X = 84.7 ; Y = 35.9 and Radius, 30.0
***      8.652      ***
Failure Surface Specified By 5 Coordinate Points
Point      X-Surf      Y-Surf
No.        (ft)         (ft)
1          70.00         19.00
2          84.34         14.59
3          99.32         15.29
4          113.18        21.03
5          119.80        27.05
Circle Center At X = 89.8 ; Y = 57.9 and Radius, 43.6
***      11.379     ***
Failure Surface Specified By 6 Coordinate Points
Point      X-Surf      Y-Surf
No.        (ft)         (ft)
1          60.00         19.00
2          74.27         14.37
3          89.25         13.73
4          103.86        17.13
5          117.03        24.32
6          119.85        27.06
Circle Center At X = 84.1 ; Y = 69.0 and Radius, 55.5
***      14.746     ***
Failure Surface Specified By 5 Coordinate Points
Point      X-Surf      Y-Surf
No.        (ft)         (ft)
1          60.00         19.00
2          74.78         16.46
3          89.77         17.03
4          104.32        20.68
5          116.59        26.67
Circle Center At X = 79.6 ; Y = 88.5 and Radius, 72.2
***      16.650     ***

```

NORTHWEST WATER RECLAMATION FACILITY

RAPID INFILTRATION BASIN (RIB) SLOPE LINER: RIB -7



(SP): $N_{avg} = 12$, $\gamma = 110$ pcf, $\phi = 30^\circ$

Project Name: Northwest Water Reclamation Facility
 Rapid Infiltration Basin (RIB) Side Slope Liners Replacement

Project Number: C17003

Subject: Existing Slope Stability Analysis
 Boring # RIB7-T
 Approx Top Approx Top Elevation: 120.3' (NAVD88)
 Approx Bottom Elevation: 114.5' (NAVD88)

Legend

- ◆— Fine Sand (SP)
- *— HDPE 60 mil (Liner)
- .-.- Domestic Hot Water (DHW)

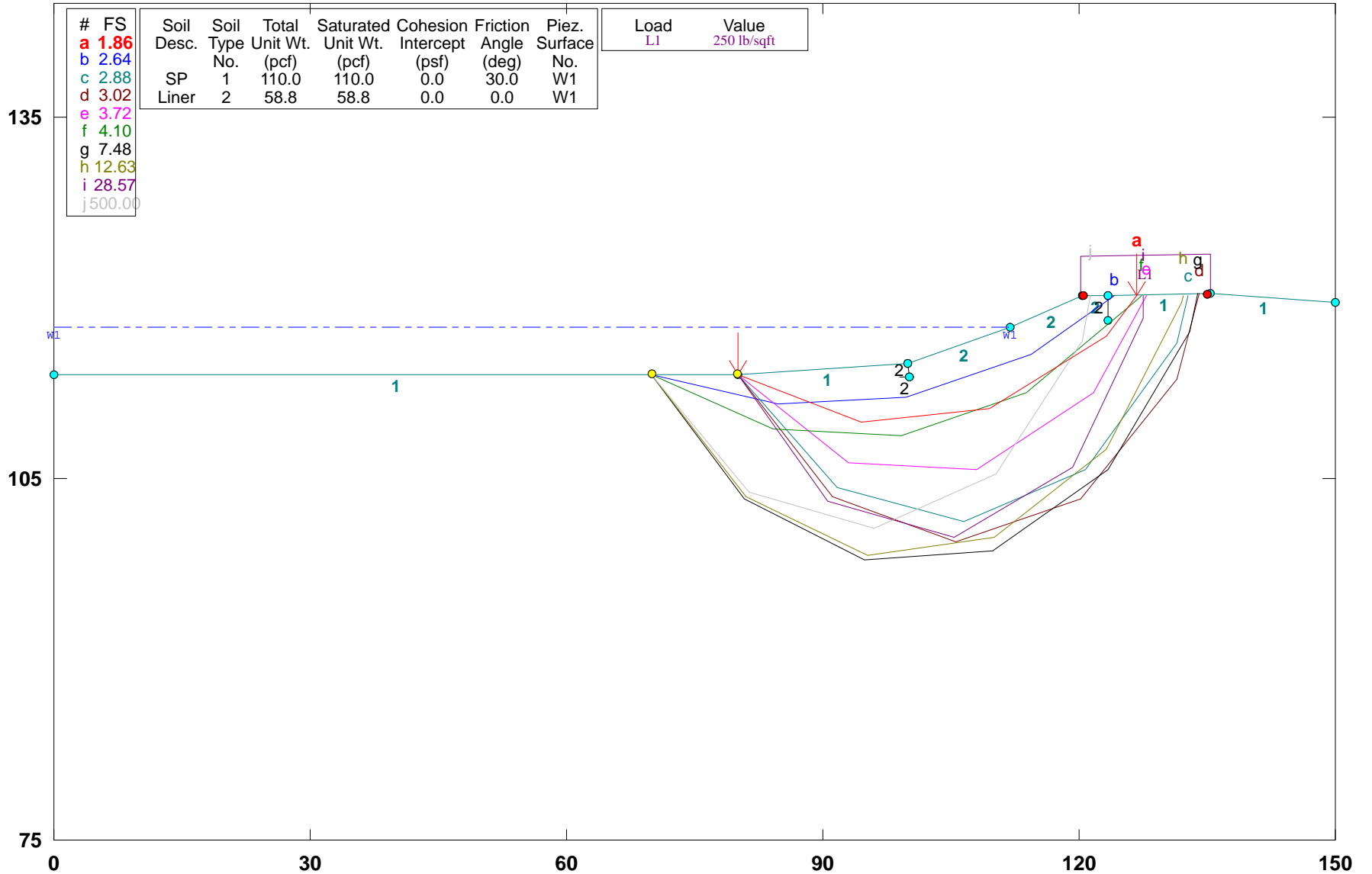
Drawn By: MS

Checked By: GNN

Date: 07/14/17

NWRF Rapid Infiltration Basin Liners RepExisting slope RIB -7 (Boring RIB7-T)

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STABL6H FSmin=1.86
Safety Factors Are Calculated By The Modified Bishop Method

**** STABL6H ****

by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 7/17/2017
Time of Run: 04:28PM
Run By: MS
Input Data Filename: Z:rib -7 (boring rib7-t)2.in
Output Filename: Z:rib -7 (boring rib7-t)2.OUT
Plotted Output Filename: Z:rib -7 (boring rib7-t)2.PLT
PROBLEM DESCRIPTION NWRP Rapid Infiltration Basin Liners Rep
Existing slope RIB -7 (Boring RIB7-T)

BOUNDARY COORDINATES

Note: User origin value specified.
Add 0.00 to X-values and 75.00 to Y-values listed.

7 Top Boundaries
10 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	38.70	80.00	38.70	1
2	80.00	38.70	100.00	39.50	1
3	100.00	39.50	112.00	42.50	2
4	112.00	42.50	120.30	45.20	2
5	120.30	45.20	123.30	45.20	2
6	123.30	45.20	135.30	45.30	1
7	135.30	45.30	150.00	44.60	1
8	123.30	45.20	123.31	43.20	2
9	100.00	39.50	100.10	38.50	2
10	99.00	38.50	100.10	38.50	2

ISOTROPIC SOIL PARAMETERS

2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param. (psf)	Pressure Constant	Piez. Surface No.
1	110.0	110.0	0.0	30.0	0.00	0.0	1
2	58.8	58.8	0.0	0.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	42.50
2	112.00	42.50

BOUNDARY LOAD(S)

1 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (lb/sqft)	Deflection (deg)
1	120.20	135.30	250.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
10 Trial Surfaces Have Been Generated.

5 Surfaces Initiate From Each Of 2 Points Equally Spaced Along The Ground Surface Between X = 70.00 ft. and X = 80.00 ft.
Each Surface Terminates Between X = 120.50 ft. and X = 135.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.
The Factor Of Safety For The Trial Failure Surface Defined By The Coordinates Listed Below Is Misleading.

