

PROJECT MANUAL
R/R Gravity Replacement Package 4
SA3054, SA3070, SA3077, SA3368 and PS F3033



ORANGE COUNTY UTILITIES DEPARTMENT
9150 CURRY FORD ROAD
ORLANDO, FLORIDA 32825

October, 2019
Bid Set

Prepared By:



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Engineer's Project No. 078292

Orange County Utilities

R/R GRAVITY REPLACEMENT PACKAGE 4 TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

DIVISION 1 - GENERAL REQUIREMENTS

01001	General Work Requirements <i>rev February, 2015</i>
01010	Summary of Work <i>rev May, 2019</i>
01021	Soils Report and Other Information
01025	Measurement and Payment <i>rev October, 2019</i>
01027	Applications for Payment <i>rev March, 2015</i>
01050	Surveying and Field Engineering <i>rev January, 2016</i>
01065	Permits and Fees <i>rev November, 2012</i>
01070	Abbreviations and Symbols
01091	Reference Specifications
01200	Project Meetings <i>rev January, 2016</i>
01300	Submittals
01301	Product Substitutions
01310	Progress Schedules <i>rev May, 2013</i>
01370	Schedule of Values <i>rev December, 2014</i>
01380	Audio-Visual Documentation
01400	Quality Control
01410	Testing and Testing Laboratory Services <i>rev December, 2014</i>
01516	Collection System Bypass <i>rev November, 2012</i>
01560	Erosion and Sedimentation Control <i>rev November, 2012</i>
01570	Maintenance of Traffic <i>rev March, 2015</i>
01580	Project Identification and Signs <i>rev Apr 2019</i>
01610	Delivery, Storage, and Handling
01650	Pump Station Start-up and Testing <i>rev November, 2012</i>
01700	Project Closeout
01720	Project Record Documents <i>rev January, 2016</i>
01740	Warranties and Bonds

DIVISION 2 - SITE WORK

02050	Demolition of Existing Structures
02080	Abandonment, Removal and Salvage or Disposal of Existing Pipe
02100	Temporary Erosion and Sedimentation Control
02140	Dewatering
02215	Finish Grading
02220	Excavating, Backfilling and Compacting
02360	Sheet Steel Piling

Roadwork

02570	Stabilized Subgrade
02572	Soil Cement Base
02573	Asphalt Pavement Removal and Replacement
02576	Concrete Sidewalks and Driveways
02577	Stormwater System
02578	Solid Sodding

Pressure/Gravity Pipe

02667	Jacking and Boring Pipe
-------	-------------------------

Wastewater Gravity System Inspection

02761	Cleaning Sanitary Sewer Systems <i>rev May, 2013</i>
02762	Televising Sanitary Sewer Systems <i>rev May, 2013</i>
02763	Televising Sanitary Sewer Laterals

Wastewater Gravity System

02771	Cure-In-Place Pipe for Sanitary Sewer Renewal <i>rev February, 2015</i>
02773	Service Lateral Clean-Outs for Televising Access
02774	Wastewater Gravity Collection System <i>rev June, 2013</i>
02775	Wastewater Manhole Rehabilitation <i>rev February, 2015</i>

Pump Station

02784	Chain Link Fences and Gates
-------	-----------------------------

DIVISION 3 - CONCRETE

03100	Concrete Formwork
03200	Concrete Reinforcement
03300	Cast-in-Place Concrete
03410	Precast Concrete Structures
03600	Grouting

DIVISION 4 - MASONRY

04050	Masonry
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DIVISION 5 – METALS - NOT USED

DIVISION 6 - WOOD, PLASTICS, AND COMPOSITES - NOT USED

DIVISION 7 - THERMAL AND MOISTURE PROTECTION - NOT USED

DIVISION 8 - OPENINGS - NOT USED

DIVISION 9 - FINISHES

- 09865 Surface Preparation and Shop Prime Painting
- 09901 Coatings and Linings *rev January, 2016*
- 09910 Prefabricated Fiberglass Liners

DIVISION 10 - SPECIALTIES - NOT USED

DIVISION 11 – EQUIPMENT- NOT USED

DIVISION 12 - FURNISHINGS - NOT USED

DIVISION 13 - SPECIAL CONSTRUCTION

- 13430 Pump Station Control Panels *rev September 2013*
- 13431 Pump Station SCADA Panels *rev April 1019*

DIVISION 14 - CONVEYING EQUIPMENT - NOT USED

DIVISION 15 - MECHANICAL

- 15064 Polyvinyl Chloride (PVC) Pipe and Fittings *rev August 2014*

DIVISION 16 – ELECTRICAL

- 16010 Electrical General Provisions
- 16110 Raceways
- 16120 Wires and Cables
- 16135 Electrical Boxes and Fittings
- 16142 Electrical Connections for Equipment
- 16143 Wiring Devices
- 16170 Circuit and Motor Disconnects
- 16180 Over Current Protective Devices
- 16190 Supporting Devices
- 16195 Electrical Identification
- 16450 Grounding

- 17166 Field Testing (R&R, 03292019 Edit) *rev April 2019*

APPENDIX

- APPENDIX A GEOTECHNICAL ENGINEERING REPORT (title sheet) *rev January, 2016*
Appendix A Geotechnical Report (geotechnical investigation)
- APPENDIX B FORMS (title sheet) *rev January, 2016*
Appendix B Pump Station Start-Up *rev January, 2016*
Appendix B Right of Entry Form for work on private property *rev January, 2016*
- APPENDIX C PERMITS OBTAINED BY COUNTY (title sheet) *rev January, 2016*
- APPENDIX D LIST OF APPROVED PRODUCTS (title sheet) *rev January, 2016*
Appendix D Orange County Utilities - List of Approved Products (*February 11, 2011*)

SECTION 01001
GENERAL WORK REQUIREMENTS

PART 1 - GENERAL 2

1.01 NOTICE AND SERVICE 2

1.02 WORK TO BE DONE 2

1.03 DRAWINGS AND PROJECT MANUAL..... 2

1.04 PROTECTION AND RESTORATION..... 3

1.05 PUBLIC NUISANCE..... 4

1.06 CONTRACTOR’S PAYMENTS TO COUNTY FOR OVERTIME WORK 4

1.07 MAINTENANCE OF SERVICE 5

1.08 TRANSFER OF SERVICE 5

1.09 LABOR..... 5

1.10 MATERIALS AND EQUIPMENT..... 6

1.11 MANUFACTURER'S SERVICE 6

1.12 INSPECTION AND TESTING..... 7

1.13 PROJECT SITE AND ACCESS 9

1.14 UTILITIES 10

1.15 RELATED CONSTRUCTION REQUIREMENTS 13

1.16 CONSTRUCTION NOT PERMITTED..... 16

PART 2 - PRODUCTS (NOT USED) 16

PART 3 - EXECUTION (NOT USED) 16

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.

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. 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 cut-ins 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.

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

- A. This Contract is for R&R Gravity Replacement Package 4 which include the replacement and /or rehabilitation of miscellaneous segments of gravity sanitary sewer, sewer laterals and manholes located in the following subdivisions:
1. SA3054 (East Orlando)
 2. SA3070 (Azalea Park)
 3. SA3077 (Lynnwood Estates)
 4. SA3368 (Park Manor Estates)
 5. F3033 (Cypress Bend Pump Station) and PS3759
- B. The Work shall consist of furnishing all labor, equipment, and materials for the construction of the facilities consisting of, but not limited to the improvements to the wastewater systems associated with the following:
1. SA3054 (East Orlando)
 - 93 linear feet of 8-inch gravity sanitary sewer
 - 208 linear feet 8" CIPP lining of existing gravity sanitary sewer
 - 2 - 4-foot Sanitary Sewer Manholes (10'-12' deep)
 - 3 laterals with cleanouts
 2. SA3070 (Azalea Park)
 - 373 linear feet of 8-inch gravity sanitary sewer
 - 140 linear feet of 10-inch gravity sanitary sewer
 - 183 linear feet of 12-inch gravity sanitary sewer
 - 50 linear feet Bore & Jack 12" carrier pipe & 24" steel casing
 - 7 - 4-foot Sanitary Sewer Manholes (8'-14' deep)
 - 9 laterals with cleanouts
 3. SA3077 (Lynnwood Estates)
 - 893 linear feet of 8-inch gravity sanitary sewer
 - 5 - 4-foot Sanitary Sewer Manholes (4'-8' deep)
 - 15 laterals with cleanouts
 4. SA3368 (Park Manor Estates)
 - 1205 linear feet of 8-inch gravity sanitary sewer
 - 6 - 4-foot Sanitary Sewer Manholes (8'-10' deep)
 - 16 laterals with cleanouts

Construction will include open-cut of roadways, asphalt restoration, sidewalk and driveway removal and replacement and restoration to all disturbed areas.

5. F3033 (Cypress Bend Pump Station) and PS3759

This work will also include the following Pump Station work:

- The demolition of Pump Station F3033 (Cypress Cove) will include removal of all equipment, piping and structures, the conversion of the wet well into a manhole and construction of 42 linear feet of 8” gravity main for the diversion of flow to Pump Station PS3759.
- Rehabilitation to Pump Station PS3759 will include the removal and replacement/relocation of SCADA equipment, Control panel and water service to make way for the construction of the connecting gravity sanitary sewer.

C. All work water and wastewater improvements shall be done in accordance with Orange County Utilities Standards and Construction Specifications Manual, latest edition and as specified in the Project Manual for a complete and acceptable project.

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.

1.03 SEQUENCE OF WORK

A. 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.

B. The Contractor shall submit a schedule and work sequence to the Owner at least five (5) days prior to the Notice to Proceed. Work on all utility lines shall be accomplished so that all facilities will stay in operation.

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 SUBSURFACE CONDITIONS AND OTHER PHYSICAL CONDITIONS

- A. This Section identifies reports of explorations and tests of subsurface conditions, and drawings of physical conditions of existing surface and subsurface structures that have been used in the preparation of the Contract Documents. Contractor may rely upon any technical information and data in those reports found in Appendix A, "Geotechnical Report (includes geotechnical investigation and dewatering ground water quality values per Chapter 62-621, paragraph 62-621.300(2), F.A.C.)." The Report(s) in Appendix A is designated as Authorized Technical Data, but those reports and drawings are not part of the Contract Documents.
- B. Any conclusions or interpretations made by the Contractor based on any Authorized Technical Data will be at the Contractor's own risk. Contractor's reliance on any non-technical information, data, interpretations or opinions also will also be at Contractor's own risk. The County/Professional assume no responsibility for any understanding reached or representation made about subsurface conditions and physical conditions of existing structures, except as otherwise expressly shown in or represented by the Authorized Technical Data provided.

- C. The only information or data contained in the geotechnical report and used in the preparation of the Contract Documents that may be properly considered authorized technical data concerning subsurface conditions is found in Appendix A "Geotechnical Report". Such technical data are made available to allow the Contractor to have access to the same information available to the County. The County/Professional do not warrant the accuracy or completeness of any such information or that the Contract Documents identify all the existing relevant reports and/or documents.

1.04 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.

END OF SECTION

SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. This Section specifies administrative and procedural requirements to define pay items and determine payable amounts, and includes but is not limited to:
 - 1. General Provisions
 - 2. Work Not Paid for Separately
 - 3. Measurement for Payment
 - 4. Partial Payment for Stored Materials and Equipment

1.02 GENERAL PROVISIONS

- A. This specification includes standard descriptions for all bid items. This Contract's specific bid items are listed in the Bid Schedule.
- B. The total Contract Amount shall cover the Work required by the Contract Documents. All costs in connection with the successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction, equipment, and tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the unit and lump sum prices bid. All Work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid.
- C. If used, all estimated quantities stipulated in the Bid Schedule or other Contract Documents are approximate and are to be used only (a) for the purpose of comparing the bids submitted for the Work, and (b) as a basis for determining an initial Contract Amount. The actual amounts of Work completed, and materials furnished under unit price items may differ from the estimated quantities. The County does not expressly or by implication represent that the actual quantities involved will correspond exactly to the quantities stated in the Bid Schedule; nor shall the Contractor plead misunderstanding or deception because of such estimate or quantities or of the character, location or other conditions pertaining to the Work. Payment to the Contractor will be made only for the actual quantities of work performed or material furnished in accordance with the Drawings and other Contract Documents, and it is understood that the quantities may be increased or decreased as provided in the General Conditions.

- D. If used, the unit prices listed in the Bid Schedule shall include all services, obligations, responsibilities, labor, materials, devices, equipment, royalties and license fees, supervision, temporary facilities, construction equipment, bonds, insurance, taxes, clean up, traffic control, control surveys, field offices, close out, overhead and profit and all connections, appurtenances and any other incidental items of any kind or nature, as are necessary to complete the Work in accordance with the Contract Documents.
- E. Except for mobilization/demobilization and project record documents, payment for Work will be based on the percent of completed work of each item in the Schedule of Values, including stored materials, as determined by the County. Progress of work in each item of the Schedule of Values will be determined separately by the County. However, the County will issue a single payment certificate for progress on the Contract.
- F. The Contractor agrees that it will make no claim for damages, anticipated profits, or otherwise because of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts therefore.
- G. Where payment by scale weight is specified under certain items, the Contractor shall provide suitable weighing equipment which shall be kept in accurate adjustment at all times and certified. The weighing of all material shall be performed by the Contractor in the presence and under the supervision of the County.
- H. All schedules included in the Contract Documents are given for convenience 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 work to be done under this Contract.
- I. Where pipe 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.
- J. All contracts shall be subject to 10% minimum retainage as defined in the General Conditions and the Agreement

1.03 WORK NOT PAID FOR SEPARATELY

- A. Delivery: Payment for equipment delivery, storage or freight shall be included in the pay items including their installation and no other separate payment will be made therefore.
- B. Bonds: Payment for bonds required by the Contract shall be included in the pay items for the Work covered by the required bonds and no separate payment will be made.
- C. Preparation of Site: Payment for preparation of site shall be included in pay items proposed for the various items of Work and no separate payment will be made therefore. Preparation of site includes setting up construction plant, offices, shops, storage areas, sanitary and other facilities required by the specifications or state law or regulations; providing access to the site; obtaining necessary permits and licenses; payments of fees;

general protection, temporary heat and utilities including electrical power; providing shop and working drawings, certificates and schedules; providing required insurance; preconstruction photographs and videos; clearing and grubbing; removal of existing pavements, sidewalks and curbs; trench excavation, sheeting, shoring and bracing; dewatering and disposal of surplus water; structural fill, backfill, compaction and grading; testing materials and apparatus; maintenance of drainage systems; appurtenant work; record drawing and close-out documentation; cleaning up; and all other work regardless of its nature which may not be specifically referred to in a Bid Item but is necessary for the complete construction of the project set forth by the Contract.

D. Permitting & Permit Fees:

1. Payment for Orange County permits (Section 01065) shall be based on 0.2% fixed percentage of the total base bid amount.

E. The Contractor shall be liable for all County personnel labor and equipment costs, penalties and fines resulting from sanitary sewer overflows. Such occurrences may be considered violations of Florida Statutes or administrative rules and may result in liability for damages and restoration, and the judicial imposition of civil penalties, pursuant to Sections 403.121 and 403.161 Fla Stat.

1. For a domestic or industrial wastewater violation not involving a surface water or groundwater quality violation, OCU shall assess a penalty of \$2,000 for an unpermitted or unauthorized discharge.
2. For an unpermitted or unauthorized discharge that resulted in a surface water or groundwater quality violation, OCU shall assess a penalty of \$5,000 per occurrence
3. In addition, for any unpermitted or unauthorized discharge, the Contractor shall also be liable in the amount of \$1.00 per gallon of sanitary sewer overflow to OCU.

F. The County reserves the right to delete any item included in the Schedule of Values and decrease the Contract Price by the scheduled amount for the item deleted.

1.04 MEASUREMENT FOR PAYMENT

A. Methods of Measurement - Generally:

1. Units of measurement shall be defined in general terms as follows:

- a. Linear Feet (LF)
- b. Square Feet (SF)
- c. Square Yards (SY)
- d. Cubic Yards (CY)
- e. Each (EA)
- f. Sacks (SK)
- g. Lump Sum (LS)

2. Unit Price Contracts/Items:

- a. Linear Feet (LF) shall be measured along the horizontal length of the centerline of the installed material, unless otherwise specified. Pipe shall be measured along the length of the completed pipeline, regardless of the type of joint required,

without deduction for the length of valves or fittings. Pipe included within the limits of lump sum items will not be measured.