Failure Surface Defined By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	70.00	38.70

2	81.30	28.83
3	95.99	25.81
4	110.27	30.41
5	120.43	41.45
6	121.30	45.20

Factor Of Safety For The Preceding Specified Surface = -3.185

Following Are Displayed The Ten Most Critical Of The Trial

Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	38.70
2	94.45	34.69
3	109.42	35.77
4	123.15	41.80
5	126.78	45.23

Circle Center At X = 98.8 ; Y = 78.5 and Radius, 44.0

*** 1.857 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	70.00	38.70
2	84.78	36.16
3	99.77	36.73
4	114.32	40.40
5	124.14	45.21

Circle Center At X = 89.5 ; Y = 108.1 and Radius, 72.1

*** 2.637 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	38.70
2	91.70	29.32
3	106.43	26.46
4	120.79	30.79
5	131.49	41.30
6	132.77	45.28

Circle Center At X = 104.9 ; Y = 57.7 and Radius, 31.3

*** 2.884 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	38.70
2	91.04	28.55
3	105.56	24.78
4	120.15	28.28
5	131.37	38.23
6	134.00	45.29

Circle Center At X = 105.8 ; Y = 55.7 and Radius, 31.0

*** 3.019 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	38.70
2	93.08	31.36
3	108.07	30.81
4	121.65	37.18
5	127.86	45.24

Circle Center At X = 101.7 ; Y = 62.0 and Radius, 31.9

*** 3.720 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	70.00	38.70
2	84.27	34.07
3	99.26	33.56
4	113.81	37.21
5	126.78	44.74

6 127.26 45.23
 Circle Center At X = 93.6 ; Y = 87.1 and Radius, 53.8
 *** 4.103 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	70.00	38.70
2	80.86	28.35
3	94.93	23.16
4	109.91	23.97
5	123.34	30.66
6	133.01	42.12
7	133.97	45.29

Circle Center At X = 100.5 ; Y = 59.8 and Radius, 37.0
 *** 7.480 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	70.00	38.70
2	80.99	28.49
3	95.20	23.68
4	110.13	25.11
5	123.17	32.52
6	132.02	44.63
7	132.16	45.27

Circle Center At X = 99.3 ; Y = 59.3 and Radius, 35.8
 *** 12.634 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	38.70
2	90.61	28.09
3	105.31	25.15
4	119.19	30.85
5	127.58	43.28
6	127.59	45.24

Circle Center At X = 102.8 ; Y = 50.9 and Radius, 25.9
 *** 28.574 ***

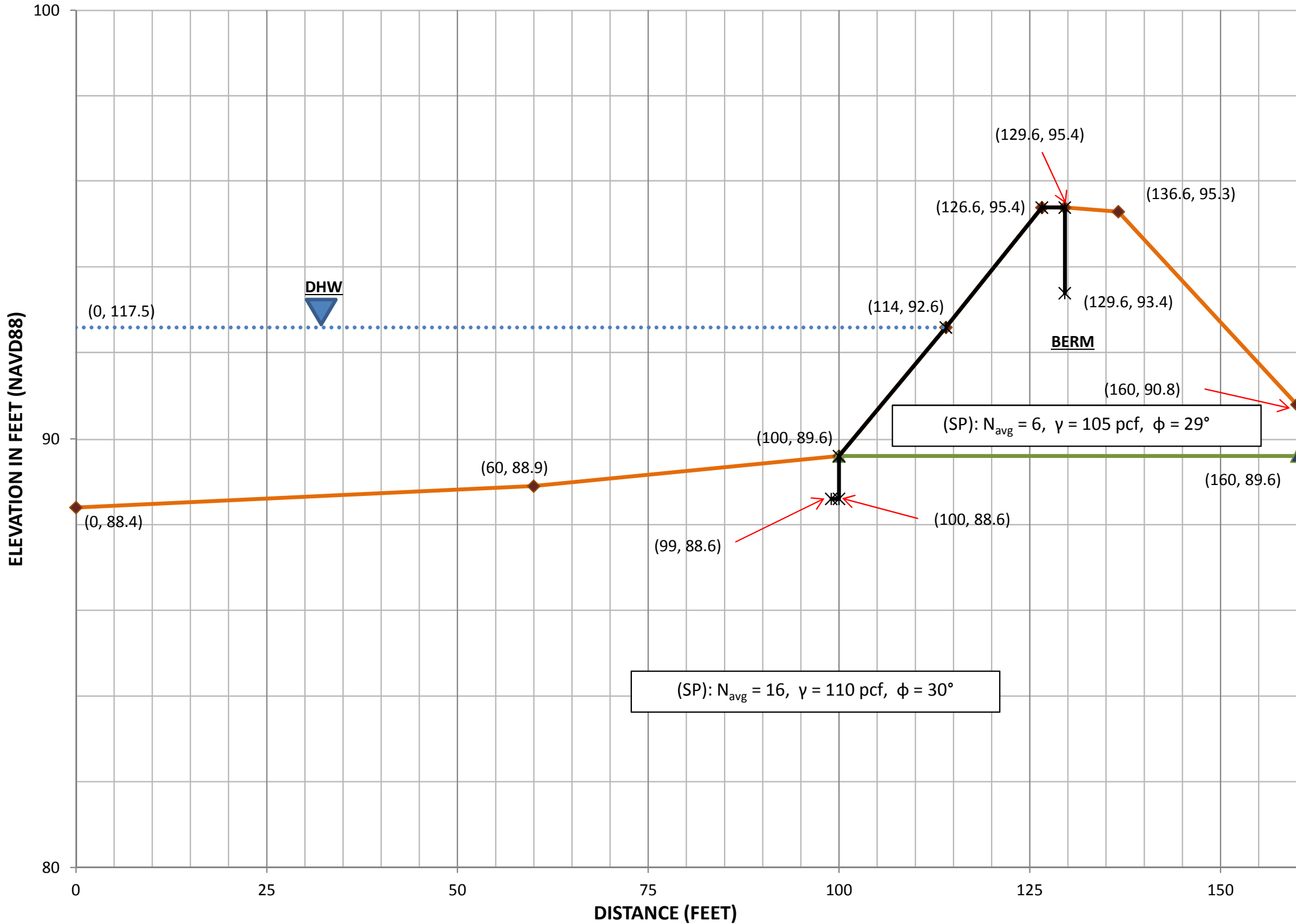
Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	70.00	38.70
2	81.30	28.83
3	95.99	25.81
4	110.27	30.41
5	120.43	41.45
6	121.30	45.20

Circle Center At X = 94.4 ; Y = 55.2 and Radius, 29.5
 *** 500.000 ***

NORTHWEST WATER RECLAMATION FACILITY

RAPID INFILTRATION BASIN (RIB) SLOPE LINER: RIB -9



Project Name: Northwest Water Reclamation Facility
 Rapid Infiltration Basin (RIB) Side Slope Liners Replacement

Project Number: C17003

Subject: Existing Slope Stability Analysis
 Boring # RIB9-T
 Approx Top Elevation: 95.4 (NAVD88)
 Approx Bottom Elevation: 89.6' (NAVD88)

- Legend
- ◆ Fine Sand (SP)
 - ▲ Fine Sand (SP)
 - ✱ HDPE 60 mil (Liner)
 - ⋯ Domestic Hot Water (DHW)

Drawn By: MS

Checked By: GNN

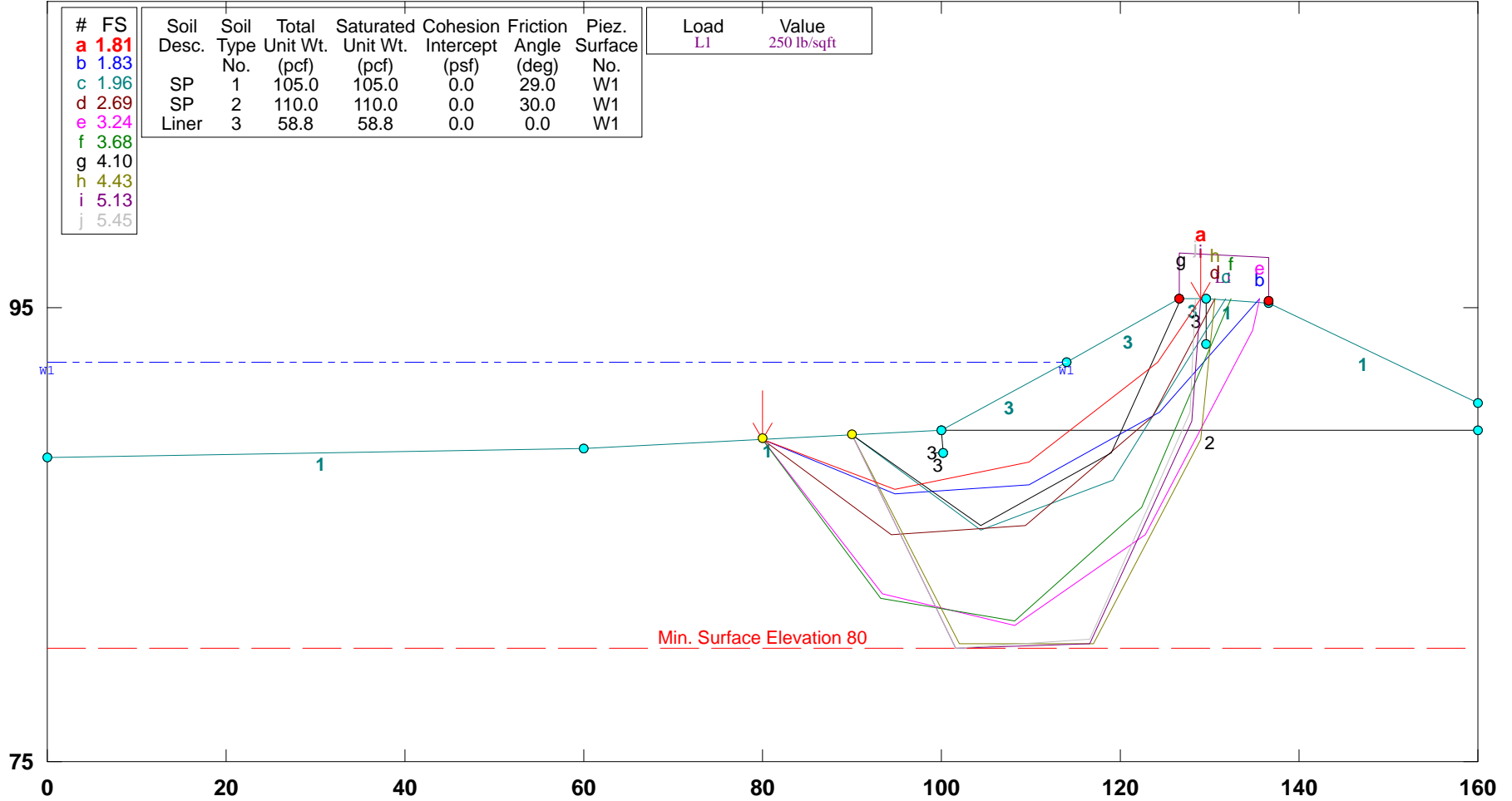
Date: 07/14/17

NWRP Rapid Infiltration Basin Liners RepExisting slope RIB -9 (Boring RIB9-T)

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#	FS	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
a	1.81							
b	1.83							
c	1.96							
d	2.69							
e	3.24							
f	3.68							
g	4.10							
h	4.43							
i	5.13							
j	5.45							

Load	Value
L1	250 lb/sqft



STABL6H FSmin=1.81
Safety Factors Are Calculated By The Modified Bishop Method

**** STABL6H ****

by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 7/17/2017
Time of Run: 04:34PM
Run By: MS
Input Data Filename: Z:rib -9 (boring rib9-t)2.in
Output Filename: Z:rib -9 (boring rib9-t)2.OUT
Plotted Output Filename: Z:rib -9 (boring rib9-t)2.PLT
PROBLEM DESCRIPTION NWRP Rapid Infiltration Basin Liners Rep
Existing slope RIB -9 (Boring RIB9-T)

BOUNDARY COORDINATES

Note: User origin value specified.
Add 0.00 to X-values and 75.00 to Y-values listed.

7 Top Boundaries
11 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	13.40	60.00	13.90	1
2	60.00	13.90	100.00	14.60	1
3	100.00	14.60	114.00	17.60	3
4	114.00	17.60	126.60	20.40	3
5	126.60	20.40	129.60	20.40	3
6	129.60	20.40	136.60	20.30	1
7	136.60	20.30	160.00	15.80	1
8	129.60	20.40	129.61	18.40	3
9	100.00	14.60	160.00	14.60	2
10	100.00	14.60	100.10	13.60	3
11	99.00	13.60	100.10	13.60	3

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param. (psf)	Pressure Constant (psf)	Piez. Surface No.
1	105.0	105.0	0.0	29.0	0.00	0.0	1
2	110.0	110.0	0.0	30.0	0.00	0.0	1
3	58.8	58.8	0.0	0.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	17.60
2	114.00	17.60

BOUNDARY LOAD(S)

1 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (lb/sqft)	Deflection (deg)
1	126.60	136.60	250.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed

Force Acting On A Horizontally Projected Surface.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

10 Trial Surfaces Have Been Generated.

5 Surfaces Initiate From Each Of 2 Points Equally Spaced

Along The Ground Surface Between X = 80.00 ft.

and X = 90.00 ft.

Each Surface Terminates Between X = 126.60 ft.

and X = 136.60 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation

At Which A Surface Extends Is Y = 5.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial

Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

```

Failure Surface Specified By 5 Coordinate Points
Point      X-Surf      Y-Surf
No.        (ft)        (ft)
1          80.00      14.25
2          94.84      12.03
3          109.79     13.17
4          124.12     17.60
5          128.96     20.40
Circle Center At X = 97.3 ; Y = 79.0 and Radius, 67.0
***      1.807      ***

Failure Surface Specified By 5 Coordinate Points
Point      X-Surf      Y-Surf
No.        (ft)        (ft)
1          80.00      14.25
2          94.80      11.78
3          109.79     12.17
4          124.43     15.42
5          135.68     20.31
Circle Center At X = 100.2 ; Y = 89.9 and Radius, 78.3
***      1.826      ***

Failure Surface Specified By 4 Coordinate Points
Point      X-Surf      Y-Surf
No.        (ft)        (ft)
1          90.00      14.43
2          104.39     10.19
3          119.24     12.32
4          131.76     20.37
Circle Center At X = 106.9 ; Y = 45.3 and Radius, 35.2
***      1.957      ***

Failure Surface Specified By 5 Coordinate Points
Point      X-Surf      Y-Surf
No.        (ft)        (ft)
1          80.00      14.25
2          94.40      10.04
3          109.39     10.36
4          123.60     15.18
5          130.69     20.38
Circle Center At X = 100.9 ; Y = 58.9 and Radius, 49.2
***      2.689      ***

Failure Surface Specified By 6 Coordinate Points
Point      X-Surf      Y-Surf
No.        (ft)        (ft)
1          80.00      14.25
2          93.37      7.45
3          108.30     5.97
4          122.74     10.00
5          134.74     19.01
6          135.55     20.32
Circle Center At X = 104.8 ; Y = 46.4 and Radius, 40.6
***      3.238      ***

Failure Surface Specified By 5 Coordinate Points
Point      X-Surf      Y-Surf
No.        (ft)        (ft)
1          80.00      14.25
2          93.27      7.25
3          108.22     6.14
4          122.38     11.10
5          132.34     20.36
Circle Center At X = 103.4 ; Y = 42.5 and Radius, 36.7
***      3.682      ***

Failure Surface Specified By 4 Coordinate Points
Point      X-Surf      Y-Surf
No.        (ft)        (ft)
1          90.00      14.43
2          104.43     10.32
3          119.06     13.60
4          126.84     20.40
Circle Center At X = 105.3 ; Y = 40.8 and Radius, 30.4
***      4.097      ***

Failure Surface Specified By 5 Coordinate Points

```

Point No.	X-Surf (ft)	Y-Surf (ft)
1	90.00	14.43
2	101.90	5.29
3	116.90	5.21
4	128.91	14.20
5	130.68	20.38

Circle Center At X = 109.5 ; Y = 27.6 and Radius, 23.5
 *** 4.430 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	90.00	14.43
2	101.67	5.00
3	116.67	5.20
4	128.09	14.92
5	129.05	20.40

Circle Center At X = 108.9 ; Y = 25.9 and Radius, 22.1
 *** 5.125 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	90.00	14.43
2	101.68	5.01
3	116.68	5.42
4	127.83	15.46
5	128.49	20.40

Circle Center At X = 108.6 ; Y = 25.6 and Radius, 21.7
 *** 5.448 ***

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APPENDIX B

ORANGE COUNTY UTILITIES

FORMS

**Risk Management (June 02)
Construction Assistance Request Form**

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Risk Management Division Information Sheet

Date:

To:

From: Susan Martin, Sr. Risk Management Analyst

Re: _____ Project
Builders' Risk/Property Insurance

In order to arrange the builders' risk insurance as required by contract, please provide the following information on the above referenced facility as soon as possible:

New facility or renovation of existing? _____

Address (Street address, City, Zip) _____

Type of Construction (see attached codes) _____

Type of Occupancy (e.g., office, warehouse) _____

Number of Floors _____

Square Footage _____

Date construction started _____

(excluding site work) _____

Date construction completed (est.) _____

Name of General Contractor _____

Completed value (Hard Cost) _____

(Exclude value of land, site work, underground property, landscaping.)

Does facility have: sprinklers? Yes _____ No _____

fire alarm? Yes _____ No _____

burglar alarm? Yes _____ No _____

Security (describe)? _____

Boiler & Machinery checklist. Does facility have: Yes / No

Steam Boilers: _____

Hot Water boilers: _____

Air conditioning/heating units: _____

Pumps, motors, generators, compressors _____

Describe below: _____

For your convenience, you may jot down the answers on this form and fax it to me at 836-8350. Thanks very much.

Completed by: _____

Date: _____

Phone: _____

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**CONTRACTOR'S ASSISTANCE REQUEST
FOR ACCESS TO COUNTY FACILITIES**

PROJECT: _____

DATE: _____ **NUMBER:** _____

LOCATION/STRUCTURE: _____

PURPOSE: _____

ADDITIONAL ASSISTANCE REQUESTED _____

DATE ACCESS NEEDED: _____

DURATION OF WORK: _____

Contractor **O.C.U. Construction**

COMMENTS/RESTRICTIONS: _____

PLANT SUPERVISOR

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APPENDIX C

ORANGE COUNTY UTILITIES

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APPENDIX D

ORANGE COUNTY UTILITIES Standards and Construction Specification Manual

LIST OF APPROVED PRODUCTS

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Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Air Release	ARV Enclosure	All ARV above ground enclosures shall be vented with tamper proof locking device						
		Water Plus Polyethylene Enclosure	131632 H30-B	Blue 44" Tall	131632 H30-P	Pantone 44"	131632 H30-G	Green 44" Tall
			171730 H40-B	Blue 30" Tall	171730 H40-P	Pantone 30"	171730 H40-G	Green 30" Tall
		Hot Box Vent Guard Fiberglass Enclosure	AVG2036 Encl	Blue 36" Tall	AVG2036 Encl	Pantone 36" Tall	AVG2036 Encl	Green 36" Tall
			GP3232 Base		GP3232 Base		GP3232 Base	
			AVG2041 Encl	Blue 41" Tall	AVG2041 Encl	Pantone 41" Tall	AVG2041 Encl	Green 41" Tall
		GP3232 Base		GP3232 Base		GP3232 Base		
	Safety-Guard/Hydro Guard	15100 Encl	Blue 34" Tall	15100 Encl	Pantone 34" Tall	15100 Encl	Green 34" Tall	
	Air Release Valves	Air Release Valves shall be Combination Type, 316 SS						
		ARI	D-040SS	Combination	D-040SS	Combination	D-020 (SS)	Combination
H-TEC		NA	NA	NA	NA	986 (316SS)	Combination	
Vent-O-Mat		Series RBX DN50	2"	Series RBX DN50	2"	RGX series		
ARV Vault	Air Release Valve Frame and Cover							
	US Foundry	NA	NA	NA	NA	USF 7665-HH-HJ		
Blow Off	Auto Blow Off	Automatic Blow Off Valve						
		Hydro Guard	HG-1 Standard Unit	Automatic	NA	NA	NA	NA
	Blow Off Valve	Blow Off Valve - Fits standard 5-1/4 inch Valve Box						
		Kupferle Foundry Co	Truflo Series TF #550		Truflo Series TF #550		NA	NA
	Water Plus Corp	The Hydrant Plus Series VB 2000B		The Hydrant Plus Series VB 2000B		NA	NA	
Casing Seals / Spacers	Casing End Seals	Casing End Seals. Annular space between pipe and steel casing shall be brick and mortar with end seals to secure ends.						