- b. Square Feet (SF), Square Yards (SY), Cubic Yards (CY), Each (EA) and Sacks (SK) shall be measured as the amount of the unit of measure installed and compacted within the limits specified and shown in the Specifications and Drawings. Slope angles and elevations shall be measured using land-surveying equipment. Contractor shall provide supporting documentation (i.e. drawings, delivery tickets, invoices, survey calculations, etc.) to verify actual installed quantities.
- B. Lump Sum Contracts/Items - Generally:
1. Quantities provided in the Schedule of Values are for the purpose of estimating the completion status for progress payments. Payment will be made for each individual item on a percentage of completion basis as estimated by the Contractor and approved by the County.
 2. Adjustments to costs provided in the accepted Schedule of Values may be made only by Change Order.
 3. The County reserves the right to delete any item included in the Schedule of Values and decrease the Contract Price by the scheduled amount for the item deleted.

1.05 MEASUREMENT AND PAYMENT ITEMS

- A. ***Only those bid items included in the Bid Schedule are applicable for this Contract.*** The County has standardized the measurement and payment items. Currently, there are approximately 100 measurement and payment items describing approximately 300 bid items. The bid item numbering system comprises five sections that are divided into 23 subsections. The sections and subsections are listed below.

10. General Requirements

10.1 General

11. Site Work

11.1 Miscellaneous

11.2 Road Work

11.3 Install/Replace Fence or Wall

11.4 Bypass Pumping

11.5 Abandon or Remove Pipe/Structure

12. Pressure Pipes

12.1 Pressure Pipe and Fittings and Restrained Joints

12.2 Valves

12.3 Tapping Sleeve and Valve Assembly

12.4 Cut-in Connections to Existing Main

12.5 Piping Appurtenances

12.6 Directional Drill

12.7 Pipe Bursting

- 13. Wastewater Collection System
 - 13.1 Cleaning Sanitary Sewers
 - 13.2 CCTV Sanitary Sewers
 - 13.3 Install/Replace Sanitary Sewer
 - 13.4 Install/Replace Sanitary Manholes
 - 13.5 Sanitary Manhole Rehabilitation
 - 13.6 Sanitary Service Laterals and Cleanouts
 - 13.7 Cured-in-Place Pipe (CIPP) Liner
 - 13.8 Sanitary Sewer Pipe Bursting
- 14. Pump Stations
 - 14.1 Wastewater Duplex Pump Station
 - 14.2 Wastewater Triplex Pump Station

All of the subsections have bid item measurement and payment descriptions. Several bid items in the Project Bid Schedule may be described with the same bid item measurement and payment description in Table A, "Measurement and Payment Items". The bid items in the Project Bid Schedule are related to the Section 01025 measurement and payment items as follows:

1. All of the bid items in the Project Bid Schedule have 8 numerical digits.
2. Table A, "Measurement and Payment Items" for each of the bid items there are five numerical digits followed by ".xxx".
3. The first 5 numerical digits of the bid item in the Project Bid Schedule designate the measurement and payment item found in Table A, "Measurement and Payment Items."

Table A

Item #	Orange County Utilities MEASUREMENT AND PAYMENT ITEMS Pg 1
10 GENERAL REQUIREMENTS	
10.1 - General	
1	<p>Bid Item 10.110.110 Mobilization, Demobilization, Bonds, and Permits (not to exceed 5% of the total of all bid items except bid items under section 10.1 General)</p> <p>a. Measurement: Measurement of various items for Mobilization and Demobilization shall not be made for payment and all items shall be included in the lump sum price. <u>This lump sum price shall not exceed 5% of the total of all bid items except bid items under section 10.1 General.</u></p> <p>b. Payment: Payment of 75 percent of the applicable lump sum price for the item shall be full compensation for the Work consisting of the preparatory Work and operations in mobilizing for beginning Work on the Contract, including, but not limited to, movement of those personnel, equipment, supplies and incidentals to the project site, preparation of submittals, and for the establishment of temporary offices and buildings, safety equipment and first aid supplies, project signs, field surveys, sanitary and other facilities required by these specifications, and State and local laws and regulations. The costs of General Requirements (Section 01001), bonds, permits, and any required insurance, project signs, and any other preconstruction expense necessary for the start of the work, excluding the cost of construction materials, shall also be included. This Work also consist of the general project management of the Work including, but not limited to, field supervision and office management, as well as other incidental cost for management of the Work during the duration of the Contract. This Work also includes maintenance of the field offices for the duration of the Contract.</p> <p>Payment of the remaining 25 percent of the applicable lump sum price for this item also consists of demobilization or the operations normally involved in ending Work on the project including, but not limited to, termination and removal of temporary utility service and field offices; demolition and removal of temporary structures and facilities; restoration of Contractor storage areas; disposal of trash and rubbish, and any other post-construction work necessary for the proper conclusion of the Work.</p>
2	<p>Bid Item 10.120.110 Preconstruction Audio-Video Documentation</p> <p>a. Measurement: Measurement shall be based on the satisfactory submittal of a comprehensive pre-construction video in accordance with the County requirements and specifications (Section 01101).</p> <p>b. Payment: Payment of the applicable Contract lump sum price as stated in the proposal will be full compensation for furnishing all labor, materials, and equipment necessary to create a comprehensive pre-construction video in accordance with the County requirements and specification.</p>
3	<p>Bid Item 10.130.110 Indemnification</p> <p>a. Payment: In consideration of the Contractor's Indemnity Agreement as set out in the Contract Documents, the County specifically agrees to give the Contractor a maximum of \$100.00 and other good and valuable consideration, receipt of which is acknowledged upon signing of the Agreement.</p>

Item #	Orange County Utilities MEASUREMENT AND PAYMENT ITEMS Pg 2
4	<p>Bid Item 10.140.110 Project Record Documents (a minimum of 1% of the total of all bid items except bid items under section 10.1 General)</p> <p>a. Measurement: Measurement for this item shall be based on satisfactory progress of the Contractor to provide Project Record Documents in accordance with the County requirements and specifications (Section 01720). Various items for Project Record Documents shall not be made for individual payment and all items shall be included in the lump sum price. This lump sum price shall be a minimum of 1% of the total of all bid items except bid items under section 10.1 General).</p> <p>b. Payment: Payment of the applicable Contract lump sum price as stated in the proposal will be full compensation for furnishing all labor, materials, and equipment necessary to create the Project Record Drawings, including the certified as-built survey, in accordance with the County requirements and specifications. Payment will be made at the lump sum price divided into equal monthly payments based on the Contract Time and acceptance by County of the progressive as-builts drawings and tables.</p>
5	<p>Bid Item 10.150.110 Maintenance of Traffic</p> <p>a. Measurement: Measurement shall be based on satisfactory Maintenance of Traffic (MOT) in accordance with County requirements and Florida Department of Transportation (FDOT) standards.</p> <p>b. Payment: Payment of the applicable Contract lump sum price as stated in the proposal will be full compensation for furnishing all labor, materials, and equipment necessary to maintain public roadway and pedestrian traffic including flag men, uniformed police officers, barricades, warning lights/flashers, and safety ropes. Also included is furnishing, installing and maintaining a Traffic Control Plan, control and safety devices, control of dust, temporary crossing structures over trenches, any necessary detour facilities, and other special requirements for the safe and expeditious movements of traffic.</p>
6	<p>Bid Item 10.160.110 Public Information Officer</p> <p>a. Measurement: Measurement shall be based on satisfactory Public Information/Relations in accordance with County requirements</p> <p>b. Payment: Payment of the applicable Contract lump sum price as stated in the proposal will be full compensation for furnishing all labor, materials, and equipment necessary to provide and maintain communication with those individuals having a residence, business, or property adjacent to or within 1,000-feet of the construction area. Payment shall include the rental of venues, preparation of and conducting all meetings, and preparation of and disbursement of printed materials.</p>
7	<p>Bid Item 10.170.110 License Agreement/Notification to Homeowner</p> <p>a. Measurement: Shall be measured as lump sum to obtain notarized License Agreement from affected property owners and all items shall be included in the lump sum price. This item shall include furnishing all labor, materials, equipment and services necessary to obtain notarized Licensed Agreement from affected property owners prior to beginning any work on private property.</p> <p>b. Payment: Pay item to be apportioned to the total of the water/wastewater system improvements of the Work requiring the execution of License Agreement(s) and paid monthly based on the Work in the areas completed as part of the pay application that require the execution of License Agreement(s).</p>

Item #	Orange County Utilities MEASUREMENT AND PAYMENT ITEMS Pg 3
11 SITE WORK	
11.1 - Miscellaneous	
8	Bid Item 11.110.110 Erosion and Sediment Control
	a. Measurement: Measurement shall be based on satisfactory Erosion and Sediment Control in accordance with the County requirements and specifications (Section 01560).
	b. Payment: Payment of the applicable Contract lump sum price as stated in the proposal will be full compensation for furnishing all labor, materials, and equipment to control and prevent sediment transportation from the Work area to adjacent properties, including installation, maintenance, and removal of temporary erosion and sediment controls.
9	Bid Item 11.120.110 Unsuitable Materials
	a. Measurement: Unsuitable Material shall be measured in actual cubic yards removed and disposed of in accordance with the County requirements and specifications. Extra volume beyond the limits of construction will not be measured for payment. The Contractor shall provide survey calculations to verify actual removed quantities.
	b. Payment: Payment will be made at the contract unit price bid per cubic yard as stated in the proposal and shall include all labor, materials and equipment to remove and dispose of unsuitable material including the removal of overburden.
10	Bid Item 11.130.110 Fill Dirt
	a. Measurement: Fill Dirt shall be measured in actual cubic yards of suitable material placed and compacted in accordance with the County requirements and specifications. Extra volume beyond the limits of construction will not be measured for payment. The Contractor shall provide survey calculations to verify actual placed quantities.
	b. Payment: Payment will be made at the contract unit prices bid per cubic yard as stated in the proposal and shall include all labor, materials and equipment to replace and compact suitable material including the removal of overburden.
11.2 - Roadwork	
11	Bid item 11.220.110 Temporary paving (cold mix overlay) (various thickness)
	a. Measurement: Temporary Paving shall be measured in actual square yards of temporary paving furnished and installed in accordance with the Plans and Specifications.
	b. Payment: Payment will be made at the contract unit price bid per square yard as stated in the proposal for Temporary Paving and shall include all labor, materials, and equipment to apply the cold mix overlay in accordance with County requirements and specifications. The unit price bid shall also include traffic signalization repair, and temporary striping and markings.

Item #	Orange County Utilities MEASUREMENT AND PAYMENT ITEMS <small>Pg 4</small>
	11.2 - Road Work
12	Bid Item 11.230.110 Milling and Resurfacing a. Measurement: Milling and Resurfacing shall be measured in actual square yards over which the milling and subsequent resurfacing is completed and accepted at the thickness as indicated in the Drawings. b. Payment: Payment will be made at the contract unit price bid per square yard as stated in the proposal for Milling and Resurfacing and shall include all labor, materials, and equipment to mill surface; dispose of milled materials; and apply Type S-III asphalt surface overlay in accordance with County requirements and specifications. The unit price bid shall also include traffic signalization repair, and permanent striping and markings.
13	Bid Item 11.241.110 Asphalt Roadway Replacement (various thickness) a. Measurement: Asphalt Roadway Repair shall be measured in actual square yards of existing asphalt paving and subgrade removal and replacement furnished and installed in accordance with the County requirements and specifications. The width measured for payment of asphalt surface repair, as measured perpendicular to the centerline of the pipe, shall be limited to the width shown on the Drawings. The length shall be as measured along the centerline of the pipe. b. Payment: Payment will be made at the contract unit price bid per square yard as stated in the proposal for Asphalt Roadway Replacement and shall include all labor, materials, and equipment necessary to provide a safe, smooth driving surface. The Work shall include saw cutting; pavement removal and proper disposal of exiting pavement, installing prime coat, tack coat, and asphalt, compaction, traffic signalization repair, and temporary striping and markings in accordance with the County requirements and specifications. Payment will be made once and shall include both temporary and permanent Asphalt Roadway Replacement.
14, 15	Bid Item 11.250.110 & 111 Concrete Pavement Replacement (4" & 6" thickness) a. Measurement: Concrete Pavement Replacement shall be measured in actual square yards of concrete removed and replaced. Width of replaced sidewalk shall match that of existing sidewalk. Replaced portions of driveways shall conform to the lines and grades of removed portions of driveways. Thickness of pavement shall be as indicated in the plans and specifications. b. Payment: Payment will be made at the contract unit price bid per square yard as stated in the proposal for Concrete Pavement Replacement and shall include all labor, materials, and equipment for saw-cutting, removal and proper disposal of existing concrete, compaction, form work, concrete replacement, restoration, and clean-up for a complete installation.
16	Bid Item 11.260.112 Storm Pipe Replacement (12-18") a. Measurement: Culvert Storm Pipe Replacement shall be measured in actual linear feet satisfactorily removed and replaced, as measured along the length of the centerline of the completed pipeline. b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for Culvert Storm Pipe Replacement and shall include all labor, materials, and equipment to remove and replace the respective storm pipe including temporary stormwater management, protection of existing utilities and irrigation, dewatering, excavation, pipe replacement, connection to existing storm pipes utilizing collars wrapped in 6-feet of filter fabric, replacement of mitered end sections, backfill, compaction, grading, sod replacement, restoration and clean-up.

Item #	Orange County Utilities MEASUREMENT AND PAYMENT ITEMS <small>Pg 5</small>
17	<p>Bid Item 11.280.110 Concrete Curb and/or Curb and Gutter Replacement</p> <p>a. Measurement: Concrete Curb and/or Curb and Gutter Replacement shall be measured in actual linear feet removed and replaced measured along the centerline of the curb within the excavation of the trench to a maximum width equal to the width of asphalt pavement cut. All additional curb and gutter damaged shall be replaced by the Contractor at his own expense.</p> <p>b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for Concrete Curb and Gutter Replacement and shall include all labor, materials, and equipment for saw-cutting, removal and proper disposal of existing concrete curb and gutter, compaction, and concrete curb and gutter replacement for a complete installation.</p>
18	<p>Bid Item 11.290.111 Sod Replacement</p> <p>a. Measurement: Sod Replacement shall be measured in actual square yards of sod furnished, laid, fertilized, watered and maintained for all areas as specified on the Drawings.</p> <p>b. Payment: Payment will be made at the contract unit price bid per square yard as stated in the proposal for Sod Replacement and shall include all labor, materials, and equipment necessary to furnish, install, fertilize, water and maintain a healthy stand of grass including any soil amendments or conditioning required to bring the existing soil to within acceptable pH levels as recommended by the sod grower.</p>
11.3 - Install/Replace Fence or Wall	
19	<p>Bid Item 11.310.110 Chain Link Fence Install/Replacement (various heights)</p> <p>a. Measurement: Chain Link Fence Replacement shall be measured in actual linear feet removed and replaced as measured along the centerline of the fence within the construction excavation. All additional fencing damaged shall be replaced by the Contractor at his own expense.</p> <p>b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for Chain Link Fence Replacement and shall include all labor, materials, and equipment to remove and properly dispose of existing chain link fence and concrete and install new chain link fence including replacement fence, gate, support posts and concrete for a complete installation.</p>
20	<p>Bid Item 11.330.110 Concrete Block Retaining Wall Install/Replacement (various heights)</p> <p>a. Measurement: Concrete Block Wall Replacement shall be measured in actual linear feet removed and replaced as measured along the centerline of the wall within the construction excavation. Any additional wall damaged shall be replaced by the Contractor at his own expense.</p> <p>b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for Concrete Block Wall Replacement and shall include all labor, materials, and equipment to remove and properly dispose of existing concrete block and construct a new concrete block wall including replacement concrete block with concrete fill, poured concrete footer, rebar, compacted sub-base and backfill for a complete installation.</p>
11.4 - Bypass Pumping	
21	<p>Bid Item 11.410.110 Bypass Pumping Sanitary Sewer Mains (various sizes)</p> <p>a. Measurement: Measurement for this item shall be based on the complete bypass operation and contingency plan in accordance with the County requirements and specifications.</p> <p>b. Payment: Payment of the applicable Contract lump sum price shall be full compensation for furnishing all labor, materials, equipment as necessary for bypass operations and contingency plan as required, including pumps, piping, and hoses; tankers; temporary bypass and service piping; hauling and proper disposal of wastewater; plugging; gasoline/diesel fuel; protection of existing facilities, utilities, and property; traffic maintenance; signs and barriers; and all incidental work required to satisfactorily complete this item.</p>