		Advance Products	Model AC and AW		Model AC and AW		Model AC and AW	
		BWM Company	Model WR and PO		Model WR and PO		Model WR and PO	
		Cascade Water Works	Model CCES		Model CCES		Model CCES	
		CCI Pipeline	Model ESW and ESC		Model ESW and ESC		Model ESW and ESC	
		Pipeline Seal & Insulator, Inc (PSI)	Model C and W		Model C and W		Model C and W	
		Power Seal	Model 4810ES		Model 4810ES		Model 4810ES	

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Casing Seals / Spacers	Casing spacer	Casing spacers shall be a min. 8-inches wide for pipe 12" Dia or less or min. 12-inches wide for pipe 16 or greater , shall have a minimum 14 gauge 304 stainless steel shell/band, minimum 10 gauge 304 reinforced risers; minimum thickness of 0.090 EPDM or PVC interior liners, glass reinforces polymer or ultra high molecular weight polyethylene and 304 stainless bolts, nuts and washers.						
		Advance Products	SSI8 / SSI12		SSI8 / SSI12		SSI8 / SSI12	
		BWM Company	BWM-SS-8 / SS-12		BWM-SS-8 / SS-12		BWM-SS-8 / SS-12	
		Cascade Water Works	Series CCS 8" / 12"		Series CCS 8" / 12"		Series CCS 8" / 12"	
		CCI Pipeline	Model CCS8 / CSS12		Model CCS8 / CSS12		Model CCS8 / CSS12	
		Pipeline Seal & Insulator, Inc (PSI)	Series S8G-2 / S12G-2		Series S8G-2 / S12G-2		Series S8G-2 / S12G-2	
Coatings	Exterior Coatings for Exposed Metal Assets	Coatings: Aerial pipe, hydrants, above ground piping, fittings, valves and Appurtenances - System 1 Zinc / Urethane / Fluoropolymer application and color code per Section 3119 Coatings & Linings. Coating shall not be in contact with Potable water unless NSF 61 approved.						
		Carboline	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils
			Carbothane 133 HB	3.0 -5.0 mils	Carbothane 133 HB	3.0 -5.0 mils	Carbothane 133 HB	3.0 -5.0 mils
			Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils
		Tnemec	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils
			Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils
			EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils
	Hydroflon Series 700		2.0 - 3.0 mils	Hydroflon Series 700	2.0 - 3.0 mils	Hydroflon Series 700	2.0 - 3.0 mils	
	Exterior Coatings for Exposed Metal Assets	Coatings: Aerial pipe, hydrants, above ground piping, fittings, valves and Appurtenances - System 2 Zinc / Epoxy / Urethane application and color code per Section 3119 Coatings & Linings. Coating shall not be in contact with Potable water unless NSF 61 approved.						
		Carboline	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils
			Carboguard 60	4.0 -6.0 mils	Carboguard 60	4.0 -6.0 mils	Carboguard 60	4.0 -6.0 mils
			Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils
		Tnemec	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils
			Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils
Hi-Build Epoxoline II			4.0 - 10.0 mils	Hi-Build Epoxoline II	4.0 - 10.0 mils	Hi-Build Epoxoline II	4.0 - 10.0 mils	
Series N69			Series N69		Series N69			
PPG / Ameron	EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils		
	Amercoat 68HS	Min 3.0 mils	Amercoat 68HS	Min 3.0 mils	Amercoat 68HS	Min 3.0 mils		
	Amercoat 385	4.0 - 6.0 mils	Amercoat 385	4.0 - 6.0 mils	Amercoat 385	4.0 - 6.0 mils		
	Amercoat 450H	2.0 - 3.0 mils	Amercoat 450H	2.0 - 3.0 mils	Amercoat 450H	2.0 - 3.0 mils		

APPENDIX D

LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Fittings	Fittings	Ductile Iron Fittings C153 SSB / C110 FLG: (Water & Reclaimed Water fittings shall cement lined or holiday free fusion bonded epoxy lined) (Wastewater fittings interior shall be Protecto 401 and holiday free)						
		American	30" & up	FBE / Cement	30" & up	FBE / Cement	30" & up	Protecto 401
		Sigma		FBE / Cement		FBE / Cement		Protecto 401
		Star		FBE / Cement		FBE / Cement		Protecto 401
		Tyler Union & Clow		FBE / Cement		FBE / Cement		Protecto 401
Flow Meter	Flow Meter	Flow Meters With Replaceable Sensors						
		EMCO	NA	NA	NA	NA	Unimag 4411E	
Hydrants	Hydrants	Hydrants Shall open left, 1-1/2 Pentagon operating nut, NST hose & pumper thread, rotate 360 degrees, closed drains, epoxy on shoe in & out and 304 SS nuts & bolts below ground.						
		American Flow Control	B-84-B (6 inch)		NA	NA	NA	NA
		Clow	Medallion 2545		NA	NA	NA	NA
		Mueller	Super Centurion 250		NA	NA	NA	NA
Joint Restraints	Ductile iron pipe MJ Restraints	Mechanical Joint Wedge-action Restraining Gland, Epoxy Coated Restrain ductile iron pipe to mechanical joint fittings, pipe and appurtenances.						
		EBAA Iron Inc	Megalug Series 1100		Megalug Series 1100		Megalug Series 1100	
		Ford / Uni-Flange	UFR-1400		UFR-1400		UFR-1400	
		Sigma	OneLok Series SLD/SLDE		OneLok Series SLD/SLDE		OneLok Series SLD/SLDE	
		Smith Blair	Cam Lok Series 111		Cam Lok Series 111		Cam Lok Series 111	
		Star	Star Grip Series 3000		Star Grip Series 3000		Star Grip Series 3000	
		Tyler Union	TufGrip Series TLD		TufGrip Series TLD		TufGrip Series TLD	
	DIP Bell Joint Restraints (4" - 12") (New & Existing)	Bell Joint Restraints for Ductile Iron Pipe (4"-12") (New & Existing) - All restraints split serrated on bell and spigot ends. Pipe 16" and greater shall have restraint gaskets or locking bells. (Wastewater only for restraint of existing DIP FM)						
		EBAA Iron Inc	Tru-Dual Series 1500TD		Tru-Dual Series 1500TD		Tru-Dual Series 1500TD	
		Ford / Uni-Flange	Uni-Flange Series 1390C		Uni-Flange Series 1390C		Uni-Flange Series 1390C	
		Sigma	PV-Lok Series PWP-C		PV-Lok Series PWP-C		PV-Lok Series PWP-C	
		Smith Blair	Bell-Lock Series 165		Bell-Lock Series 165		Bell-Lock Series 165	
		Star	StarGrip Series 3100S		StarGrip Series 3100S		StarGrip Series 3100S	
DIP Bell Joint Restraints (16" & Greater)	Ductile Iron Pipe Bell Joint Restraints for Ductile Iron Pipe (16" & Greater) - All restraints shall have a split back-up ring for the bell and a serrated or wedge action gland for the spigot end. New installation for water & reclaimed water piping 16" and greater shall have restraint gaskets or locking bells.							
	EBAA Iron Inc	Series 1100HD	Existing Only	Series 1100HD	Existing Only	Series 1100HD	Existing Only	
	Sigma	Series SSLDH	Existing Only	Series SSLDH	Existing Only	Series SSLDH	Existing Only	
	Star	Series 3100S	Existing Only	Series 3100S	Existing Only	Series 3100S	Existing Only	

APPENDIX D

LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Joint Restraints	Ductile iron pipe Bell Joint Restraint Gaskets and Locking Bell (4" & Above)	Bell Joint Restraint Gaskets and Locking Bell (4" & Above) Stainless Steel locking wedges built into the gasket-rubber. ANSI/AWWA C111/A21.11 Standard for Rubber-Gasket Joints for Ductile Iron Pressure Pipe. Ductile Iron Bell Joint Restraint for Push-On Pipe- Locking bell joint system that prevents joint separation and allows for joint deflection. Bells shall be painted red to verify restrained gasket.						
		American	Fast Grip Gasket	Gasket	Fast Grip Gasket	Gasket	NA	NA
			Flex-Ring Joint	Bell Lock	Flex-Ring Joint	Bell Lock	NA	NA
			Lok-Ring Joint	Bell Lock	Lok-Ring Joint	Bell Lock	NA	NA
		Griffin	Talon RJ Gasket	Gasket	Talon RJ Gasket	Gasket	NA	NA
			Snap-Lok	Bell Lock	Snap-Lok	Bell Lock	NA	NA
			Sure Stop 350 Gasket	Gasket	Sure Stop 350 Gasket	Gasket	NA	NA
		McWane Inc. DI Pipe Group	Thrust-Lock	Bell Lock	Thrust-Lock	Bell Lock	NA	NA
			TR-Flex	Bell Lock	TR-Flex	Bell Lock	NA	NA
			Super-Lock	Bell Lock	Super-Lock	Bell Lock	NA	NA
			Field Lok 350 Gasket	Gasket	Field Lok 350 Gasket	Gasket	NA	NA
		US Pipe	Field Lok Gasket	Gasket	Field Lok Gasket	Gasket	NA	NA
			TR-Flex	Bell Lock	TR-Flex	Bell Lock	NA	NA
			HP Lok Restraint Joint	Bell Lock	HP Lok Restraint Joint	Bell Lock	NA	NA
	SS to DIP Transition Restraint -Flanged stainless steel pipe from Wetwell to Valve box restrained joint transition (epoxy coated, SS hardware) Flg x PE RJ.							
	SS to DIP Transition Restraint	EBAA Iron Inc	NA	NA	NA	NA	Megaflange 2100	
		Sigma	NA	NA	NA	NA	SigmaFlange with One Lock SLDE	
		Smith Blair	NA	NA	NA	NA	911 Flange - Lock Restrained FCA	
	PVC Pipe MJ Restraints	Mechanical Joint Wedge-action Restraining Gland, Epoxy Coated Restrain PVC pipe to mechanical joint fittings, and appurtenances.						
		EBAA Iron Inc	Mega-lug Series 2000PV		Mega-lug Series 2000PV		Mega-lug Series 2000PV	
			NA	NA	NA	NA	Megalug Series 2200 (42"-48")	
		Ford / Uni-Flange	UFR 1500 Series		UFR 1500 Series		UFR 1500 Series	
		Sigma	One Lok Series SLC/SLCE		One Lok Series SLC/SLCE		One Lok Series SLC/SLCE	
		Smith Blair	Cam Lok Series 120		Cam Lok Series 120		Cam Lok Series 120	
		Star	Star Grip Series 4000		Star Grip Series 4000		Star Grip Series 4000	
		Tyler Union	TufGrip Series TLP		TufGrip Series TLP		TufGrip Series TLP	
	PVC Bell Joint Restraints (4" - 12") (New & Existing)	PVC Bell Joint Restraints: PVC pipe Split Serrated on Bell End and Spigot End. (4" - 12") (New & Existing)						
		EBAA Iron Inc	Tru-Dual Series 1500TD		Tru-Dual Series 1500TD		Tru-Dual Series 1500TD	
Ford / Uni-Flange		Uni-Flange Series 1390		Uni-Flange Series 1390		Uni-Flange Series 1390		
Sigma		PV-Lok Series PWP		PV-Lok Series PWP		PV-Lok Series PWP		
Smith Blair		Bell-Lock Series 165		Bell-Lock Series 165		Bell-Lock Series 165		
Star		Series 1100C		Series 1100C		Series 1100C		
Tyler Union		TufGrip 300C		TufGrip 300C		TufGrip 300C		

APPENDIX D

LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Joint Restraints	PVC Bell Joint Restraints (16" & Greater)	PVC Bell Joint Restraints: (16" & Greater) PVC pipe Split Serrated on Bell End and Spigot End. Water & Reclaimed Water Existing pipe only. Wastewater shall be new and existing pipe.						
		Ford / Uni-Flange	Series 1390	Existing Only	Series 1390	Existing Only	Series 1390	
		JCM	Sur-Grip Series 621	Existing Only	Sur-Grip Series 621	Existing Only	Sur-Grip Series 621	
		Sigma	PV-Lok PWP	Existing Only	PV-Lok PWP	Existing Only	PV-Lok PWP	
		Smith Blair	Bell-Lock Series 165	Existing Only	Bell-Lock Series 165	Existing Only	Bell-Lock Series 165	
		Star	Series 1100C	Existing Only	Series 1100C	Existing Only	Series 1100C	
Pipe	PVC C900 DR 18 Bell & Spigot (4" - 12")	C900 Bell & Spigot PVC Pipe: 4 to 12-inch - AWWA C-900, Minimum DR18 for Water, Reclaimed and Wastewater. DR14 for Fire Lines. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.						
		Certaanteed 4" to 12"	Certa-Lok C900/RJ	Blue	Certa-Lok C900/RJ	Pantone Purple	Certa-Lok C900/RJ	Green
		Diamond Plastics Corp	C-900	Blue	C-900	Pantone Purple	Diamond C900	Green
		Ipex Inc	C-900 Blue Brute	Blue	C-900	Pantone Purple	C900 Blue Brute	Green
		JM Eagle	C-900	Blue	C-900	Pantone Purple	C-900	Green
		National Pipe & Plastics Inc	C-900 Dura- Blue	Blue	C-900	Pantone Purple	C-900 Pipe	Green
		North American Pipe Corp (NAPCO)	C-900	Blue	C-900	Pantone Purple	C-900	Green
		Sanderson Pipe Corp	C-900	Blue	C-900	Pantone Purple	C-900	Green
	PVC C905 DR 18 Bell & Spigot 16" and Larger	C905 Bell & Spigot PVC Pipe 16" and Larger: AWWA C-905, Minimum DR18 for all Force Mains up to 24". Minimum DR21/DR25 for 30" and greater. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.						
		Certaanteed 16"	NA	NA	NA	NA	Certa-Lok C905/RJ	NA
		Diamond Plastics Corp	NA	NA	NA	NA	Trans-21 DR18	Green
		Ipex Inc	NA	NA	NA	NA	IPEX Centurion	Green
		JM Eagle	NA	NA	NA	NA	C905 Big Blue	Green
		National Pipe & Plastics Inc	NA	NA	NA	NA	C905	Green
HDPE C906 DR11	HDPE Pipe DR11 AWWA C906 shall be Ductile Iron Pipe Size, PE 3408/3608/4710 DIPS manufactured in accordance with ASTM F-714 and listed with NSF. Pipe shall be marked in accordance with either AWWA C901,AWWA C906. Compression type connections are not acceptable in new installations. Pipe joints shall be butt fusion or electro-fusion with flange or adapter. All HDPE shall be color coded to the Utility. Color identifications are in accordance with the APWA/ULCC Uniform Color Code. Manufacturers shall be members in good standing with PPI to maintain approval status.							
	JM Eagle	HDPE	DR11 Blue	HDPE	DR11 Pantone	HDPE	DR11Green	
	Performance Pipe(Chevron)	Driscoplex 4000	DR11 Blue	Driscoplex 4000	DR11 Pantone	Driscoplex 4300	DR11 Green	
	PolyPipe, Inc.	EHMW Poly Pipe	DR11 Blue	EHMW	DR11 Pantone	EHMW	DR11Green	

APPENDIX D

LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Pipe	Ductile Iron Pipe	Ductile iron/Cast iron: (4" to 12" = Class 350, 16" to 24" - Class 250, 30" to 64" = Class 200). Water and Reclaimed water shall be cement lined. Wastewater Piping shall be Protecto 401 and Holiday Free. Exterior coatings as specified. Wastewater DIP piping shall be for pump station piping only. Manufacturers shall be members in good standing with DIPRA to maintain approval status.						
		American	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		Griffin	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		McWane Inc. DI Pipe Group	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		US Pipe	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
Sample	Sample Station	Sample Stations - Bacteriological Sample Station with built in flush system, all internal piping to be 2", brass and includes lockable green enclosures.						
		Safety-Guard	SG-BSS-05 pedestal #77	green enclosure	NA	NA	NA	NA
		Water Plus Corp	Model 5000	green	NA	NA	NA	NA
Services	Brass Service Saddles	Brass Service Saddles for 1" & 2" water & reclaimed water services on 4" through 12" Mains - Service saddles can be hinge or bolt controlled OD saddles to be used on C-900 and existing IPS OD PVC pipe.						
		Ford	Series S-70, S-90	4"-12"	Series S-70, S-90	4"-12"	NA	NA
		AY McDonald	Model 3891 / 3895,3801 / 3805	4"-12"	Model 3891 / 3895,3801 / 3805	4"-12"	NA	NA
		Mueller	Series S-13000/H-13000	4"-12"	Series S-13000/H-13000	4"-12"	NA	NA
	Service Saddles	Service Saddles for 1" (CC) & 2" (Iron pipe threads) Water & Reclaimed Water services on mains greater than 12". Service saddles for 2" taps (iron pipe threads) on 4" mains and greater for Waste Water. : Epoxy or nylon coated stainless steel 18-8-type 304 double straps, controlled O.D. saddles to be used on C-900 / C905 or DI for all 1-in and -2in taps on pipes over 12in.						
Ford		Series FC202	16" & greater	Series FC202	16" & greater	Series FC202	4" & greater	
JCM		Series 406	16" & greater	Series 406	16" & greater	Series 406	4" & greater	
Mueller		DR2S	16" & greater	DR2S	16" & greater	DR2S	4" & greater	
Romac		Series 202NS	16" & greater	Series 202NS	16" & greater	Series 202NS	4" & greater	
Smith Blair		Series 317	16" & greater	Series 317	16" & greater	Series 317	4" & greater	
Service Saddles for HDPE	Service Saddles for 1" (CC) & 2" (Iron Pipe threads) Water and Reclaimed Water Services: Epoxy or nylon coated stainless steel 18-8-type 304 double straps, controlled O.D. saddles to be used on HDPE for all 1-in and -2in taps. Taps to HDPE pipe shall be approved on a case by case basis.							