Item #	Orange County Utilities MEASUREMENT AND PAYMENT ITEMS <small>Pg 6</small>
11.4 - Bypass Pumping	
22	Bid Item 11.420.110 Bypass Pump Station (various flows) a. Measurement: Measurement for this item shall be based on the complete bypass operation and contingency plan in accordance with the County requirements and specifications. b. Payment: Payment of the applicable Contract lump sum price shall be full compensation for furnishing all labor, materials, equipment as necessary for bypass operations and contingency plan as required, including pumps, piping, and hoses; tankers; temporary bypass and service piping; hauling and proper disposal of wastewater; plugging; gasoline/diesel fuel; protection of existing facilities, utilities, and property; traffic maintenance; signs and barriers; and all incidental work required to satisfactorily complete this item.
11.5 - Abandon or Remove Pipe/Structure	
23	Bid Item 11.510.110 Abandon-in-Place Pipe a. Measurement: Abandon-in-Place Pipe, regardless of size and material, shall be measured in actual linear feet satisfactorily abandoned-in-place in accordance with the County requirements and specifications (Section 02080). Pipe abandonment shall be measured along the centerline without deduction for valves and fittings. b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for Abandon-in-Place Pipe and shall include all labor, materials, and equipment to excavate, backfill and compact; sheet, shore, and brace; dewater; completely drain and properly dispose of pipe contents; grout fill, and plug or cap existing pipes of all services and sizes designated "to be abandoned" on the Drawings. Also included in this item is the removal of existing valve boxes located on valves connected to piping designated to be retired. Valve boxes shall be removed, backfilled and compacted with suitable material.
24	Bid Item 11.530. 110 Remove Existing Pipe a. Measurement: Remove Existing Pipe, regardless of size and material, shall be measured in actual linear feet satisfactorily excavated, removed, and salvaged in accordance with the County requirements and specifications (Section 02080). Pipe removal shall be measured along the centerline without deduction for valves and fittings. Also included in this item is the removal and salvage of items including air release valves and vaults, and fire hydrant assemblies. b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for Remove Existing Pipe and shall include all labor, materials, and equipment to sheet, shore, and brace; dewater; excavate; completely drain and properly dispose of pipe contents; plug or cap; restoration, sod, clean-up; remove and salvage pipe of all services and sizes designated "to be removed" on the Drawings, backfill and compact. Also included in this item is the removal and salvage of items (as listed in Specification Section 02080) attached to the piping to be removed.
25	Bid Item 11.540. 110 Remove Existing Manhole a. Measurement: Measurement for Remove Existing Manhole shall be made per actual number of manholes satisfactorily excavated and removed in accordance with the County requirements and specifications. b. Payment: Payment for Remove Existing Manhole shall be made based on the authorized quantity at the unit price indicated in the Bid. Payment of the applicable Contract unit prices shall be full compensation for furnishing all labor, materials, and equipment to sheet, shore, and brace, dewater, completely drain and properly dispose of manhole contents, remove manhole designated "to be removed" on the Drawings. Also included in this item is backfilling and compaction complete in place to finish grade of road or natural ground (including additional soil to replace volume of removed manhole)

Item #	<p style="text-align: center;">Orange County Utilities MEASUREMENT AND PAYMENT ITEMS Pg 8</p>
	13.3 - Install / Replace Sanitary Sewer Main
26-30	<p>Bid Item 13.310.110-114 Sanitary Sewer Main 8-inch Diameter (various depths)</p> <p>a. Measurement: The installation and/or replacement of Sanitary Sewer Main shall be measured in actual linear feet satisfactorily furnished and laid, as measured along the length of the centerline of the completed pipeline without deduction for the length of manholes. The depth shall be calculated from the invert to the top of the surface. Pipe included within the limits of lump sum pay items will not be measured for payment under this item.</p> <p>b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for Sanitary Sewer Main and shall include all labor, materials, and equipment to construct the respective pipeline including coordination with existing utilities, protection of existing utilities including service connections, tree protection, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, and grading, all testing; restoration and clean-up. This item also includes the removal and replacement of fences and gates, mailboxes, trees, shrubs, irrigation sprinklers, sod and other obstructions.</p>
31, 32	<p>Bid Item 13.320.112&114 Sanitary Sewer Main 10-inch Diameter (various depths)</p> <p>a. Measurement: The installation and/or replacement of Sanitary Sewer Main shall be measured in actual linear feet satisfactorily furnished and laid, as measured along the length of the centerline of the completed pipeline without deduction for the length of manholes. The depth shall be calculated from the invert to the top of the surface. Pipe included within the limits of lump sum pay items will not be measured for payment under this item.</p> <p>b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for Sanitary Sewer Main and shall include all labor, materials, and equipment to construct the respective pipeline including coordination with existing utilities, protection of existing utilities including service connections, tree protection, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, and grading, all testing; restoration and clean-up. This item also includes the removal and replacement of fences and gates, mailboxes, trees, shrubs, irrigation sprinklers, sod and other obstructions.</p>
33, 34	<p>Bid Item 13.330.113&113 Sanitary Sewer Main 12-inch Diameter (various depths)</p> <p>a. Measurement: The installation and/or replacement of Sanitary Sewer Main shall be measured in actual linear feet satisfactorily furnished and laid, as measured along the length of the centerline of the completed pipeline without deduction for the length of manholes. The depth shall be calculated from the invert to the top of the surface. Pipe included within the limits of lump sum pay items will not be measured for payment under this item.</p> <p>b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for Sanitary Sewer Main and shall include all labor, materials, and equipment to construct the respective pipeline including coordination with existing utilities, protection of existing utilities including service connections, tree protection, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, and grading, all testing; restoration and clean-up. This item also includes the removal and replacement of fences and gates, mailboxes, trees, shrubs, irrigation sprinklers, sod and other obstructions.</p>

Item #	Orange County Utilities MEASUREMENT AND PAYMENT ITEMS <small>Pg 9</small>
35	<p>Bid Item 13.350.110 Sanitary Sewer Main Connection to Existing Manhole/Wetwell</p> <p>a. Measurement: Measurement for Sewer Main Connection to Existing Manhole shall be made per actual number of core bores and connections to existing manholes/wetwell satisfactorily furnished and installed.</p> <p>b. Payment: Payment for Sewer Main Connection to Existing Manhole shall be made based on the authorized quantity at the unit price indicated in the Bid. Payment of the applicable Contract unit price shall be full compensation for furnishing all labor, materials and equipment necessary for a complete connection to an existing manhole/wetwell including protection of existing utilities, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, and grading, wall seal, core drilling, and bench adjustment.</p>
36	<p>Bid Item 13.330.200 Bore & Jack 12" Carrier Pipe With 24" Steel Casing including boring and receiving Pits (10'-12' depth)</p> <p>a. Measurement: The quantity for payment shall be the actual horizontal distance in liner feet of steel casing & carrier pipe furnished and installed, as measured along the length of the centerline of the completed pipeline along the ground, and without consideration for the vertical change in elevation of the pipeline.</p> <p>b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and constructing the pipeline's complete installation for jacking and boring the 20" steel casing pipe and 12" carrier pipe beneath the existing roadway and culvert to the lengths and depths as shown on the Drawings. Work shall also include clearing and grubbing, excavation, pits, furnishing and installing of the steel casing pipe, respective restrained joint carrier pipe (as shown on the Drawings), casing spacers, end seals, dewatering, sheeting, shoring and bracing, pipe materials and installation, locate wire, vent pipe, backfill, compaction, grading, filling, testing and disinfection (where applicable), sodding, restoration and cleanup to provide a complete and operable jack and bore pipeline crossing</p>
13.4 – Install/Replace Sanitary Manholes	
37-41	<p>Bid Item 13.410.110-114 Sanitary Manhole 4-foot Diameter (various depths)</p> <p>a. Measurement: Measurement for Sanitary Manhole shall be made per actual number of sanitary manholes of each type and depth satisfactorily furnished and installed. Depth shall be measured from the center of the invert to the top of the lid.</p> <p>b. Payment: Payment for Sanitary Manhole shall be made based on the authorized quantity at the unit price indicated in the Bid. Payment of the applicable Contract unit price shall be full compensation for furnishing all labor, materials and equipment necessary for a complete sanitary manhole installation including excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, and final grading, crushed rock base, connection of new or existing sanitary sewer, polyolefin sheeting for exterior joint sealing, adjustment of the manhole rim, interior and exterior surface coatings to provide a complete and operable sanitary manhole.</p>

Item #	<p style="text-align: center;">Orange County Utilities MEASUREMENT AND PAYMENT ITEMS Pg 10</p>
	13.5 - Sanitary Manhole Rehabilitation
42	<p>Bid Item 13.520.110 & 11 Clean, Seal and Coat Manhole/Structure (various diameters)</p> <p>a. Measurement: Seal and Recoat Manhole shall be measured in vertical feet of manhole sealed and recoated. Manhole seal and recoat shall be measured along the center vertical length of the manhole.</p> <p>b. Payment: Payment will be made at the contract unit price bid per vertical feet as stated in the proposal for Seal and Recoat Manhole and shall include, but is not necessarily limited to, all labor, equipment, services, supervision and materials for coating existing manholes as shown on the Contract Drawings. The work shall include all surface preparation, leak repair, crack repair, installation of the coating in accordance with the manufacturer's recommendations, and inspection of the finished coating system.</p>
43	<p>Bid Item 13.550.110 Re-Construct Manhole Benching</p> <p>a. Measurement: Measurement for Re-Construct Manhole Benching shall be made per actual number of manhole benching cleaned and re-constructed in accordance with the Drawings and specifications</p> <p>b. Payment: Payment for Re-Construct Manhole Benching shall be made based on the authorized quantity at the unit price indicated in the Bid. Payment of the applicable Contract unit price shall be full compensation for furnishing all labor, materials and equipment necessary for the cleaning and re-construction of manhole benching including cleaning and debris removal, placement and finishing of concrete, restoration and clean-up.</p>
44	<p>Bid Item 13.570.200 Replace Outside Drop Connection</p> <p>a. Measurement: Measurement for Replace Drop Connection shall be made per actual number of existing sub-standard manhole exterior drop connections that are replaced with Orange County Utilities approved outside drop connection.</p> <p>b. Payment: Payment for Replace Drop Connection with outside Drop Connection shall be made based on the authorized quantity at the unit price indicated in the Bid. Payment of the applicable Contract unit price shall be full compensation for furnishing all labor, materials and equipment necessary to remove the existing outside drop connection and install the new standard drop connection to the exterior of the manhole.</p>
45,46	<p>Bid Item 13.620.110&112 Install/Replace 6" Sanitary Sewer Lateral & cleanout (up to 40 LF and 4' to 8' depth @ main) (various depths)</p> <p>a. Measurement: Repair/Replace Sanitary Sewer Lateral shall be made per actual number of sanitary sewer laterals satisfactorily repaired or replaced, depending upon sewer lateral depth.</p> <p>b. Payment: Payment will be made based on the authorized quantity at the unit price indicated in the Bid Schedule and shall include all labor, materials, and equipment necessary to repair or replace the existing sanitary sewer lateral including gravity main connection and including installation of cleanout. Connection including excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, and grading, removal and disposal of existing service lateral, all incidentals to connect and reactivate sewer service connections, all pipe, wyes, bends and plugs necessary to provide a watertight service connection, leakage testing, protection of existing utilities, structures, and property, restoration and clean-up. This item also includes the removal and replacement of fences and gates, mailboxes, trees, shrubs, irrigation sprinklers, sod and other obstructions.</p>

Item #	Orange County Utilities MEASUREMENT AND PAYMENT ITEMS Pg 11
	13.6 - Sanitary Service Laterals and Cleanouts
47	Bid Item 13.640.110 Service Lateral Connection to Manhole a. Measurement: Measurement for Service Lateral Connection to Manhole shall be made per actual number of sanitary sewer lateral service connections made to manholes satisfactorily furnished and installed. b. Payment: Payment for Service Lateral Connection to Manhole shall be made based on the authorized quantity at the unit price indicated in the Bid. Payment of the applicable Contract unit price shall be full compensation for furnishing all labor, materials and equipment necessary for a complete connection to an existing manhole including excavation, sheeting, shoring and bracing, dewatering, backfill, compaction and grading, core drilling and wall seal, protection of existing utilities and property, restoration and clean-up. This item also includes the removal and replacement of fences and gates, mailboxes, trees, shrubs, irrigation sprinklers, sod and other obstructions.
48	13.7 - Cured-In-Place Pipe (CIPP) Liner Bid Item 13.710.110 Sanitary Sewer Main CIPP Liner (various diameters) a. Measurement: CIPP Liner shall be measured in actual linear feet of furnished and satisfactorily installed cured-in-place liner in the sanitary sewer main from center of manhole to center of manhole, regardless of depth, in accordance with the County requirements and specifications (Section 02771). CIPP liner installation shall be measured along the length of the centerline of the rehabilitated sanitary sewer. b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the Bid Schedule for CIPP Liner and shall include, but is not necessarily limited to, all labor, materials, and equipment necessary for a complete CIPP liner installation including pre and post CCTV inspection, sanitary sewer cleaning (medium cleaning), qualified personnel, providing and processing of liner material, service connection and manhole/wall interface sealing, all costs associated with providing cured CIPP samples for testing, blocking or plugging of incoming lines, grouting, leakage testing, reinstate service laterals, protection of existing utilities, structures, and property, restoration and clean-up.
	14.0 - Pump Stations
49	Bid Item 14.110.200 Duplex Pump Station Rehabilitation PS3759 a. Measurement: Measurement for this item shall be based on satisfactory rehabilitation of the existing Pump Station complete and ready for continuous operation. b. Payment: Payment of the applicable Contract lump sum price as stated in the proposal will be full compensation for furnishing all labor, materials, and equipment necessary to rehabilitate the existing pump station as indicated on the Drawings. Work includes but is not necessarily limited to the following: Pump Station improvements and modifications including fencing and gates, masonry walls and gates, rehabilitate and line the existing wetwell, replacement of the top slab, pumps, motors, control panel, cables, rails, valves, pressure piping and appurtenances, as shown on the Drawings. All demolition, removal and disposal of existing facilities as noted in the Drawings including tie-ins, intercepts, conflicts and abandonment of piping, conduits or electrical services. All coordination, materials and equipment, tools, and labor to relocate the existing SCADA control panel, SCADA pole, water service connection, or extend an existing water service connection. All coordination with the electric power company, materials, equipment, tools, labor and fees to install an electrical service connection. Installation of all site and adjacent improvements noted on drawings including driveways and driveway connections, fencing with curb and gate, asphalt and concrete paving, rock fill and sodding. All work required to construct, complete start-up testing and deliver a complete operational Pump Station without interruption of service.