	Ford	Series FCP202		Series FCP202		Series FCP202		
	Romac	Series 202N-H		Series 202N-H		Series 202N-H		
	Smith Blair	Series 317-1 for HDPE		Series 317-1 for HDPE		Series 317-1 for HDPE		
Corporation Stops Ball Type	Corporation Stops Ball Type (1-inch with AWWA taper C threads only/pack joint outlet for CTS) 2" Corporation Stop Ball Type shall be 2" MIP X FIP threads.							
	Ford	FB1000, FB1700-7		FB1000, FB1700-7		FB1700-7	2" ARV	
	AY McDonald	4701B-22, 3149B2		4701B-22, 3149B2		3149B2	2" ARV	
	Mueller	P25008, B-20046		P25008, B-20046		B-20046	2" ARV	

APPENDIX D

LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Services	Curb Stops	Curb Stops - Straight Valves: Ball type compression 2" cts O.D. tubing by 2" FIP						
		Ford	B41-777W		B41-777W		NA	NA
		AY McDonald	6102W-22		6102W-22		NA	NA
		Mueller	P25172		P25172		NA	NA
	Curb Stops	Curb Stops - Straight Valves: ball type compression x compression						
		Ford	B44-444W		B44-444W		NA	NA
		AY McDonald	6100W-22		6100W-22		NA	NA
		Mueller	P25146		P25146		NA	NA
	PE tubing	Polyethylene tubing: AWWA C901. UV protection (SDR-9) 1-inch and 2-inch only. PE 3408 / PE 4710						
		Charter Plastics	Blue Ice		Lav Ice		NA	NA
		Endot	Endopure Blue		Endocore Lavender		NA	NA
		JM Eagle	Pure-Core		NA	NA	NA	NA
Line Stops	Line Stops							
	JCM							
	Romac							
	Smith Blair							
Tapping Sleeves and Valves	Tapping Sleeves	Tapping Sleeves: (Mechanical joint for taps on cast iron, ductile iron, PVC & AC pipe, including size on size) with stainless steel nuts and bolts.						
		American Flow Control	Series 2800		Series 2800		Series 2800	
			Series 1004		Series 1004		Series 1004	
		Clow	Series F-5205	DIP/PVC	Series F-5205	DIP/PVC	Series F-5205	DIP/PVC
			Series F-5207	A/C Pipe	Series F-5207	A/C Pipe	Series F-5207	A/C Pipe
		JCM	Series 414	FBE	Series 414	FBE	Series 414	FBE
		Mueller	Series H-615	DIP/PVC	Series H-615	DIP/PVC	Series H-615	DIP/PVC
			Series H-619	A/C Pipe	Series H-619	A/C Pipe	Series H-619	A/C Pipe
Smith Blair	Style 623	FBE	Style 623	FBE	Style 623	FBE		
Tapping Valves: 12" and smaller	Tapping Valves: 12" and smaller - Tapping Valves shall be furnished with an alignment lip and installed in the vertical position for Water and Reclaim Water. Wastewater shall be installed horizontally and abandoned in the open position. Tapping valves shall be resilient seated only and meet the requirements of AWWA C509 or C515							
	American Flow Control	Series 2500	Alignment Lip	Series 2500	Alignment Lip	Series 2500	Alignment Lip	
	Clow	Series F-6114	Alignment Lip	Series F-6114	Alignment Lip	Series F-6114	Alignment Lip	
	Mueller	Series T2360 (4"-12")	Alignment Lip	Series T2360 (4"-12")	Alignment Lip	Series T2360 (4"-12")	Alignment Lip	

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LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Tapping Sleeves and Valves	Tapping Valves: 16" and Larger	Tapping Valves: 16" and Larger - Tapping valves shall be furnished with an alignment lip and be installed in the vertical position for Water and Reclaimed Water. No tapping valve shall be installed horizontally for Water and Reclaim Water unless approved by the engineer. Tapping Valves 16" and larger AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a spur gear actuator unless noted by the engineer. All tapping valves above 24" shall be furnished with NPT pipe plugs for flushing the tracks when valves are installed horizontally. Tapping valves for Wastewater shall be installed horizontally and abandoned in open position.						
		American Flow Control	Series 2500	Alignment Lip & flushing port	Series 2500	Alignment Lip & flushing port	Series 2500	Alignment Lip & flushing port
		Clow	Series F-6114	Alignment Lip & flushing port	Series F-6114	Alignment Lip & flushing port	Series F-6114	Alignment Lip & flushing port
		Mueller	Series T2361 (14"&up)	Alignment Lip & flushing port	Series T2361 (14"&up)	Alignment Lip & flushing port	Series T2361 (14"&up)	Alignment Lip & flushing port
Valves	Butterfly Valve 42" and Above	Butterfly Valves 42"and above. AWWA C504. Actuators input torques based on 150 psi valve pressure and 16 fps velocity with a maximum input of 80 ft-lb on 2" nuts and shall withstand 250 ft-lbs. Valve seats shall be leak-tight in both directions at 150 psi.						
		Clow	Style #1450		Style #1450		NA	NA
		Dezurik	BAW		BAW		NA	NA
		Mueller / Pratt	LINSEAL III / Groundhog		LINSEAL III / Groundhog		NA	NA
	Check Valves	Valves (Check) 4-inch and Larger (8 mil epoxy lined)						
		American Flow Control	NA		NA		Series 600 or 50 line	
		Clow / M&H / Kennedy	NA		NA		106	
	Gate Valves 4" - 12"	Gate Valves 12" and smaller - resilient seated only AWWA C509 or C515. Valve seat shall be leak-tight in both directions at 150 psi.						
		American Flow Control	Series 2500		Series 2500		NA	NA
		Clow	Series F-6100		Series F-6100		NA	NA
Mueller		Series A-2360		Series A-2360		NA	NA	
Gate Valves (Vertical) 16" and Up	Gate Valves 16" and larger (Vertical Installation) AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a gear actuator unless noted by the engineer. Valve seat shall be leak-tight in both directions at 150 psi.							
	American Flow Control	Series 2500		Series 2500		NA	NA	
	Clow	Series F-6100		Series F-6100				
	Mueller	Series A-2361		Series A-2361		NA	NA	

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LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater			
			Model #	Comments	Model #	Comments	Model #	Comments		
Valves	Plug Valves	Plug Valves - Bi-directional, MJ & Flanged (min. 8mil fusion bonded epoxy with stainless steel bolts), gear operator to be sized for rated pressure of the valve. Valves 4"-20" shall be 80% Full Port and valves 24" and greater shall be minimum of 70% full port. Valve shall be factory tested to minimum 100 PSI in both directions.								
		Clow	NA	NA	NA	NA	F-5412 FLG	4" & up		
			NA	NA	NA	NA	F-5413 MJ	4" & up		
		Dezurik	NA	NA	NA	NA	Series PEF or PEC	4" & up		
		Millikan / Pratt	NA	NA	NA	NA	Eccentric / Ballcentric	4" & up		
		Val-Matic	NA	NA	NA	NA	5600 or 5800 (FLG)	4" & up		
NA	NA		NA	NA	5700 or 5900 (MJ)	4" & up				
Valve Boxes	Valve Boxes with Locking Lids (Cast Iron)	Two piece standard screw type Heavy Duty Valve Boxes with Locking Lids (Cast Iron) and type of service cast in heavy duty traffic lid (H2O loading) ASTM A48								
		Bingham/Taylor	Series 4905	Box	NA	NA	Series 4905	Box		
			4905-X	Extension	NA	NA	4905-X	Extension		
			4904-L	Blue Water Locking Lid	NA	NA	4904-L	Green Sewer locking Lid		
		Sigma	Series VB 261X-267X	Box	VB-25031LK-VB-2612	Box	Series VB 261X-267X	Box		
			VB 6302	Extension	VB-6302	Extension	VB 6302	Extension		
			VB 4650W	Blue Water Locking Lid	VB2503LK	Purple Square Locking Lid	VB 4650S	Green Sewer locking Lid		
		Star	Series VB-0002	Box	NA	NA	Series VB-0002	Box		
			VBEX 12-24S	Extension	NA	NA	VBEX 12-24S	Extension		
			VBLIDLOCK	Blue Water Locking Lid	NA	NA	VBLIDLOCK	Green Sewer locking Lid		
		Tyler Union	Series 6850	Box	NA	NA	Series 6850	Box		
			58, 59, 60	Extension	NA	NA	58, 59, 60	Extension		
			Locking Lid	Blue Water Locking Lid	NA	NA	Locking Lid	Green Sewer locking Lid		
		Valve Box	Valve Box	For mains equal to, or greater than, 16" diameter or equal to greater than 6' feet deep						
				American Flow Control	# 2A - 9A Retrofit Valve Box Insert	Fit inside std valve boxes	NA		2A - 9A Retrofit Valve Box Insert	Green Sewer locking Lid
				Mueller Company	MVB050C thru MVB130C with Extension Stem	Blue Water Locking Lid	MVB050CR thru MVB130CR with Extension Stem	Purple Square Locking Reclaim Lid	MVB050C thru MVB130C with Extension Stem	Green Sewer locking Lid
				MVB875 Guide Plate		MVB875 Guide Plate		MVB875 Guide Plate		

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LIST OF APPROVED PRODUCTS - GRAVITY SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Coatings	Anti-Graffiti Paint	Block Walls-Anti-Graffiti Paint per Section 3119 Coatings & Linings						
		American Building Restoration Products	NA	NA	NA	NA	Polyshield Graffiti Preventer for Unpainted Masonry Type B	Super Bio Strip or Strip it all
		Tnemec / Chemprobe	NA	NA	NA	NA	626 DUR A PEL	680 Mark A Way
		Professional Products of Kansas, Inc	NA	NA	NA	NA	Professional Water Seal & Anti-Graffiti (PWS-15 Super Strength)	Professional Phase II Cleaner
	Coatings for Existing Manholes	Rehabilitation corrosion protection system per Section 3119 Coatings & Linings. Interior coating for force main connections to existing concrete manholes only. New precast structures and existing pump stations shall be lined.						