Item #	Orange County Utilities MEASUREMENT AND PAYMENT ITEMS Pg 12
	14.0 - Pump Stations
50	Bid Item 14.120.200 Duplex Pump Station Demolition PS3033 a. Measurement: Measurement for this item shall be based on satisfactory demolition and restoration of the existing Pump Station Site. b. Payment: Payment of the applicable Contract lump sum price as stated in the proposal will be full compensation for furnishing all labor, materials, and equipment necessary to decommission the existing pump station as indicated on the Drawings. Work includes but is not necessarily limited to the following: Removal of all site equipment including sanitary pressure pipe, valves, valve vault, control panel, cables, electrical, SCADA equipment, water piping and valves. All demolition, removal and disposal of existing facilities as noted in the Drawings including tie-ins, intercepts, conflicts and abandonment of piping, conduits and electrical services, removal of concrete, rock, fencing and gates. Furnish all coordination and labor for the termination of services for removal of the existing SCADA system, water service connection and the electric power termination, including labor and fees to terminate all services and disconnection. Finishing restoration shall include all labor, materials, and equipment for installation of all site and adjacent improvements including fill, finish grading and sod. All work all work to be completed without interruption of service.
51	Bid Item 14.560.200 Wetwell to Manhole Conversion a. Measurement: Measurement for the wetwell to manhole conversion shall be made per actual number of structures converted, including, back filling, cleaning, sealing, lining, benching and re-constructed in accordance with the Drawings and specifications. b. Payment: Payment for structure conversion shall be made based on the authorized quantity at the Contract unit price and shall be full compensation for furnishing all labor, materials and equipment necessary to include all work as indicated on the Drawings. Work includes, but is not necessarily limited to, the following: Removal of top slab, hatch, pipes, pumps and all equipment interior to the wetwell., addition of flowable fill, filling/sealing of holes, cleaning, sealing of interior, installation of fiberglass liner, construction of manhole benching, installation of new top slab, ring and cover and finishing clean-up.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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 (one (1) paper copy and electronic copy)
 3. Table 01050-2 Asset Attribute Data Form Examples (one (1) paper copy and electronic copy)
 4. Table 01050-3 Pipe Deflection Table (one (1) paper copy and electronic copy)
 5. Table 01050-4 Gravity Main Table (one (1) paper copy and electronic copy)
 6. An electronic copy of all survey field notes
 7. Partial Release of Lien
 8. Partial Consent of Surety
 9. Site photographs
 10. Updated Progress Schedule: submit one (1) electronic copy and five (5) copies
 11. Summary of Values
 12. Pay Request
 13. On-Site Storage of materials
- 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

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

Asset Attribute Table Examples								
A	C	D	E	F	G	H	I	
ID Number	Plan Sheet #	Easting	Northing	Elevation	Manufacturer	Model #	Comments	
1								
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

Asset Attribute Table Examples															
A	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
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	518086.00	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 vls	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	Water Main	12	Brand A	Z100	200	Yes	3 to 1	Yes	Brand A
10															

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

Manhole Worksheet

Asset Attribute Table Examples															
A	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
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	474895.63	1501636.02	114.98			109.96	110.22		110.12		Del Zotto		
4	SAN-MH03	AT-2	474849.33	1501600.22	115.18				109.86				Del Zotto		
5	SAN-MH04	AT-2	474850.21	1501416.85	115.91	109.19			110.42				Del Zotto		
6	SS-1	C1.05A	478117.70	1501622.99	118.13								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							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							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															

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

Meter Worksheet

Asset Attribute Table Examples							
A	C	D	E	F	G	H	
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

Asset Attribute Table Examples								
A	C	D	E	F	G	H	I	
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

Cleanout Worksheet

Asset Attribute Table Examples					
A	C	D	E	F	G
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
4					Sanitary Service

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

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	1500585.05	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 Ø°	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 Ø.
 angle ABC = arccos((AB²+BC²-AC²)/(2*AB*BC))
 180-Ø/2 = angle ABC
 Calculate the total deflection Ø.
 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((Ø/2)*(PI/180))=(Chord/2)/R and length AC=Chord
 R=AC/(2*sin(Ø*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 of Award, 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 01070
ABBREVIATIONS AND SYMBOLS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Reference to the following standards of any technical society, organization or body shall be construed to mean the latest standard, code or specification or tentative specification adopted and published at the date of advertisement for bids, even though reference has been made to an earlier standard. Such reference is hereby made a part of the Contract the same as if herein repeated in full and in the event of any conflict between any of these specifications, standard codes or tentative specifications and the Contract Documents, the most stringent shall govern.

AA	Aluminum Association
AASHTO	American Association of State Highway and Transportation Officials
ABPA	Acoustical and Board Products Association
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	American Moving and Conditioning Association
ANSI	American National Standards Institute
API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ASA	American Standards Association (now ANSI)
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSCBC	American Standard Safety Code for Building Construction
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWBP	American Wood Preservers Board
AWS	American Welding Society
AWWA	American Water Works Association

CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard
DOT Spec	Standard Specification for Road and Bridge Construction –
FDOT	Florida Department of Transportation
FAC	Florida Administrative Code
FS	Federal Standard
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
NACE	National Association of Corrosion Engineers
NASSCO	National Association of Sewer Service Companies
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NEC	National Electrical Code
NECA	National Electrical Contractor's Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPT	National Pipe Threads
NSF	National Science Foundation
OSHA	U.S. Department of Labor, Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PS	United States Products Standards
SAE	Society of Automotive Engineers
SDI	Steel Decks Institute
SJI	Steel Joists Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Structural Steel Painting Council
UL	Underwriter's Laboratories, Inc.
USASI	United States of American Standards Institute (Now ANSI)

B. UNITS OF MEASUREMENT

CU FT	cubic feet
CU IN	cubic inch(es)
CY	cubic yard(s)
Deg C	degree(s) Centigrade
Deg F	degree(s) Fahrenheit
F	Fahrenheit
FT	feet, foot
G	gram(s)
GA	gage
GAL	gallon(s)
GPH	gallon(s) per hour
GPM	gallon(s) per minute

GPS	gallon(s) per second
HR	hour(s)
IN	inch(es)
IPS	iron pipe size
KG	kilogram(s)
L	liter(s)
LB	pound(s)
LBF-IN	pound (force) inch
LF	linear foot, linear feet
MIN. min.	minute(s), minimum
ml	milliliter
MO	month(s)
OZ	ounce(s)
QT	quart
RH	relative humidity
SF	square foot, square feet
SQ IN	square inch(es)
YD	yard(s)
YR	year(s)

C. TERMINOLOGY

@	at
AB	anchor bolt
ADJ	adjust, adjustable
ADMIN	administration
AFG	above finished grade
AGGR	aggregate
AL	aluminum
ALT	alternate
APPX	appendix
APX	approximate
ART	article
ASPH	asphalt
ASSY	assembly
AUTO	automatic
AUX	auxiliary
AVE	avenue
AVG	average
AWG	American Wire Gauge
BAR	barrier
BCCMP	bituminous coated corrugated metal pipe
BL	base line
BLDG	building
BLKG	blocking
BM	beam

C to C	center to center
CCB	concrete block, masonry
CEM	cement
CIP	cast iron pipe, cast in place
CJ	construction joint
CL	center line, clearance
CM	Construction Manager
CMP	corrugated metal pipe
CO	cleanout
CONC	concrete
CONN	connection
CONST	construction
CONT	continuous
CONTR	contractor
CU, COP	copper
ORR	corridor
CRIT	critical
CTD	coated
CTR	center
CULV	culvert
d	delta
DBL	double
DEM	demolition, demolish
DEPT	department
DET	detail
DIA, D	diameter
DIAG	diagonal
DIM	dimension
DWG	drawing
FEM	female
FUT	future
FV	field verify
FM	force main
FH, HYD	fire hydrant
ID	inside diameter
MAS	masonry
MATL	material
MAX	maximum
MFD	manufactured
MFG	manufacturing
MFR	manufacturer
MH	manhole, metal hallide
MIN	minimum
MISC	miscellaneous
MTL	material

NAT	natural
NATL	national
NOM	nominal
NTS	not to scale
OD	outside diameter
PP	power pole
R	radius
Rd	road
REIN	reinforce
REL A	relief air
REQD	required
REV	revision
RR	railroad
R/W	right-of-way
RWM	reclaimed water main
RY	railway
SAN	sanitary
SCH	schedule
SECT	section
SLV	sleeve
SQ	square
SST	stainless steel
ST	street
STA	station
STD	standard
SURF	surface
SUSP	suspend(ed)
SYM	Symbol, symmetrical
SYS	system
TEMP	Temperature, temporary
TYP	typical
UTIL	utility
W	West
WLD	welded
WM	water main
W/O	without
WT	weight
YD	yard
YR	year
Y W	wye

END OF SECTION

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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 County will schedule and administer a pre-construction conference, periodic progress meetings and specific topic meetings throughout the progress of the Work. The County 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 County 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 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.
- 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. Photographs and digital pictures shall be in color. Provide 1 copy of each digital picture on each of three (3) CDs and provide 1 print of each photograph in two (2) separate albums.
- B. Photographs shall be from locations to illustrate the condition of Construction and state of progress adequately.
- C. 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.
- D. Deliver electronic images, prints, and negatives to the County.
- E. 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.
- F. Provide loose-leaf albums for each set of photographs to hold prints with a maximum of 50-leaves per binder.
- G. 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.
- H. 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.

- I. 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.
- J. 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.
- K. 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 CDs.

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 15 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 17.
 - 1. Mobilization/Demobilization at 5% of the base bid for the pump station.
 - 2. Project Record Documents at 1% of the base bid for the pump station.
 - 3. Indemnification at \$100.00 divided by the number of pump stations in the project.
 - 4. Demolition of existing pump station
 - 5. Bypass pumping
 - 6. Wetwell structure, liner, top slab, hatch covers and appurtenances
 - 7. Valve vault structure, hatch covers and appurtenances, drain piping and appurtenances
 - 8. Wetwell (mechanical): 316 stainless steel piping and appurtenances, pumps and base plates
 - 9. Valve vault (mechanical): piping, valves, and appurtenances
 - 10. Yard piping, fittings, valves, and appurtenances (outside of structures)
 - 11. Site work and access drive
 - 12. Chain link fence and gates
 - 13. Masonry walls and gates
 - 14. Odor control equipment, related piping, monitoring equipment, etc.
 - 15. Generator, fuel storage tank and related piping
 - 16. Electrical control panel, wiring, and connections
 - 17. Start-up and testing

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 DVD media viewable on standard DVD players or computer.

- B. Each DVD 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 DVD 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 DVD 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 DVDs and boxes shall bear labels with the following information:
1. DVD 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 01516
COLLECTION SYSTEM BYPASS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Work covered by this section consists of providing all temporary bypassing to perform all operations in connection with the flow of wastewater around pipe segment(s) or pump stations. The purpose of bypassing is to prevent wastewater overflows and provide continuous service to all wastewater customers. The Contractor will maintain wastewater flow in the construction area in order to prevent backup and/or overflow and provide reliable wastewater service to the users of the wastewater system at all times.

1.02 SUBMITTALS

- A. Prior to implementation of any bypass, the Contractor will submit and receive County acceptance of a bypass plan. The Contractor will submit to the County a comprehensive written plan for approval and acceptance that describes the intended bypass for the maintenance of flows during construction. The Contractor will also provide a sketch showing the location of bypass pumping equipment for each pump station or line segment(s) around which flows are being bypassed. The plan will include proposed tanker(s), pump(s), bypass piping, backup plan and equipment, work schedule, monitoring log for bypass pumping, monitoring plan of the bypass pumping operation, and maintenance of traffic plan.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The Contractor will provide and maintain adequate equipment, piping, tankers, and other necessary appurtenances in order to maintain continuous and reliable wastewater service in all wastewater lines as required for construction. The Contractor will have tankers, backup pump(s), piping, and appurtenances ready to deploy immediately.
- B. All piping will be designed to withstand at least twice the maximum system pressure or a minimum of 50-psi, whichever is greater.
- C. When bypassing a pump station, one (1) back-up pump equal to the primary unit will be provided by the Contractor. Bypass pumps shall have a maximum rating of 55 decibels for sound attenuation.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall have all materials, equipment and labor necessary to complete the repair, replacement, or rehabilitation on the job site prior to isolating the gravity main segment, manhole, or pump station. The Contractor will demonstrate that the temporary bypass pumping system is in good working order and is sufficiently sized to successfully handle flows by performing a test run for a period of 24-hours prior to beginning the Work.

3.02 TRAFFIC CONSIDERATIONS

- A. The Contractor shall locate bypass pumping suction and discharge lines so as to not cause undue interference with the use of streets, private driveways, and alleys, to include the possible temporary trenching of piping at critical intersections. Additional traffic maintenance requirements are found in Section 01570 "Maintenance of Traffic".

3.03 BYPASS OPERATION

- A. The Contractor shall submit a bypass plan to the County and the bypass plan must be approved before the bypass is operational to perform the Work. Contractor shall maintain the wastewater system flow and no surcharging will be allowed to occur out of the system.
- B. Where Work requires the main or pump station to be taken out service after normal working hours and bypass pumping is being used; the Contractor shall be responsible for monitoring the bypass operation 24-hours per day, 7-days per week. Any electronic monitoring in lieu of on-site monitoring must be detailed in the comprehensive written bypass plan.
- C. The Contractor shall ensure that no damage will be caused to private property as a result of bypass pumping operations. The Contractor will complete the Work as quickly as possible and pass all tests and inspections before discontinuing bypassing operations and returning flow to the wastewater manhole, main, or pump station.
- D. During bypassing, no wastewater will be leaked, dumped, or spilled in or onto, any area outside of the existing wastewater system.
- E. The Contractor shall immediately notify the County should a sanitary sewer overflow (SSO) occur. The Contractor shall take the necessary action to wash down, clean up and disinfect the spillage area to the satisfaction of the County or other governmental agency.
- F. The Contractor shall cease bypass operations and return flows to the new and/or existing sewer when directed by the County. When bypass operations are complete, all bypass piping shall be drained into the wastewater system prior to disassembly.

3.04 CONTRACTOR LIABILITY

- A. The Contractor shall be responsible for all required pumping, equipment, piping, and appurtenances to accomplish the bypass and for any and all damage that results directly or indirectly from the bypass pumping equipment, piping and/or appurtenances. The Contractor shall also be liable for all County personnel labor and equipment costs, penalties and fines resulting from sanitary sewer overflows. It is the intent of these specifications to require the Contractor to establish adequate bypass pumping as required regardless of the flow condition.

END OF SECTION

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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 01570
MAINTENANCE OF TRAFFIC

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes identifying safety hazards and then furnishing all necessary labor, materials, tools, and equipment including, but not limited, to signs, barricades, traffic drums, cones, flashers, construction fencing, flag persons, variable message boards, uniformed police officers, warning devices, temporary pavement markings, temporary sidewalk, delineators, etc., to maintain vehicular and pedestrian traffic through and adjacent to the project area. These measures and actions shall be taken to safely maintain the accessibility of public and construction traffic by preventing potential construction hazards. . All materials, work and incidental costs related to Maintenance of Traffic will be paid for at the contract lump sum price.

1.02 REQUIREMENTS

- A. The Traffic Control Plan shall conform to the following standards:
 - 1. Standard Specifications for Road and Bridge Construction, latest edition including all subsequent supplements issued by the Florida Department of Transportation, (FDOT).
 - 2. Manual on Uniform Traffic Control Devices for Streets and Highways by U.S. Department of Transportation, Federal Highway Administration.
 - 3. Right-of-Way Utilization Regulations, Orange County, Florida, latest edition.
- B. All references to the respective agencies in the above referenced standards shall be construed to also include the municipality as applicable for this Work.
- C. Sequence the Work in a manner that will minimize disruption of vehicular and pedestrian access through and around the construction area.
- D. Traffic planning and control for the maintenance and protection of pedestrian and vehicular traffic affected by the Contractor's Work includes, but is not limited to:
 - 1. Construction and maintenance of any necessary detour equipment and facilities.
 - 2. Providing necessary facilities for access to residences and businesses.
 - 3. Furnishing, installing, and maintenance of traffic control and safety devices (e.g. signage, barricades, barriers, message boards, etc.), and flag persons as appropriate during Construction.
 - 4. Control of water runoff, dust and any other special requirements for safe and expeditious movement of traffic.

- E. Planning, maintenance and control of traffic shall be provided at the Contractor's expense. The Contractor will bear all expense of maintaining the vehicle and pedestrian traffic throughout the work area.
- F. The Contractor will ensure all personnel involved in traffic control are and capable of communicating with the public. The Contractor may be required to hire off-duty uniformed police officers, in addition to flag persons, to direct and maintain traffic. Locations and conditions requiring such uniformed police officers shall be as directed by the County. The Contractor shall be required to utilize uniformed police officers for work within FDOT maintained ROW, road closures affecting school traffic and during all night work involving a road closure or crossing on nonresidential roads.
- G. The Contractor will remove temporary equipment and facilities when no longer required, restore grounds to original, or to specified conditions.

1.03 SUBMITTALS

- A. Submit at Contractor's own expense a Traffic Control Plan for approval by the controlling roadway agency (FDOT, Orange County Public Works or other local government) having jurisdiction over the road for approval.
 - 1. The Traffic Control Plan will detail procedures and protective measures proposed by the Contractor to provide for protection and control of traffic affected by the Work consistent with the following applicable standards:
 - a. Standard Specifications for Road and Bridge Construction, latest edition including all subsequent supplements issued by the Florida Department of Transportation, (FDOT Spec.).
 - b. Manual of Traffic Control and Safe Practices for Street and Highway Construction, Maintenance and Utility Operations, FDOT.
 - c. Right-of-Way Utilization Regulations, Orange County, Florida, latest edition.
- B. All references to the respective agencies in the above referenced standards shall be construed to also include the municipality as applicable for this Work.
- C. The Traffic Control Plan will be signed and sealed by a Professional Engineer registered in the state of Florida and shall include proposed locations and time durations of the following, as applicable:
 - 1. Pedestrian and public vehicular traffic routing.
 - 2. Lane and sidewalk closures, other traffic blockage and lane restrictions and reductions anticipated to be caused by construction operations. Show and describe the proposed location, dates, hours and duration of closure, vehicular and pedestrian traffic routing and management, traffic control devices for implementing pedestrian and vehicular movement around the closures, and details of barricades.
 - 3. Location, type and method of shoring to provide lateral support to the side of an excavation or embankment parallel to an open travel-way.
 - 4. Allowable on-street parking within the immediate vicinity of worksite.
 - 5. Access to buildings immediately adjacent to worksite.
 - 6. Driveways blocked by construction operations.