		CCI Spectrum, Inc	NA	NA	NA	NA	Spectrashield	min of 500 mils
		Kerneos Aluminate Technologies	NA	NA	NA	NA	Sewpercoat	1" (1000mil)
		Raven Lining System	NA	NA	NA	NA	Raven 155 Primer Raven 405	min 8 mils min 125 mils
		Sauereisen	NA	NA	NA	NA	210 Series Topcoat Glaze 210G	min 125 mils min 20 mils
		Tnemec	NA	NA	NA	NA	Series 434 Topcoat Glaze 435	min 125 mils 15-20 mils
PVC Pipe and fittings	Pipe SDR 35 Gravity Mains	PVC Pipe for Gravity SDR26/SDR 35 (Green in color) ASTM-D034. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.						
		Certainteed	NA	NA	NA	NA	Gravity Sewer Pipe	
		Diamond Plastics Corp	NA	NA	NA	NA	Sani-21 SDR-35	
		JM Eagle	NA	NA	NA	NA	Gravity Sewer	
		National Pipe & Plastics, Inc.	NA	NA	NA	NA	Ever-Green Sewer Pipe	
		North American Pipe Corp (NAPCO)	NA	NA	NA	NA	Gravity Sewer	
		Sanderson Pipe Corp	NA	NA	NA	NA	Gravity Sewer	
	Locate Balls	Locating Marker Systems - Wastewater Locator balls placed at all sanitary sewer cleanouts						
		3M	NA	NA	NA	NA	3M™ EMS 4" Extended Range 5' Ball Marker 1404-XR	
	Fittings SDR 35	Fittings, Adapters and Plugs - Gravity PVC ASTM-D3034, Min SDR26/ SDR 35						
		GPK Products, Inc.	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Harrington Corporation (HARCO)	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Multi Fittings Corp.	NA	NA	NA	NA	SDR26/SDR 35 Trench Tough Sewer Fittings	
JM Eagle		NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings		
Plastic Trends Inc		NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings		
TIGRE USA, Inc.		NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings		

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LIST OF APPROVED PRODUCTS - GRAVITY SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater		
			Model #	Comments	Model #	Comments	Model #	Comments	
PVC Pipe a	Flexible Pipe Connectors	Flexible Pipe Connectors and Transitions							
		Fernco	NA	NA	NA	NA	1002, 1051, 1056 Series		
		Indiana Seal	NA	NA	NA	NA	102, 151, 156 Series		
		Mission Rubber	NA	NA	NA	NA	MR02, MR51, MR 56 Series		
Precast Concrete Structures	MH Lids	Frame and Cover							
		USF Fabrication Inc.	NA	NA	NA	NA	USF 225-AS		
	Adj Ring	Top Adjusting Rings - HDPE with heavy duty loading (H-20)							
		Ladtech, Inc	NA	NA	NA	NA	24R, 24S with Rope Sealant CS2455		
	Hatches	Wet Well and Valve Vault Access Frames and Covers (Include the term "Confined Space" etched or cast into the cover with recessed lock & hasp. Frames and covers per manufacturers specifications.							
		Halliday Products	NA	NA	NA	NA	S1R or S2R Series		
		USF Fabrication Inc.	NA	NA	NA	NA	APS or APD Series		
	Precast Concrete Structures	Precast Manhole and Wetwell Structures ASTM C478. Precast concrete shall be batched with concrete dyed crystalline waterproofing admixture with corrosion protection. Concrete without admixture or without color tint /tracer shall be rejected.							
		Allied Precast	NA	NA	NA	NA		Dyed Admix	
		Atlantic Concrete Products, Inc.	NA	NA	NA	NA		Dyed Admix	
		Delzotto Products, Inc.	NA	NA	NA	NA		Dyed Admix	
		Dura Stress Underground Inc.	NA	NA	NA	NA		Dyed Admix	
		Hanson Pipe & Product	NA	NA	NA	NA		Dyed Admix	
		Mack Concrete	NA	NA	NA	NA		Dyed Admix	
		Oldcastle Precast	NA	NA	NA	NA		Dyed Admix	
	Standard Precast Inc.	NA	NA	NA	NA		Dyed Admix		
	Concrete Admix	Crystalline Waterproofing Concrete Admix with color dye shall be added to all concrete structures (precast and cast-in-place) to provide waterproofing and corrosion resistance. Concrete without admixture or without color tint / tracer shall be rejected. % concentration of admix with colored dye added to the mix shall be based on weight of cement.							
Kryton International		NA	NA	NA	NA	KIM K-301R (with red dye)	2%		
Xypex Chemical Corp		NA	NA	NA	NA	Xypex Admix C-1000Red (with red dye)	3.0 - 3.5%		
Liners	Interior Liner for New or existing Precast Manhole and Precast Wetwell Structures per Section 3119 Coatings & Linings								
	AFE	NA	NA	NA	NA	Fiberglass Liner			
	AGRU Liner	NA	NA	NA	NA	HDPE Liner (Min 2 mm for Manhole / Min 5 mm for Pump Station)			
	Containment Solutions Inc. (Flowtite)	NA	NA	NA	NA	Fiberglass Liner			
	GSE Studliner	NA	NA	NA	NA	HDPE Liner (Min 2 mm for Manhole / Min 5 mm for Pump Station)			
	GU Liner	NA	NA	NA	NA	Reinforced Plastic Liner			
		L & F Manufacturing	NA	NA	NA	NA	Fiberglass Liner		

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LIST OF APPROVED PRODUCTS - GRAVITY SYSTEMS

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Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater		
			Model #	Comments	Model #	Comments	Model #	Comments	
Precast Concrete Structures	Heat Shrink Seal	Heat Shrink Seal - Precast structures shall be primed with manufacturer approved primer prior to application of heat shrunk encapsulation.							
		Canusa-CPS	NA	NA	NA	NA	Wrapid Seal with WrapidSeal Primer (Canusa G Primer)		
		Pipeline Seal & Insulator, Inc (PSI)	NA	NA	NA	NA	Riser Wrap with Polyken 1027 or 1039 primer		
	Joining Material	Joining Material Min. 2" width for all products to ensure squeeze out with manufacturer approved primer.							
		Henry Company	NA	NA	NA	NA	Ram-Nek	with Primer	
		Martin Asphalt Company	NA	NA	NA	NA	Evergrip 990	with Primer	
		Trelleborg Pipe Seals	NA	NA	NA	NA	NPC – Bidco C-56	with Primer	
	Pipe Seals Gravity	Resilient Connector Pipe Seals, Manhole - Gravity less than 12-inch and less than 15-ft deep							
		Atlantic Concrete	NA	NA	NA	NA	A-Lok (cast-in-place)		
		Hail Mary Rubber	NA	NA	NA	NA	Star Seal (cast-in-place)		
		IPS	NA	NA	NA	NA	Wedge Style		
		NPC	NA	NA	NA	NA	Kor-N-Seal Model WS		
		Press seal gasket	NA	NA	NA	NA	PSX Direct Drive		
	Pipe Seals Gravity	Cast in Place Pipe Seals, Manhole - Gravity Greater Than or Equal to 12-inch and all pipe sizes greater than 15-ft deep							
		Atlantic Concrete	NA	NA	NA	NA	A-Lok	cast in place	
		Hail Mary Rubber	NA	NA	NA	NA	Star Seal	cast in place	
	FM Pipe Seals	Modular Pipe Seals for Wet Well and Valve Box penetrations and all forcemain connections to existing and new precast concrete structures. EPDM Rubber with 316 SS Hardware							
		CCI Pipeline Systems	NA	NA	NA	NA	Wrap-It Link WL-SS Series		
		Pipeline Seal & Insulator, Inc / Link Seal	NA	NA	NA	NA	Link-Seal S-316 Modular Seal		
		Proco Products, Inc	NA	NA	NA	NA	PenSeal ES-PS Series		

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LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Generator	Gen	Generator Systems, Fixed Shall be UL 2200 Certified.						
		Caterpillar	NA	NA	NA	NA	CAT Diesel Generator Set	
		Cummins Power Generation	NA	NA	NA	NA	Diesel Generator Set	
	Fuel Tanks	Generator Fuel Tanks. Shall be UL2085 certified.						