7. Temporary traffic control devices, temporary pavement striping and marking of streets and sidewalks affected by construction
8. Temporary commercial and industrial loading and unloading zones.
9. Construction vehicle reroutes, travel times, staging locations, and number and size of vehicles involved.

D. Obtain and submit prior to erection, or otherwise impacting traffic, all required permits from all authorities having jurisdiction, including Orange County Public Works, if applicable.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. The Contractor shall furnish, erect, and maintain all necessary traffic control devices, including flag person, in accordance with the Manual of Uniform Traffic Control Devices for Streets and Highways published by the U.S. Department of Transportation, Federal Highway Administration.

1. FLAG PERSONS

- a. All flag persons used on this Project will adhere to the following requirements:
- b. Any person acting as a flag person on this Project will have attended a training session taught by a Contractor's qualified trainer before the start date of this Contract.
- c. The Contractor's qualified trainer will have completed a "Flag person Train the Trainer Session" in the 5-years previous or before the start date of this Contract and will be on file as a qualified flag person trainer.
- d. The flag person trainer's name and Qualification Number will be furnished by the Contractor at the Pre-Construction meeting. The Contractor will provide all flag persons with the Flag Person Handbook and will observe the rules and regulations contained therein. This handbook will be in the possession of all flag person while flagging on the Project.
- e. Flag persons will not be assigned other duties while working as authorized flag persons.
- f. Any person replacing flag person for break shall have the same training.

PART 3 - EXECUTION

3.01 NOTIFICATIONS

A. The Contractor will notify individual owners, owner's agents, and tenants of buildings affected by the construction, with copies to the county, 72-hours in advance of any construction activities.

B. The Contractor shall notify residents and pedestrians via variable message boards no later than 10 days prior to the closure of any road, lane or pedestrian thoroughfare.

- C. The Contractor shall notify Emergency Management Services agencies, Lynx and OCPS no less than 7 days prior to such closures or whenever roads are impassable.
- D. Implement closing of vehicle or pedestrian thoroughfare in accordance with the construction drawings and the approved Traffic Control Plan.
- E. The Contractor will immediately notify the County of any vehicular or pedestrian safety or efficiency problems incurred as a result of the construction of the Project.

3.02 GENERAL TRAFFIC CONTROL

- A. The Contractor will sequence and plan construction operations and will generally conduct Work in such a manner as not to unduly or unnecessarily restrict or impede normal traffic.
- B. Unless otherwise provided, all roads within the limits of the Work will be kept open to all traffic by the Contractor. The Contractor will keep the portion of the project being used by public traffic, whether it is through or local traffic, in such condition that traffic will be adequately accommodated.
- C. The Contractor will be responsible for installation and maintenance of all traffic control devices and requirements for the duration of the construction period. Necessary precautions for traffic control will include, but not be limited to, warning signs, signals, lighting devices, markings, barricades, canalizations, and hand signaling devices.
- D. The Contractor will provide and maintain in a safe condition temporary approaches or crossings and intersections with trails, roads, streets, businesses, parking lots, residences, garages and farms.
- E. The Contractor will provide emergency access to all residences and businesses at all times. Residential and business access will be restored and maintained at all times outside of the Contractor's normal working hours.
- F. Traffic is to be maintained on one section of existing pavement, proposed pavement, or a combination thereof. Alternating one-way traffic may be utilized and limited to a maximum length of 500-feet during construction hours. Lane width for alternating one-way traffic will be kept to a minimum width of 10-feet, or as directed by the County.
- G. Travel lanes and pedestrian access will be kept reasonably smooth, dry, and in a suitable condition at all times.
- H. The Contractor will make provisions at all "open cut" street crossings to allow for free passage of vehicles and pedestrians, either by bridging or other temporary crossing structures. Such structures will be of adequate strength and proper construction and will be maintained by the Contractor in such a manner as not to constitute an undue traffic hazard.

- I. The Contractor will keep all signs in proper position, clean, and legible at all times. Care will be taken so that weeds, shrubbery, construction materials, equipment, and soil are not allowed to obscure any sign, light, or barricade. Signs that do not apply to construction conditions should be removed or adjusted so that the legend is not visible to approaching traffic.
- J. The County may determine the need for, and extent of, additional striping removal and restriping.
- K. Excavated material, spoil banks, construction materials, equipment and supplies will not be located in such a manner as to obstruct traffic, as practicable. The Contractor will immediately remove from the site all demolition material, exercising such precaution as may be directed by the County. All material excavated shall be disposed of so as to minimize traffic and pedestrian inconvenience and to prevent damage to adjacent property.
- L. During any suspension, the Contractor will make passable and open to traffic such portions of the Project and/or temporally roadways as directed by the County for accommodation of traffic during the anticipated period of suspension. Passable conditions will be maintained until issuance of an order for the resumption of construction operations. When Work is resumed, the Contractor will replace or renew any Work or materials lost or damaged because of such temporary use in every respect as though its prosecution had been continuous and without interferences.

3.03 TEMPORARY SHORING

- A. Use shoring to maintain traffic when it is necessary to provide lateral support to the side of an excavation or embankment parallel to an open travel-way. Provide shoring when a theoretical 2:1 or steeper slope from the bottom of the excavation or embankment intersects the existing ground line closer than 5-feet (1.5 m) from the edge of pavement of the open travel-way.
- B. The Contractor will furnish, install, and remove sheeting, shoring, and bracing necessary to maintain traffic at locations shown on the Traffic Control Plan and other locations determined during construction.

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 one 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. Name of Project
 - 2. Contract Number
 - 3. Orange County Government name and logo
 - 4. Identification of "Board of County Commissioners"
 - 5. Identification of "Orange County Utilities"

6. Name of Public Information Officer with telephone number and email address.
7. Consulting Engineer
8. 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

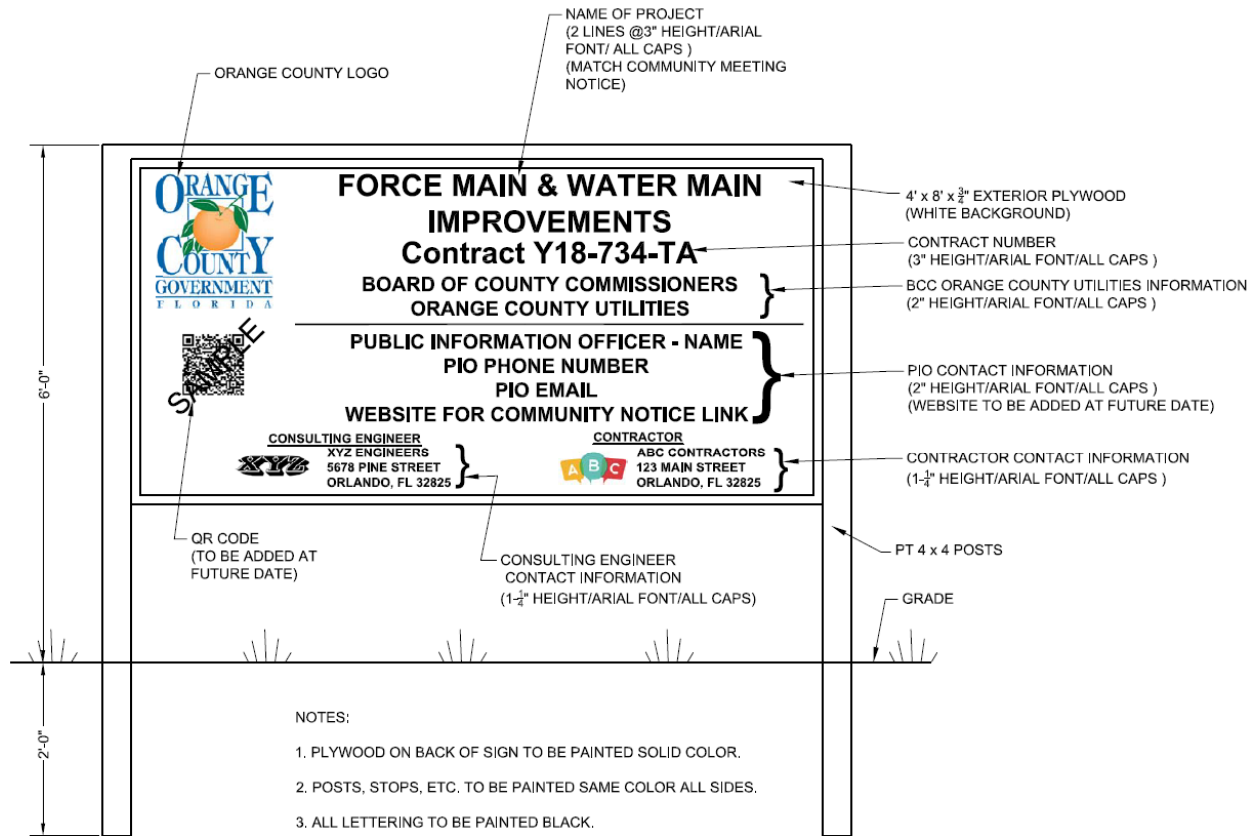
- A. Install project identification signs within 10-days of the Notice to Proceed date. Failure to erect the signs may be reason to delay approval of the initial Application for Payment.
- B. Paint exposed surfaces of supports, framing, and surface material; one (1) coat of primer and two (2) coats of 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.



CONSTRUCTION SIGN
N.T.S.

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 01650
PUMP STATION START-UP AND TESTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor will conduct preliminary testing of pump station facilities, products and equipment. If the preliminary field tests disclose any items furnished under this Contract which do not comply with the requirements of the Contract Documents, the Contractor shall make all changes, adjustments and replacements required prior to Start-up Demonstration and Acceptance Testing.
- B. The Contractor shall arrange qualified instruction by the manufacturer's representative for the County's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.
- C. The Contractor shall furnish all labor, fuel, energy, lubrication, water, and all other materials, equipment, tools and instruments necessary for the Start-up Demonstration and Acceptance Testing unless otherwise specified.
- D. The startup and final check out shall demonstrate and ensure to the County the complete operating pump station system. The Contractor shall provide documentation certifying proper installation, testing and operation of all prescribed equipment and systems.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PUMP STATION START-UP TESTING AND INSPECTION

- A. The Contractor shall notify the County at least 10 normal working days prior to start-up.
- B. The following shall have been successfully met prior to pump station start-up:
 - 1. A walk through letter of acceptance received
 - 2. All wire checks conducted
 - 3. Video of gravity main inspections completed
 - 4. FDEP Clearances received
 - 5. FDEP placard for fuel tank if applicable
 - 6. Completed Appendix B "Pump Station Start-Up" form
 - 7. Certified Boundary Survey and As-Built Survey
 - 8. The Contractor shall conduct preliminary testing of equipment prior to start-up testing and make all changes, adjustments and replacements required; and

9. The liner(s) shall meet the testing requirements of the Contract Documents and a letter or form signed by the County that testing was witnessed and approved.
- C. The intent of the start-up testing is for the Contractor to demonstrate to the County that the Work will function as a complete and operable system under normal as well as emergency operating conditions and the pump station is ready for acceptance.
- D. The Contractor shall furnish all labor, fuel, energy, lubrication, water and all other materials, equipment, tools, and instruments necessary for pump station start-up testing and inspection. All material used shall be listed on the Appendix D "List of Approved Products." All required certification letters, spare parts and supplies shall be provided to the County. Listed below is a partial checklist of requirements to be met.
1. The Contractor shall coordinate startup activities with the County, the manufacturer's representatives and Subcontractors. A factory representative knowledgeable in the mechanical and electrical equipment furnished shall inspect and supervise a start-up of their respective equipment. A minimum of 1 full business day shall be provided for the testing. Additional time may be necessary due to faulty or incomplete Work. Upon satisfactory completion of the equipment testing and inspection, the factory representative(s) shall issue the required manufacturer's warranty certificates.
 2. Initiate start-up of each system in accordance with the operation and maintenance manual. Demonstrate that all of the components of a system are operating under their own controls as designated without overheating or overloading any parts and without objectionable vibration as determined by the County.
 3. Observe the system operation and make adjustments as necessary to optimize the system performance. Coordinate with County for any adjustments desired or operational problems requiring debugging.
 4. All functions of the pump station mechanical and electrical equipment shall be tested and inspected for operation and workmanship. All equipment shall be properly installed and meet the design performance requirements.
 5. The pumps shall be flow tested at the pump station start-up to verify their performance meets the design requirements and the manufacturer's pump curve.
 6. Furnish 2 printed copies and 3 electronic copies in Acrobat "pdf" format of the Operation and Maintenance Manual for the pump station to the County.
 7. A pump station start-up report shall be completed. See Appendix B "Pump Station Start-Up Report Form."
 8. The Contractor shall bear the entire expense of rectifying Work installed.
 9. The Contractor shall furnish the County with a written certification signed by the Manufacturer's representative that the equipment has been properly installed and lubricated, is in accurate alignment, is free from undue stress imposed by piping or mounting bolts, and has been operated under full load conditions and that satisfactory operation has been obtained.

E. Re-testing

If the start-up testing does not meet the requirements, the deficiencies shall be corrected and the testing procedure will be rescheduled again.

F. FDEP fuel tank placard

When a generator fuel tank is required, the Contractor shall submit documentation that the facility has passed the FDEP fuel tank compliance inspection and that a properly completed "Storage Tank Facility Registration Form" has been submitted to the Florida Departmental of Environmental Protection including all applicable fees. The placard shall be provided to the County.

G. Acceptance

1. The pump station shall be accepted based on the pump station functioning as a complete and operable system under normal as well as emergency operating conditions, the approved construction documents have been met and any deficiencies that were observed and noted have been corrected.
2. The Contractor shall ensure all fuel, lubrication, and all other materials for operation are replenished.

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 the Work as substantially complete, submit to the County a written notice stating so and requesting an inspection to determine the status of completion. 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 data compact discs, 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 compact disc or DVD. 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.

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. Furnish an extended warranty for sanitary sewer main liner certified by the manufacturer for specified material properties for a particular job. The manufacturer warrants the liner to be free from defects in raw materials for 1-year from the date of acceptance. During the warranty period, any defects which affect the integrity or strength of the pipe shall be repaired at the Contractor's expense in a manner acceptable to the County.
 2. Furnish an extended warranty for sanitary lateral liner certified by the manufacturer for specified material properties for a particular job. The manufacturer warrants the liner to be free from defects in raw materials for 1-year from the date of acceptance. During the warranty period, any defects which affect the integrity or strength of the pipe shall be repaired at the Contractor's expense in a manner acceptable to the County.

END OF SECTION

SECTION 02050
DEMOLITION OF EXISTING STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. This Section specifies the labor, materials, equipment, and incidentals required for the demolition, relocation, and/or disposal of all structures, building materials, equipment, and accessories to be removed as shown on the Drawings and as specified herein.
2. There may be existing and active stormwater, wastewater, water, and other facilities on site as indicated on the Drawings. It is essential that these facilities, when encountered, remain intact and in service during the proposed demolition. Consequently, the Contractor shall be responsible for the protection of these facilities and shall diligently direct all his activities toward maintaining continuous operation of the existing facilities and minimizing operational inconvenience.
3. Demolition generally includes:
 - a. Complete demolition and removal of manholes, valve vaults, wetwells, piping, and mechanical and electrical equipment related to the Work as shown on the Drawings and specified herein.
 - b. Complete demolition and removal of all above and below ground structures, concrete slabs and foundations, vaults, and underground utilities (water, wastewater, electrical, etc.) as shown on the Drawings and specified herein.
 - c. All material, equipment, rubble, debris, and other products of the demolition shall become the property of the Contractor for his disposal off-site in accordance with all applicable laws and ordinances at the Contractor's expense. The sale of salvageable materials by the Contractor shall only be conducted off-site. The sale of removed items on the site is prohibited by the County.
4. The Contractor shall examine the various Drawings, visit the site, determine the extent of the Work, the extent of work affected therein, and all conditions under which he is required to perform the various operations.
5. The Contractor shall fill and compact all voids left by the removal of pipe, structures, etc. with materials described herein to a grade that will provide for positive drainage of the disturbed area to drain run-off in direction consistent with the surrounding area. The Contractor shall provide all fill materials to the site as needed. Compaction of fill shall match the compaction of adjacent undisturbed material.

1.02 QUALITY ASSURANCE

- A. Permits and Licenses: Contractor shall obtain 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.

- B. Notices: Contractor shall issue written notices of planned demolition 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. Utility Services: Contractor shall notify utility companies or local authorities furnishing gas, water, electrical, telephone, or sewer service to remove any equipment in the structures to be demolished and to remove, disconnect, cap, or plug their services to facilitate demolition.
- D. Contractor shall notify the Orange County Risk Management Department in writing prior to beginning any demolition work.

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 their approval, 2 copies of proposed methods and operations of demolition or relocation of the structures specified below prior to the start of Work. Include in the schedule the coordination of shut-off, capping, and continuation of utility service as required.
- C. Provide a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the County's operations.
- D. Before commencing demolition work, all structure relocation, bypassing, capping, or modifications necessary will be completed. Actual work will not begin until the County has inspected and approved the prerequisite work and authorized commencement of the demolition work.
- E. The above procedure must be followed for each individual demolition operation.

1.04 SITE CONDITIONS

- A. Prior to demolition, the Contractor shall obtain written verification from the utility owner(s) that the existing utilities, including stormwater, wastewater, and/or water facilities, are not operational and are ready for demolition.
- B. The County assumes no responsibility for the actual condition of the structures to be demolished or relocated.
- C. Conditions existing at the time of inspection for bidding purposes will be maintained by the County insofar as practicable. However, variations within each site may occur prior to the start of demolition work.
- D. No additional payment will be made for pumping or other difficulties encountered due to water.

- E. Certain information regarding the reputed presence, size, character and location of existing underground structures, pipes and conduit has been shown on the Drawings. There is no certainty of the accuracy of this information, and the location of underground structures shown may be inaccurate and other obstructions than those shown may be encountered. The Contractor hereby distinctly agrees that the County is not responsible for the correctness or sufficiency of the information given; that in no event is this information to be considered as a part of the Contract; that he shall have no claim for delay or extra compensation on account of incorrectness of information regarding obstructions either revealed or not revealed by the Drawings; and that he shall have no claim for relief from any obligation or responsibility under this Contract in case the location, size, or character of any pipe or other underground structure is not as indicated on the Drawings, or in case any pipe or other underground structure is encountered that is not shown on the Drawings.

1.05 RESTRICTIONS

- A. No building, tank or structure, or any part thereof, shall be demolished until an application has been filed by the Contractor with the Building Department Inspector and a permit issued if a permit is required. The fee for this permit shall be the Contractor's responsibility. Demolition shall be in accordance with applicable provisions of the Building Code of the State of Florida.
- B. No explosives shall be used at any time during the demolition. No burning of combustible material will be allowed.
- C. Contractor shall notify the Orange County Risk Management Department prior to beginning any demolition work.

1.06 DISPOSAL OF MATERIAL

- A. All salvageable or useable material or equipment to be retained by the County shall be shown on Drawings, and shall be moved to a designated area by Contractor for pick up by County. The Contractor shall promptly remove all other materials from the site as indicated or shown on the Drawings.
- B. All materials not retained by the County shall become the Contractor's property and shall be removed off-site.
- C. The on-site storage of removed items is prohibited by the County. Off-site sale of salvageable material by the Contractor is acceptable.

1.07 TRAFFIC AND ACCESS

- A. Conduct work to ensure minimum interference with on-site and off-site roads, streets, sidewalks, and occupied or used facilities.

- B. Special attention is directed towards maintaining safe and convenient access to the existing facilities remaining in operation by plant personnel and plant associated vehicles, including trucks and delivery vehicles.
- C. Do not close or obstruct streets, sidewalks, or other occupied or used facilities without permission from the County. Provide alternate routes around closed or obstructed traffic in access ways.

1.08 PROTECTION

- A. Conduct operations to minimize damage by falling debris or other causes to adjacent buildings, structures, roadways, other facilities, and persons. Provide interior and exterior shoring, bracing, or support to prevent movement or settlement or collapse of structures to be demolished and adjacent facilities to remain.

1.09 DAMAGE

- A. Promptly repair damage caused to adjacent facilities by demolition operations as directed by the County at no cost to the County.

1.10 UTILITIES

- A. Maintain existing utilities as directed by the County to remain in service and protect against damage during demolition operations.
- B. Do not interrupt existing utilities serving occupied or operational facilities, except when authorized by County. Provide temporary services during interruptions to existing utilities as acceptable to the County.
- C. The Contractor shall cooperate with the County to shut off utilities serving structures of the existing facilities as required by demolition operations.
- D. The Contractor shall be solely responsible for making all necessary arrangements and for performing any necessary work involved in connection with the interruption of all public and private utilities or services.
- E. All utilities being abandoned shall be terminated at the service mains in conformance with the requirement of the utility companies or the municipality owning or controlling them.

1.11 EXTERMINATION

- A. If required, before starting demolition, the Contractor shall employ a certified rodent and vermin exterminator and treat the facilities in accordance with governing health laws and regulations. Any rodents, insects, or other vermin appearing before or during the demolition shall be killed or otherwise prevented from leaving the immediate vicinity of the demolition work.

1.12 POLLUTION CONTROL

- A. For pollution control, use water sprinkling, temporary enclosures, and other suitable methods as necessary to limit the amount of dust rising and scattering in the air to the lowest level of air pollution practical for the conditions of work. The Contractor shall comply with the governing regulations.
- B. Clean adjacent structures and improvements of all dust and debris caused by demolition operations as directed by the County. Return areas to conditions existing prior to the start of Work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SEQUENCE OF WORK

- A. The sequence of demolition and relocation of existing facilities shall be in accordance with the approved critical path schedule as specified in paragraph 1.03 above.

3.02 REMOVAL OF EXISTING PROCESS EQUIPMENT, PIPING, AND APPURTENANCES

- A. Equipment to be retained by the County will be designated for retention by the County prior to bidding as specified in Paragraph 1.06 above. Subject to the constraints of maintaining existing facilities in operation as shown on the Drawings, all other process equipment, non-buried valving and piping, and appurtenances shall be removed from the site.

3.03 DEMOLITION PROCEDURES

The Contractor shall adhere to the following demolition procedures as referenced on the Drawings:

- A. **TO BE DEMOLISHED:** Demolition shall be the breaking up, cutting, filling of any holes resulting, final grading of the area, performing any other operations required, and the removal from the site of all structures and equipment (structures, substructures, floor slabs, equipment, tanks, pipes, fittings, electrical systems, light poles, wiring, underground conduits and wiring, isolated slabs, and sidewalks) as indicated on the Drawings. All pieces of concrete, metal, and any other demolished material shall be removed to a depth of at least 5-feet below existing grade. Broken pieces of concrete may be size reduced by an on-site crusher, but in any event must be removed from the project site.

Before commencing structural demolition, remove all mechanical, electrical, piping, and miscellaneous appurtenances. Completely remove the structure by thoroughly breaking up concrete into pieces no more than 2-feet across the largest dimension.

- B. TO BE REMOVED: Where indicated on the Drawings, the structures and equipment shall be completely removed from the site with all associated connecting piping or electrical service. The item shall be taken whole or in parts to be salvaged or disposed of by the Contractor.
- C. TO BE ABANDONED: Where indicated on the Drawings, the structures and equipment shall be left in place, drained, and the contents properly disposed. The upper 4-feet of the structure shall be cut and removed, including the cover slab and access port, frame, and cover. All structures to be abandoned with bottom slabs shall be drilled (2 holes minimum, 2.0-inch diameter each) or hole punched to prevent flotation and filled with common fill.
- D. PIPING TO BE REMOVED: Where indicated on the Drawings, pipe (and conduit) shall be drained and the contents properly disposed. The pipe (or conduit) shall then be completely removed from the site, including fittings, valves, and other in-line devices. Connections to existing piping to remain shall be plugged by mechanical means (M.J. plugs, tie-rods, or thrust blocks). Piping shall be removed in accordance with Specification Section 02080 "Abandonment, Removal and Salvage or Disposal of Existing Pipe."
- E. PIPING TO BE ABANDONED: Where indicated on the Drawings, piping (or conduit) shall be left in place. All such piping shall be drained and the contents properly disposed. The pipe (or conduit) shall then be filled with grout (flowable fill) and each end of the pipe (or conduit) shall be plugged using a concrete plug in a manner acceptable to the County. Piping shall be abandoned in accordance with Specification Section 02080 "Abandonment, Removal and Salvage or Disposal of Existing Pipe."
- F. TO BE PROTECTED: Where indicated on the Drawings, the utility service, fence, structure, tree, or device so designated shall be temporarily protected during the prosecution of the demolition work as specified in Division 1.
- G. TO REMAIN: Where indicated on the Drawings, the designated facilities shall remain intact and in service during the prosecution of the demolition work.

3.04 DEWATERING OF EXISTING PROCESS UNITS AND DISPOSAL OF RESIDUE

The Contractor shall notify the County prior to beginning the dewatering work on any existing process units which contain wastewater, grit, or sludge. The Contractor, at his own expense, shall remove the entire contents of each structure and dispose off site. The proper transport and disposal of all residues shall remain the responsibility of the Contractor.

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 02140

DEWATERING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This Section specifies the furnishing of equipment; labor and materials necessary to remove storm or subsurface waters from excavation areas in accordance with the requirements set forth, as shown on the Drawings, and/or geotechnical report.

1.02 QUALITY ASSURANCE

- A. Qualifications: The Contractor shall engage a Geotechnical Engineer registered in the State of Florida, to design the temporary dewatering system. The Contractor shall submit conceptual plan for the dewatering system prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan and certification of this shall be provided by the Geotechnical Engineer. The dewatering system shall be designed by a firm who regularly engages in the design of dewatering systems and who is fully experienced, reputable and qualified in the design of such dewatering systems.
- B. The dewatering of any excavation areas and the disposal of the water shall be in strict accordance with the latest revision of all local and state government rules and regulations.
- C. Permits: The Contractor shall obtain and pay respective fees for all local, state, and federal permits (including the Orange County, St. Johns River Water Management District, and/or South Florida Management District discharge permits) required for the withdrawal, treatment and disposal/discharge of water from the dewatering operation, prior to start of work.
- D. Comply with Florida Administrative Code, Chapter 62-621.300 (2).

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. In accordance with FAC 62-621.300(2), submit analytical test results from a certified laboratory for the parameters listed in the FDEP "Generic Permit for the Discharge of Produced Ground Water from Any Non-Contaminated Site Activity" to the FDEP and the County. The submitted information shall show the location of the work, where the water will be going to, as well as an estimate for the amount, rate and duration of discharge being proposed.

- C. Provide notification to all jurisdictional permitting agencies in accordance with the requirements of the respective agency.
- D. Provide a detailed plan and operation schedule for dewatering of excavations.
 - 1. Provide descriptive literature of the dewatering system.
 - 2. Provide a plan for erosion and sedimentation control during dewatering.
 - 3. Provide copies of all permits/approvals for disposal/discharge of water during dewatering.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall have on-site and available the analytical test results performed in accordance with the FDEP "Generic Permit for the Discharge of Produced Ground Water from Any Non-Contaminated Site Activity" (FAC 62-621.300(2)).
- B. The Contractor shall provide adequate equipment for the removal of storm or subsurface waters which may accumulate within the excavation.
- C. The Contractor's attention is directed to the water surface elevations discussed in the report(s) on subsurface investigations. Water levels will normally vary from season to season.
- D. The Contractor shall be required to monitor the performance of the dewatering system during the progress of the Work and make such modifications as may be required to assure that the systems will perform satisfactorily. The dewatering system shall be designed in such a manner as to preserve the undisturbed bearing capacity of the sub-grade soils at the bottom of the trench or excavation.
- E. Prior to excavation, the Contractor shall submit his proposed method of dewatering and maintaining dry conditions to the County. Approval of the dewatering plan shall not relieve the Contractor of the responsibility for the satisfactory performance of the system. The Contractor shall be responsible for correcting any disturbance of natural bearing soils or damage to structures caused by an inadequate dewatering system or by interruption of the continuous operation of the system as specified.
- F. If subsurface water is encountered, the Contractor shall utilize suitable equipment to adequately dewater the excavation. A wellpoint system or other County acceptable dewatering method shall be utilized if necessary to maintain the excavation in a dry condition for preparation of the trench bottom and for pipe laying. Within and adjacent to residential areas and other areas as required by the County, engines driving dewatering pumps shall be equipped with residential type mufflers and the noise shall not exceed 55 decibels within 50-feet.

3.02 DEWATERING AND DISPOSAL

- A. The Contractor shall construct and place all pipelines, structures, concrete work, structural fill, backfill and bedding material in-the-dry. In addition, the Contractor shall make the final 24-inches of excavation in-the-dry and not until the water level is a minimum of 2-foot below proposed bottom of excavation. For purposes of this Contract, in-the-dry is defined as $\pm 2\%$ of the optimum moisture content of the soil.
- B. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of all water entering excavations. Contractor shall keep excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.
- C. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
- D. It is expected that dewatering will be required for pre-drainage of the soils prior to final excavation for most of the in-ground structures or piping and for maintaining the lowered groundwater level until construction has been completed so that the structure, pipeline or fill will not be floated or otherwise damaged.
- E. If wellpoints are used, Contractor shall adequately space wellpoints to maintain the necessary dewatering. Provide suitable filter sand and/or other means to prevent pumping of fine sands and silts. A continual check shall be maintained by the Contractor to ensure that the subsurface soil is not being removed by the dewatering operations. Pumping from wellpoints shall be continuous and standby pumps shall be provided.
- F. The Contractor's proposed method of dewatering shall include groundwater observation wells to determine the water level during construction. Observation wells shall be installed along pipelines as required to verify depth to water level and at locations approved by the County.
- G. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from the surface shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped or drained by gravity to maintain an excavation bottom free from standing water.
- H. Flotation shall be prevented by the Contractor by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible for all damages which may result from failure to adequately keep excavations dewatered.
- I. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent properties or facilities. No water shall be discharged without appropriate treatment for adverse contaminants. No water shall be drained in work built or under construction without prior consent from the County. Water shall be filtered to remove sand and fine soil particles before disposal into any drainage system.

- J. Dewatering of excavations shall be considered incidental to the construction of the Work and all costs shall be included in the various Contract prices in the Bid Form, unless a separate bid item has been established for dewatering.

3.03 GROUNDWATER TREATMENT (IF REQUIRED)

- A. If concentrations of tested groundwater quality parameters exceed those allowable in the FDEP Generic Permit for the Discharge of Produced Groundwater from any Non-Contaminated Site Activity (62-621.300(2), F.A.C.), the Contractor shall treat the effluent.
- B. The Contractor shall immediately notify the County and discuss the parameters that exceed allowable limits.
- C. The Contractor shall meet with the FDEP to determine alternatives that are acceptable to the FDEP.
- D. The Contractor shall apply for and obtain any and all permits and/or treatment approvals that FDEP requires including but not limited to:
 - 1. Generic Permit for Discharges from Petroleum Contaminated Sites (62-621.300(1)). Allows discharges from sites with automotive gasoline, aviation gasoline, jet fuel, or diesel fuel contamination; or
 - 2. Permit for all Other Contaminated Sites (62-04; 62-302; 62-620 & 62-660). The coverage is available only through the individual NPDES permit issued by FDEP, allows discharges from sites with general contaminant issues i.e. ground water and/or soil contamination other than petroleum fuel contamination; or
 - 3. Generic Permit for the Discharge of Produced Ground Water from Any Non-Contaminated Site Activity (62-621.300(2), F.A.C.); or
 - 4. Generic Permit for Stormwater Discharge from Large or Small Construction Activities (62-621.300(4)(a), F.A.C.); or
 - 5. An Individual Wastewater Permit (62-604.300(8) (a))
- E. The Contractor shall implement the appropriate treatment that is acceptable to FDEP and County to attain compliance for all excess limits encountered during dewatering activities. Treatment may include, but is not limited to: Chemical, Biological, Electrolysis or any combination of the three.
- F. The Contractor shall make every effort to minimize the spread of contamination into uncontaminated areas. Provide for the health and safety of all workers at the job site and make provisions necessary for the health and safety of the public that may be exposed to any potentially hazardous conditions. Ensure provision adhere to all applicable laws, rules or regulations covering hazardous conditions and will be in a manner commensurate with the level of severity of the conditions.
- G. If necessary, provide contamination assessment and remediation personnel to handle site assessment, determine the course of action necessary for site security and perform the necessary steps under applicable laws, rules and regulations for additional assessment and/or remediation work to resolve the contaminations issue.