		Convault	NA	NA	NA	NA	CVT-3SF or CVT-3FF	
		Phoenix	NA	NA	NA	NA	Envirovault	
	GR	Generator Receptacle (GR)						
		Cooper Crouse-Hinds	NA	NA	NA	NA	AR2042 (230V, 200A, 3P, 4W) With AJA1 Angle Adaptor	
		Cooper Crouse-Hinds	NA	NA	NA	NA	AR2042-S22 (460V, 200A, 3P, 4W) With AJA1 Angle Adaptor	
		Pyle National	NA	NA	NA	NA	JRE-4100 (230V, 100A, 3P, 4W)	
ATS	Generator Transfer Switch							
	Russelectric	NA	NA	NA	NA	RMTD Series with model 2000 controller	NEMA 12/3R 316SS Enclosure	
Odor Control Units	Biotrickling Filters	Biotrickling filters						
		BioAir	NA	NA	NA	NA		
		Biorem	NA	NA	NA	NA	Biosorbens BTF	
		Envirogen	NA	NA	NA	NA	BTF	
		Siemens	NA	NA	NA	NA	Zabocs BTF	
	Carbon Adsorption Units	Carbon Adsorption Units						
		Calgon	NA	NA	NA	NA		
		Pure Air Filtration	NA	NA	NA	NA		
		Siemens	NA	NA	NA	NA		
	Pressure Gauges	Pressure Gauges shall have Diaphragm Seals. Oil filled.						
Ashcroft		NA	NA	NA	NA	10 1008SL 02L 60#	Gauge Diaphragm Seal	
		25 200SS 02T XYTSE						
Terice		NA	NA	NA	NA	D83LFSS4002LA100 - Gauge		
						M51001SSSS - Diaphragm Seal		
Winter Gauges	NA	NA	NA	NA	D99100 Fill and Mount Charge			
Pumps	Submersible Pumps							
	ABS	NA	NA	NA	NA			
	Flygt	NA	NA	NA	NA	PFQ770 0-60 PSI D70950 top D70954 Bottom		

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LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Pumps	Floats	Float Regulator (FR) - Duplex and Triplex Pump Stations						
		Atlantic Scientific	NA	NA	NA	NA	Roto-Float	
	Radar	Radar - Pulse Burst Radar Transmitter. Input 24 VDC and Output 4-20 mA						
		Magnetrol	NA	NA	NA	NA	R82-520A-011	
Pump Station Main Ser	Main Srvce Disconnect	Main Service Disconnect Breaker						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
	Surge Protector Device	Surge Protector - UL 1449, 3rd Edition listed and labeled, minimum 10 year warranty, NEMA LS-1 and IEEE C62, 41/45 tested with NEMA 4X enclosure, internal fusing, voltage and phase to match service. Rated 80,000 amps per mode for Duplex & Triplex stations and 150,000 Amperes per mode for Master Stations. All devices shall be provided with a NEMA 4X Plastic enclosure which is approved in lieu of stainless steel.						
		Current Technology (Power & Systems)	NA	NA	NA	NA	XN-80, TG-150 or CurrentGuard 150 Plus Series	
		Joslyn AKA (Total Protection Solutions)	NA	NA	NA	NA	TSS-ST 160 Series, ST 300 Series or JSP-300 Series	
		Surge Suppressors, Inc	NA	NA	NA	NA	LSE Series or SHL Series	
Sub Panel	Sub Panel	Sub-Panel Enclosure - NEMA 12/3R Enclosure 316SS, white polyester Powder coated finish inside and out, With 3 Point Pad lockable Handle, and Door Stop						
		Hoffman	NA	NA	NA	NA		
		Schaefer	NA	NA	NA	NA		
		Universal enclosure systems	NA	NA	NA	NA		
Pump Station Control Panel	Control Panel	Control Panel Supplier						
		ECS	NA	NA	NA	NA		
		Sta-Con Inc	NA	NA	NA	NA		
	Enclosure	Enclosure - NEMA 12/3R Enclosure 316SS, white polyester Powder coated finish inside and out, With 3 Point Pad lockable Handle, and Door Stop						
		Hoffman	NA	NA	NA	NA		
		Schaefer	NA	NA	NA	NA		
		Universal enclosure systems	NA	NA	NA	NA		
	Mnts	Mounting Channel for Enclosures						
		Unistrut Stainless Steel	NA	NA	NA	NA	1" 5/8 x 1" 5/8 316 SS	
	Seal-off	Explosion-Proof Sealoff						
	Cooper Crouse-Hinds	NA	NA	NA	NA	EYSR - 2 Inch Min.		
FL	Flasher (FL)							
		MPE	NA	NA	NA	NA	025-120-105	
		SSAC	NA	NA	NA	NA	FS-126	

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LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Pump Station Control Panel		Alarm Light / With Base and Globe (AL)						
	AL	American Electric	NA	NA	NA	NA	F32552	
		Red Dot Globe	NA	NA	NA	NA	VGLR-01	
		Red Dot Base					VA-01	
		Alarm Horn (AH)						
	AH	Wheelock	NA	NA	NA	NA	3IT-115-R	
		Fuses (F)						
	Fuse	Bussmann	NA	NA	NA	NA	FNQ-R or KTK-R	
		Hand-Auto-Off Selector (HOA)						
	HOA	Square D	NA	NA	NA	NA	9001-SKS43B	
		Horn Silence Button (HSS)						
	HSS	Square D	NA	NA	NA	NA	9001-SKR1RH5	
		Mechanical Interlock						
	Inter-lock	Square D	NA	NA	NA	NA	S29354	
		Control Panel Main Circuit Breaker (MCB) With S29450 Circuit Breaker Auxiliary Switch						
	Breakers	Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Emergency Circuit Breaker (ECB) With S29450 Circuit Breaker Auxiliary Switch						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Motor Circuit Breaker (MB)						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Control Circuit Breaker/ GFCI Receptacle Breaker/ SCADA Breaker						
	Square D	NA	NA	NA	NA	QOU120		
	Motor Starter (MS)							
MS	Square D	NA	NA	NA	NA	Type S Class 8536		
	Overload Heater(OL)							
OL	Square D	NA	NA	NA	NA	Part number will vary with size needed		
	Overload Reset							
OR	Square D	NA	NA	NA	NA	9066-RA1		
	Control Circuit Transformer (XMFR)							
Transformer	Square D	NA	NA	NA	NA	9070TF75D23	120/24 Volt .075 KVA	
	Main Circuit Transformer (MCT)							
	Square D	NA	NA	NA	NA	9070T2000D1	480/120 2KVA	
	Supplemental Protector Breaker - 3 pole, 1-amp for Phase Monitor							
SPB	Square D	NA	NA	NA	NA	MG24532		

APPENDIX D

LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater		
			Model #	Comments	Model #	Comments	Model #	Comments	
Pump Station Control Panel	PM	Phase Monitor (PM)							
		MPE 240 V.	NA	NA	NA	NA	001-230-118-OVG5		
		MPE 480 V.	NA	NA	NA	NA	002-480-123-OVG5		
	Pump Alternator	Pump Automatic Alternator (PAA)							
		Diversified Duplex	NA	NA	NA	NA	ARA-120-ACA		
		Diversified Triplex	NA	NA	NA	NA	ARA-120-AME		
		MPE Duplex	NA	NA	NA	NA	008-120-13SP		
		MPE Triplex	NA	NA	NA	NA	009-120-23P		
	MPE Triplex Socket	NA	NA	NA	NA	SD-12-PC			
	Alt. Test Switch	Alt. Test Switch							
		Carling Technologies	NA	NA	NA	NA	6GG5E-78		
		Honeywell	NA	NA	NA	NA	2TL1-50		
	Relay	Relay							
		Potter Brumfield 24 Volt	NA	NA	NA	NA	KRPA-11AN-24		
		Potter Brumfield 120 Volt	NA	NA	NA	NA	KRPA-11AN-120		
		Square D 24 Volt	NA	NA	NA	NA	8501KP12P14V14		
	Square D 120Volt	NA	NA	NA	NA	8501KP12P14V20			
	Relay Base	Relay Base							
		IEDC 8 Pin Relay Base 600 Volt	NA	NA	NA	NA	SR2P-06		
	Duplex Receptacle / GFCI	Duplex Receptacle/GFCI (DR) Upgraded to 20 Amp							
		Hubbell	NA	NA	NA	NA	GFTR20BK		
		Pass & Seymour	NA	NA	NA	NA	2095TRBK		
	ETM	Elapse Time Meter (ETM)							
		Reddington	NA	NA	NA	NA	711-0160		
	Grounding	Grounding System							
		Marathon	NA	NA	NA	NA	Neutral Isolation Block 1421570		
		Panduit	NA	NA	NA	NA	Ground Lug LAM2A 1/0 - 014 -6Y		
		Square D	NA	NA	NA	NA	Ground Buss PK7GTA		
TS	Terminal Strip (TS)								
	Marathon	NA	NA	NA	NA	Series 200			
	Square D	NA	NA	NA	NA	9080GR6			
TS	Terminal Strip End Blocks and End Clamps								
	Square D	NA	NA	NA	NA	9080GM6B & 9080GH10			

APPENDIX D

LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Pump Station Control Pane	PL	Pilot Light (PL) 24 Volt with 1819 Bulb						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelight 930507X	
	RL	Run Indicator Light (RL) 120 Volt						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelites 930507X With 120MB Bulb	
	MT	Moisture and Temperature Failure Light (MT) 120 Volt with 120MB Bulb						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelites 930507X	
Sluice Gate	Sluice Gate for Wet Well with Motorized Operator							
	BNW	NA	NA	NA	NA	Model 77 - 316 SS		
	Fontaine	NA	NA	NA	NA	Model 20 - 316 SS		
VFD	Variable Frequency Drives							
	Square D	NA	NA	NA	NA			

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