- H. Delineate the contamination area(s) and any staging or holding area required and develop a work plan that will provide the schedule of projected completion dates for the final resolution of the contamination issue.
- I. Maintain jurisdiction over activities inside any delineated contamination areas and any associated staging or holding areas. Be responsible for the health and safety of workers within the delineated areas. Provide continuous access to representatives of regulatory or enforcement agencies having jurisdiction.

3.04 REMOVAL

Immediately upon completion of the dewatering system, the Contractor shall remove all of his equipment, materials, and supplies from the site of the Work, remove all surplus materials and debris, fill in all holes or excavations, and grade the site to elevations of the surface levels which existed before work started. The site shall be thoroughly cleaned and approved by the County.

END OF SECTION

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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 02360
SHEET STEEL PILING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The Work covered in this Section consists of furnishing all labor, equipment, appliances, and materials and performing all operations in connection with the installation of a steel sheet piling wall in strict accordance with this Section of the specification, Appendix F "Structural Engineering Report (Sheet Piling)", and the applicable Drawings, and subject to the terms and condition of the Contract.
- B. Work Included: The Work to be performed under this Section of the specifications includes, but is not limited to the following:
 - 1. Furnishing and driving of all steel piling required, including special piling required for closures and corners.
 - 2. Excavation, removal, and disposal of all materials and obstructions of whatever nature encountered that interfere with the driving of the sheet piling.

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."
- B. Shop Drawings:
 - 1. The Contractor shall prepare as soon as possible after award of the contract, complete and accurate Shop Drawings of all Work of this Section. The Drawings shall include the size and spacing of all steel members. All members shall be numbered for identification in erection. Shop Drawings shall give complete information necessary for fabrication of component parts of the structure, including location, type, and size of all bolts and welds. Shop and field welds shall be clearly distinguished. Welding symbols used on Shop Drawings shall be American Welding Society symbols. The types of steel used for component parts shown shall be noted on each Shop Drawing. Drawings shall show complete dimensioned layout of all steel sheet piling.
 - 2. No steel shall be ordered until such drawings have been approved by the County.
 - 3. Approval by the County covers general design of details only, and if any change is made, which would cause members not to fit, or would not give sufficient strength, the Contractor shall call the County's attention to the fact at once, in writing, so that corrections may be made. If the Contractor fails to do this, the sole responsibility shall rest upon the Contractor.
 - 4. Any error or omission on the Contractor's Drawings, even though approved, shall not relieve the Contractor from the responsibility of performing the Work in accordance with the specifications.

5. Any details not sufficiently shown on the plans shall be furnished to the Contractor by the County upon request.

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. Steel Sheet Piling: Steel Sheet Piling shall be domestic steel or equivalent, conforming to the requirements of ASTM A-328 or approved equal and shall be given a protective coating as specified in the Contract.
 1. The Contractor shall be required to furnish the County with three (3) certified copies of the records of chemical and physical tests of the steel sheet piling. One bending test will be required upon at least 1-piece taken at random from every 30-tons of sheet piling. The testing agency shall be approved by the County. All costs in connection with testing shall be paid by the Contractor.
- B. Protective Coating
 1. General: All bulkhead steel sheet piling shall be given a protective coating as hereinafter specified. Each sheet shall be coated, within the limits shown of the Drawings, with 1 coat of primer and 1 coat of coal tar epoxy.
 - a. Surface Preparation: The surfaces to be coated shall be dry grit-blasted. All Work blasted in 1-day must be coated on that day and before the dew point has been reached. Any blasted area, not coated, which is exposed overnight, shall be at least whip-blasted again before primer application. All areas of the surface to be blasted which show any trace of oil or grease shall be degreased using V.M. and P. Naphtha, or Xylol, prior to grit blasting. All surfaces to be coated shall be completely dry, free of soil, dust, oil, paint, scale, and grit at the time of application of the primer.
 - b. Application: Both the primer and the coal tar epoxy shall be prepared and applied in strict conformance with the manufacturer's instructions and recommendations, except as herein modified. Dry film thickness of the primer shall be 3-mils minimum. Dry film thickness of the coal tar epoxy shall be 10-mils minimum. The Contractor shall submit certification that the minimum film thickness requirements have been met. The primer shall be allowed to cure a minimum of 24-hours before application of the coal tar epoxy.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The Contractor shall ascertain the location of any utilities or drain lines that pass through the area in which the sheet piling is to be driven, and shall protect same during installation of sheet piling.
- B. Piles shall be carefully located as shown on the Drawings, in accordance with approved Shop Drawings and driven in a plumb position, each pile interlocked with adjoining piles for its entire length. The Contractor shall drive all piles true to line and shall provide suitable temporary wales or guide structures to insure that the piles are driven in correct alignment. All piles shall be driven to depths shown on the Drawings and shall extend to the elevations indicated for the tops of the piles.
- C. Driving: Piles shall be driven by approved methods in such a manner as not to subject the piles to serious injury and to insure proper interlocking throughout the length of the piles. Pile hammers shall be of approved sizes and types and shall be maintained in proper alignment during driving operations by use of suitable leads or by guides attached to the hammer. A protecting cap of approved design shall be employed in driving, when required, to prevent damage to the tops of piles. Vibratory drivers/Extractors are also acceptable. All piles shall be driven without the aid of a water jet, unless otherwise authorized. If at any time the forward or leading edge or the piling wall is found to be out of plumb in the plane of the wall, the piles already assembled and partly driven shall be driven to full depth and the Contractor shall provide and drive tapered piles or take other corrective measures to insure succeeding piles are plumb. The maximum permissible taper for any tapered pile will be 1/8- inch per foot of length. Each run of piling shall be driven to grade progressively from the start and no pile shall be driven to a lower grade than those behind it in the same run except when the piles behind it cannot be driven deeper. If the pile next to the one being driven tends to follow below final grade, it may be pinned to the next adjacent pile. Piles driven out of interlock with adjacent piles or otherwise injured shall be removed and replaced by new piles at the Contractor's expense. Piles shall not be driven within 100-feet of concrete less than 7-days old.
- D. Sheet piling shall be installed plumb and true with the following tolerances:
 - 1. Deviation from vertical, not more than 1/8-inch per foot.
 - 2. Alignment, in any given 30-foot length of bulkhead: no point at the top of the bulkhead, before capping, shall deviate more than 2-inches from a straight line.
 - 3. After capping there shall be no deviation of more than 1-inch in any 30-feet for the cap.

- E. Cutting and Splicing Piles: Accepted piles driven to refusal and extending above cut-off elevation shall be cut off to required grade. Piles driven below grade and piles which, because of damaged heads have been cut off to permit further driving and are then too short to reach final grade shall be extended to the required grade by welding an additional length, when directed, without cost to the County. The Contractor shall trim the tops of piles exclusively battered during driving, when directed to do so, at no cost to the County. Cut-offs shall become the property of the Contractor and shall be removed from the site. The Contractor shall cut holes in the piles for bolts, rods, drains, or utilities at locations and of sizes shown on the Drawings or as directed.
- F. Welding: Where welding is specified or permitted by the County it shall conform to the AWS Specifications and shall be performed in the presence of a representative of and approved inspection agency.

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 02572
SOIL CEMENT BASE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Furnish and install base course using a combination of soil, Portland cement, and water.

1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO) latest edition:
 - 1. AASHTO T-88: Particle Size Analysis of Soils
 - 2. AASHTO T-89: Determining the Liquid Limit of Soils
 - 3. AASHTO T-90: Determining the Plastic Limit and Plasticity Index of Soils
 - 4. AASHTO T-134: Moisture-Density Relations of Soil-Cement Mixtures
 - 5. AASHTO T-135: Wetting and Drying Test of Compacted Soil-Cement Mixtures
 - 6. AASHTO T-267: Determination of Organic Content in Soils by Loss on Ignition
- B. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, latest implemented edition:
 - 1. Specification Section 911: Limerock Material for Base and Stabilized Base
 - 2. Specification Section 916: Bituminous Materials
 - 3. Specification Section 921: Portland Cement and Blended Cement

1.03 QUALITY ASSURANCE

- A. For density and thickness determination, a LOT is defined as 2,500 square yards of base, plus any small section of base at the end of a day's operation in the preceding LOT. The County may include small irregular areas as part of another LOT. Areas such as an intersection, crossover, and ramp will be considered as a separate LOT. No LOT shall include more than 3,500 square yards or it shall be considered as a separate LOT.
- B. Five (5) density tests shall be performed at locations randomly selected by the County within each LOT.
- C. Five (5) thickness measurements shall be performed at locations randomly selected by the County within each LOT. Three-inch minimum diameter test holes are required to determine the thickness.

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. Soil-cement design mix

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. Cement shall be Portland cement, Type I, II, III, or Type 1-P per FDOT Specification Section 921.
- B. Use water that is free from substances deleterious to hardening of the soil-cement mixture.
- C. Curing Material shall be per FDOT Specification Section 916.
- D. Emulsified asphalt shall be Grade SS, RS, or MS as approved by the County. Dilute as recommended by the manufacturer.
- E. Soils for base course construction shall be either limerock material per FDOT Specification Section 911 or soils meeting the following requirements:

**Table 02572-1
Soil Requirements**

Physical Characteristic	Acceptance Level	Testing Standard
Organic Material	Maximum 5%	AASHTO T-267
Total Clay and Silt Content (Minus No. 200 Sieve)	Maximum 25%	AASHTO T-88
Plastic Index	Maximum 10%	AASHTO T-90
Liquid Limit	Maximum 25%	AASHTO T-89

**Table 02572-2
Soil Gradation Requirements**

Soil Gradation Requirements (Per AASHTO T-88)	
Passing 2-inch sieve	Minimum 100%
Passing No. 4 sieve	Minimum 55%
Passing No. 10 sieve	Minimum 37%

2.03 PROPORTIONING OF MIX

- A. Submit for approval a design mix for the soil proposed for use in soil-cement construction prepared by a testing laboratory approved by the County. The design mix submittal shall include the results of tests run to verify that the soil meets the requirements; results of tests used to establish the cement content; and a final design laboratory sample. Submit the design mix to the County for approval a minimum of 60-calendar days prior to beginning of soil-cement construction for Brush Loss Design Method or 15-calendar days prior to beginning of soil-cement construction for Strength Design Method. Express the cement as a percentage of the dry unit weight of the soil. For mixed-in-place construction, use a ratio of cement based on the maximum density of the soil determined in accordance with AASHTO T-99 and rounded up to the nearest pound per cubic yard.
- B. When proportioning the soil-cement mixture in accordance with strength design, determine the minimum cement content using FM 5-520. The design compressive strength specified shall be achieved in 7-days. Ensure that the cement content is not less than 5% by weight except as noted below.
- C. When proportioning the soil-cement mixture in accordance with Brush Loss Design criteria, determine the minimum cement content in accordance with AASHTO T-135. Ensure that the cement content is not less than 5% by weight except as noted below. Ensure that the soil-cement loss at the completion of 12 cycles of testing conforms to the limits in the following table.

**Table 02572-3
Soil Limits**

Soil Group	Limits
AASHTO Soils Groups A-1, A-2-4, A-2-5, and A-3	Not over 14%
AASHTO Soils Groups A-2-6, A-2-7, A-4, and A-5	Not over 10%
AASHTO Soils Groups A-6 and A-7	Not over 7%

- D. When proportioning of soil-cement mixture by the Brush Loss Design Criteria Method and processing by Central-Plant-Mixing where the requirements noted below are met, the County will not require strength testing of field specimens. Verify the properties of the parent material during the processing, on a random frequency, to ensure that the final mix has not changed from the original design. Provide the County a printout of each day's production that shows proportioning of the mixture meets the approved Brush Loss Design, including cement.
- E. Do not apply the minimum 5% cement content specified above if obtaining the soil material used in producing a soil-cement mixture from a commercial source (not to exclude recycled materials) where soil properties are consistently uniform, and if processing the mixture in a central mix plant that automatically weighs components and automatically records the weight of each component on a printed ticket, tape, or other digital record.

PART 3 - EXECUTION

3.01 GENERAL

- A. Use any machine, combination of machines, or equipment that is in good, safe working condition and that will produce results meeting the requirements for cement application, soil pulverization, mixing water application, compaction, finishing, and curing, as required herein. Compaction equipment shall be used that will produce a base at the required density.

3.02 SUBGRADE PREPARATION

- A. Subgrade shall be completed before beginning base construction operations. Ensure that the subgrade is firm enough to support the equipment used in the soil-cement base operations without appreciable distortion or displacement. Remove any unsuitable material and replace it with suitable material.
- B. When constructing the base with central-plant-mixed soil-cement, grade and shape the subgrade to the lines, grades, and typical cross-section shown in the plans. Ensure that the subgrade is moist but not ponded at the time of placing the mixed base course material.

3.03 BASE SOIL FOR MIXED-IN-PLACE PROCESSING

- A. Grade and shape the area over which the base is to be constructed to an elevation that will provide a base in conformance with the grades, lines, thickness, and typical cross-sections shown on the plans. Remove all roots, sticks, and other deleterious matter during processing.

3.04 PROCESSING OF SOIL-CEMENT MIXTURE

- A. Mix the soil, cement, and water either by mixed-in-place or central-plant-mix methods.
- B. Do not allow the percentage of moisture in the soil at the time of cement application to exceed the quantity that will permit a uniform and intimate mixture of soil and cement during mixing operations.
- C. During seasons of freezing temperature, do not spread any cement or soil-cement mixture unless the ambient temperature is at least 40°F in the shade.
- D. At the completion of moist-mixing, pulverize the soil so that 100% passes a 1-1/2-inch sieve, 95 to 100% passes the 1-inch sieve and a minimum of 80% passes a No. 4 sieve, exclusive of gravel, shell, or stone.
- E. Operations shall be completed within a period of 4-hours starting at the time mixing commences.

3.05 MIXED-IN-PLACE METHOD

- A. Where feasible, process the entire width of the base in a single operation. Uniformly spread the design quantity of cement on the soil at the required rate of application, by means of an approved method. Replace spread cement that becomes displaced before starting mixing. Check the uniformity of spread rate by:
 - 1. Weight of cement spread/square yards covered for a short trial section that is between 100 and 300-feet in length; or
 - 2. Use of a square yard cloth/box
- B. After applying the cement, begin mixing within 60-minutes. Initially mix the soil and cement until the cement has sufficiently blended with the soil to prevent formation of cement balls when applying additional water; then add water if necessary, and re-mix the soil-cement mixture. Do not perform windrow mixing.
- C. Process up to the full depth in 1 course, provided the distribution of cement and water and the specified density are satisfactory to the County. If not, construct courses of such thickness to obtain satisfactory results. Make provisions to achieve adequate bonding between courses.
- D. Immediately after mixing of the soil and cement, add any additional water that is necessary. If the moisture content exceeds that specified, manipulate the soil-cement mixture by re-mixing or grading as required to reduce the moisture content to within the specified range. Avoid excessive concentrations of water. Continue mixing during and after applying water until obtaining a uniform mixture of soil, cement, and water.
- E. As an alternative to the above-described procedure, the Contractor may use an approved machine that will blend the cement and the soil. Additional water may be added and mixed as necessary.

3.06 CENTRAL-PLANT-MIXED METHOD

- A. Mix the soil, cement, and water in a pugmill of either the batch or continuous-flow type. Equip the plant with feeding and metering devices that will accurately proportion the soil, cement, and water in the quantities specified. Mix soil and cement sufficiently to prevent cement balls from forming when adding additional water. Continue mixing until obtaining a uniform mixture of soil, cement, and water.
- B. Haul the mixture to the roadway in trucks equipped with protective covers. Place the mixture on the moistened subgrade in a uniform layer with suitable equipment. Do not allow more than 60-minutes to elapse between placing of soil-cement in adjacent passes of the spreader at any location, except at construction joints. Ensure that the layer of soil-cement is uniform in thickness and surface contour and in such quantity that the completed base will conform to the required grade and cross-section. Do not perform windrow mixing.

3.07 CONSTRUCTION JOINTS

- A. Prior to joining any previously constructed section of base, form a vertical construction joint by cutting back into the completed work to form a true vertical face of acceptable soil-cement to the full depth of the base course. Moisten the vertical face as needed prior to placing new material against it.

3.08 SHAPING AND FINISHING

- A. Prior to final compaction, shape the surface of the soil-cement to the required lines, grades, and cross-section. In all cases where adding soil-cement mixture to any portion of the surface, lightly scarify the surface with a spring tooth harrow, spike drag, or other approved device to uniformly loosen the surface prior to adding material and prior to the initial set of the soil-cement mixture. Compact the resulting surface to the specified density. Continue rolling until all rutting ceases and until the base conforms to the density requirements.
- B. Ensure that the surface material is moist but not ponded, and maintained at not less than 2% below its specified optimum moisture content, during finishing operations. Perform surface compaction and finishing in such a manner as to produce a smooth dense surface, free of compaction planes, construction cracks, ridges, and loose material.
- C. If the time limits specified above are exceeded, either remove and replace the base or leave the base undisturbed for a period of 7-days, after which, the County will examine it to determine its suitability. If found unsuitable, remove and replace the base at no additional cost to County.

3.09 COMPACTION

- A. Begin compacting the soil-cement mixture immediately after mixing or placing. Do not allow more than 30-minutes to elapse between the last pass of moist-mixing or spreading and the start of compaction of the soil-cement mixture at a particular location.
- B. Determine the optimum moisture content and the maximum density in the field by the methods prescribed in AASHTO T-134 on representative samples of the soil-cement mixture obtained immediately after the initial mixing. Determine the density for each day's run or change of material.
- C. Uniformly compact the loose material to meet the density requirements specified below. During compaction operations, reshape the material to obtain required grade and cross-section.

3.10 PROTECTION AGAINST DRYING

- A. While finishing and correcting the surface, keep the surface of the base continuously moist by sprinkling water as necessary until applying the emulsified asphalt curing material. As soon as practicable, protect the base from drying for 7-days by applying the emulsified asphalt at the rate of 0.20 to 0.25-gallons of the diluted mixture per square yard. Provide complete coverage without excessive runoff. While applying the bituminous material, ensure that the soil-cement surface is dense, free of all loose and extraneous material, and contains sufficient moisture to prevent excessive penetration of the bituminous materials.
- B. If it is necessary to allow construction equipment or other traffic to use the completed base before the bituminous material has cured sufficiently to prevent pickup or displacement, sand the bituminous material, using approximately 10-lbs of clean sand per square yard. Do not use cover material containing organic acids or other compounds detrimental to the soil-cement base.
- C. Maintain the curing material during the 7-day protection period.

3.11 OPENING TO TRAFFIC

- A. Do not allow traffic on the base subsequent to completion of the finishing operations for a minimum period of 72-hours. As an exception to this requirement, allow equipment necessary for correction of surface irregularities, application of water, and application of curing materials on the base, if the tire contact pressures of such equipment do not exceed 45-psi. Under special conditions (i.e. low speed limit, low traffic volume, urban conditions), the County may waive the 72-hour period.

3.12 MAINTENANCE

- A. Maintain the base to a true and satisfactory surface until the wearing surface is constructed. If the County requires any repairing or patching, extend the repair or patch to the full depth of the base, and make them in a manner that will ensure restoration of a uniform base course in accordance with the requirements of these Specifications. Do not repair the base by adding a thin layer of soil-cement or concrete to the completed work. Make full depth repairs to small or minor areas, such as at manholes or inlets, with Class I concrete.
- B. For patching of deficient areas less than 100-square feet and less than 1-inch in depth, correct the areas using Type S-III Asphalt Concrete. For patching of deficient areas less than 100-square feet and greater than 1-inch in depth, remove the areas to full depth and replace them using Asphalt Base Course Type 3, Type S Asphaltic Concrete, or soil-cement.

3.13 DENSITY TESTING REQUIREMENTS

- A. As soon as possible after completing compaction, perform field density testing to ensure that the density is 97% of the maximum density as determined by methods prescribed in AASHTO T-134.
- B. If an individual test value within a LOT is less than 94% of the maximum density, determine the extent of this deficiency by performing density tests using a 5-foot grid pattern until a test value of 95% or greater is located in all directions. Remove the delineated area of base, and replace it with base meeting all requirements of this section, at no cost to the County.
- C. As an exception to the foregoing, if 3 or more of the original 5 individual test values within a LOT are less than 94% of the maximum density, the County will reject the entire LOT, and the Contractor shall remove all base within the LOT and replace it with base meeting all requirements of this Section, at no expense to the County.

3.14 SURFACE FINISH ACCEPTANCE REQUIREMENTS

- A. After compacting and finishing, and not later than the beginning of the next calendar day after constructing any section of base, measure the surface with a template cut to the required cross-section and a 15-foot straightedge placed parallel to the centerline of the road. Both templates shall be provided by the Contractor. Correct all irregularities greater than 1/4-inch to the satisfaction of the County with a blade adjusted to the lightest cut which will ensure a surface that does not contain depressions greater than 1/4-inch under the template or the straightedge. The County may approve other suitable methods for measurement.

3.15 THICKNESS ACCEPTANCE REQUIREMENTS

- A. Construction tolerances for thickness are as follows:

**Table 02572-4
Thickness Tolerances**

	Allowable Deviation From Plan Thickness
Central-Plant-Mixed Processing	-1-inch
Mixed-in-Place Processing	+/- 1-inch

- B. When any thickness measurement is outside the construction tolerance, the County will take additional thickness measurements at 10-foot intervals parallel to the centerline in each direction from the measurement which is outside the construction tolerance until a measurement in each direction is within the construction tolerance.
- C. The County will evaluate an area of base found to have a thickness outside the construction tolerance and may require the Contractor to remove and replace it with acceptable base of the thickness shown in the plans at no expense to the County.

3.16 STRENGTH TESTING OF FIELD SPECIMENS

- A. Check the adequacy of cement content and uniformity of distribution of cement within the base by sampling and testing the completed mix.
- B. Take samples at the project site just prior to final compaction and perform a minimum of 2 Strength Test Values (STV) each day, with at least 1 STV per each 2,500 square yards mixed.
- C. Ensure that each STV is the average strength value of a minimum of 3 individual specimens.
- D. Take representative samples of the mixed soil-cement material for determining an STV just prior to final compaction, recording the sample location, and ensuring that the samples are large enough to mold 3 or more compressive strength test specimens as prescribed in FM 5-520.
- E. Mold test specimens at the field moisture content and cast the individual test specimens as close to identical as possible
- F. Rest the molds during compaction of strength test specimens on a 200-pound concrete block that the Contractor provides.
- G. Gently extrude these test specimens from the compaction mold, and carefully place them in a moist curing environment (not in direct contact with water) such as a tightly closed container under wet cloth or burlap at locations where they will not be disturbed.

- H. Continue the initial field cure for at least 24-hours, and if after 24-hours it is determined that the specimens have not gained sufficient strength to be moved without probable damage, continue field curing until the County determines that each specimen can be safely moved without probable damage occurring. When the County determines that the specimens can be safely moved, transport them to the laboratory where they will be cured, as described in the design procedure (FM 5-520), to 7-days of age. At 7-days of age, test the individual specimen for determination of compressive stress and ensure that the loading procedure and rates are the same, as described in FM 5-520.
- I. If an STV is less than 60% of the Laboratory Design Strength, remove and replace the material represented by the STV, at no expense to the County.
- J. When the LOT average thickness of soil-cement base is deficient by more than 1-inch and the judgment of the County is that the area of such deficiency should not be removed and replaced, payment for the area retained will be at 50%.
- K. When multiple deficiencies occur, the applicable percent payment schedule will be applied to the LOT of base that is identified with each deficiency. The penalty for each deficiency will be applied separately to the unit price.

END OF SECTION

SECTION 02573

ASPHALT PAVEMENT REMOVAL AND REPLACEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Mill or remove existing asphalt pavement and base materials and install asphalt paving on a prepared base or as an overlay to existing asphalt pavement sections. Provide Maintenance of Traffic and coordinate and install temporary and permanent replacement of traffic signalization and pavement striping and markings.

1.02 REFERENCES

- A. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, 2000 and 2004 editions.
 - 1. Section 300 – Prime and Tack Coats for Base Courses (2000 and 2004 Editions)
 - 2. Section 320 – Hot Bituminous Mixtures – Plant, Methods, and Equipment (2000 and 2004 Editions)
 - 3. Section 327 – Milling of Existing Asphalt Pavement (2000 and 2004 Editions)
 - 4. Section 330 – Hot Bituminous Mixtures – General Construction Requirements (2000 and 2004 Editions)
 - 5. Section 331 – Type S Asphalt Concrete (2000 Edition)
 - 6. Section 334 – Superpave Asphalt Concrete (2004 Edition)
 - 7. Section 901 – Coarse Aggregate (2000 and 2004 Editions)
 - 8. Section 902 – Fine Aggregate (2000 and 2004 Editions)
 - 9. Section 916 – Bituminous Materials (2000 and 2004 Editions)
 - 10. Section 917 – Mineral Filler (2000 and 2004 Editions)
- B. Florida Department of Transportation (FDOT) Design Standards, 2000 and 2004 editions.

1.03 QUALITY ASSURANCE

- A. Asphalt pavements shall be plant-mixed hot bituminous mixtures. Plant operations shall not begin unless all weather conditions are suitable for laying operations. A prime and tack coat shall be first applied to newly constructed bases. A tack coat shall be applied on existing pavements that are to be overlaid with an asphalt mix and between successive layers of asphalt mix. Apply prime and tack coats when ambient or base surface temperature is above 40°F, and when temperature has been above 35°F for 12-hours immediately prior to application. Construct asphaltic concrete paving when ambient temperature is above 45°F. Do not apply when base is wet, contains excess moisture, or during rain. Establish and maintain required lines and elevations.

- B. Do not spread the mixture when the wind is blowing to such an extent that proper and adequate compaction cannot be maintained or when sand, dust, etc., are being deposited on the surface being paved to the extent that the bond between layers will be diminished.
- C. Field compaction density and thickness testing frequencies of the asphalt 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.
- D. Asphalt extraction gradation shall be tested from grab samples collected once every 1,800-square yards of asphalt delivered to the site, or a minimum of once per day. Obtain the results in a timely manner (no later than the end of the day) so that adjustments can be made if necessary.
- E. On initial use of a Type S mix design at a particular plant, as a minimum, run an additional extraction gradation analysis if more than 500-tons [450-metric tons] of mixture are produced on the first day of production.
- F. Tolerances for Quality Control Tests (Extraction Gradation Analysis) shall be in accordance with FDOT Specification Section 331.

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. Submit for each proposed design mix the Gradation analysis; Grade of asphalt cement used; and Marshall Stability in pounds flow.
 - 2. Provide a single percentage of asphalt by weight of total mix intended to be incorporated in the completed mixture, shown to the nearest 0.1%. For structural mixes (S-1, S-3) establish the optimum asphalt content at a level corresponding to a minimum of 4.5% air voids. Provide the laboratory density of the asphalt mixture for all mixes except Open-Graded Friction Courses.
 - 3. Identify source and description of the materials to be used.
 - 4. Provide certification that the mix design conforms to specification requirements.
 - 5. Field compaction density and thickness testing.
 - 6. Field asphalt extraction gradation.

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. Type S Asphalt Concrete (Type S-1 or S-3) is required. The equivalent fine Type SP (Superpave) Asphalt Concrete mixture (Traffic Level C) meeting the requirements of FDOT Specification Section 334 may be selected as an alternate at no additional cost to the County. The equivalent mixes are as follows:
 1. Type S-1: Type SP-12.5
 2. Type S-3: Type SP-9.5
- C. Asphalt plant and equipment shall meet the requirements in FDOT Specification Section 320.

2.02 AGGREGATE

- A. Coarse Aggregate, Stone, Slag, or Crushed Gravel shall meet the requirements in FDOT Specification Section 901.
- B. Fine Aggregate shall meet the requirements in FDOT Specification Section 902.
- C. Aggregate gradation shall meet the following:

**Table 02573-1
Bituminous Concrete Mixtures
(Gradation Design Range)**

Type	Total Aggregate Passing Sieves ¹							
	3/4-inch [19.0 mm]	1/2-inch [12.5 mm]	3/8-inch [9.5 mm]	No. 4 [4.75 mm]	No. 10 [2.0 mm]	No. 40 [425 μm]	No. 80 [180 μm]	No. 200 [75 μm]
S-1 ⁴	100	88-98	75-93	47-75	31-53	19-35	7-21	2-6
S-3 ⁴		100	88-98	60-90	40-70	20-45	10-30	2-6
ABC-1		100						0-12
ABC-2		100			55-90			0-12
ABC-3 ²	70-100			30-70	20-60	10-40		2-10
FC-2 ³		100	85-100	10-40	4-12			
FC-3 ⁴		100	88-98	60-90	40-70	20-45	10-30	2-6
1. In inches [mm] or sieves [μm]. 2. 100% passing 1-1/2-inch [37.5 mm] sieve. 3. The County may increase the design range for the No. 10 [200 mm] sieve for lightweight aggregates. 4. The County may retain up to 1% on the maximum sieve size.								

- D. Use clean aggregate containing no deleterious substances. Do not use coarse or fine aggregate which contains more than 0.5% of phosphate.
- E. In laboratory tests, and for the purpose of proportioning the paving mixture, consider all material passing the No. 10 [2.00-mm] sieve and retained on the No. 200 [75 μm] sieve as fine aggregate, and the material passing the No. 200 [75 μm] sieve as mineral filler.

- F. Do not use any screenings in the combination of aggregates containing more than 15% of material passing the No. 200 [75 µm] sieve. When two screenings are blended to produce the screening component of the aggregate, one of such screenings may contain up to 18% of material passing the No. 200 [75 µm] sieve, as long as the combination of the two does not contain over 15% material passing the No. 200 [75 µm] sieve. Screenings may be washed to meet these requirements.

2.03 ASPHALT CEMENT

- A. Superpave PG Asphalt Binder or Recycling Agent shall meet the requirements in FDOT Specification Section 916.
- B. Mineral Filler shall meet the requirements in FDOT Specification Section 917.
- C. Marshall design mix shall be in accordance with the following:

**Table 02573-2
Marshall Design Properties For Bituminous Concrete Mixes**

Mix Type	Minimum Marshall Stability (lbs.)	Flow* (0.01 in)	Minimum VMA (%)	Air Voids (%)	Minimum Effective Asphalt Content (%)	VFA Voids Filled with Asphalt (%)
S-1	1,500	8-13	14.5	4-5	**	65-75
S-3	1,500	8-13	15.5	4-6	**	65-75
ABC-1	500	7-15	15	5-16	6.0	-
ABC-2	750	7-15	15	5-14	5.5	-
ABC-3	1,000	8-13	14	4-7	**	65-78
FC-2	-	-	-	-	-	-
FC-3	1,500	8-13	15.5	4-6	**	65-75

* The maximum Flow value during production shall not exceed one point more than shown in the Table.

** The ratio of the percentage by weight of total aggregate passing the No. 200 sieve to the effective asphalt content expressed as a percentage by weight of total mix shall be in the range of 0.6 to 1.2.

2.04 BITUMINOUS MIXTURE

- A. Use a bituminous mixture composed of a combination of aggregate (coarse, fine or mixtures thereof), mineral filler, if required, and bituminous material. Ensure that no more than 20% by weight of the total aggregate used is silica sand or local materials as defined in FDOT Specification Section 902. Size, grade, and combine the several aggregate fractions in such proportions that the resulting mixture meets the grading and physical properties of the verified mix design.

PART 3 - EXECUTION

3.01 GENERAL

- A. Set up, install and maintain temporary traffic control devices and detours as necessary in accordance with Specification Section 1570 "Maintenance of Traffic."
- B. Asphalt pavements, including all surface courses and base courses, where shown to be open cut and removed on the Drawings or specified in the Project Manual, shall be removed to a line back from each edge of the trench, other excavation, or to the limits indicated on the Drawings. Pavements shall be cut straight, clean and square with a power saw or other tools and equipment suitable for the Work.
- C. Asphalt pavements, where shown to be milled on the Drawings or specified in the Project Manual, shall be milled according to FDOT Specification Section 327.
- D. Asphalt mixtures shall meet the general construction requirements specified in FDOT Specification Section 330.
- E. Spread the mixture only when the surface upon which it is to be laid has been previously prepared, is intact, firm, and properly cured, and is dry. Do not spread mixture that cannot be finished and compacted during daylight hours.
- F. Deliver the asphalt cement from the asphalt plant at a temperature not to exceed 350°F and equip the transport tanks with sampling and temperature sensing devices meeting the requirements of FDOT. Maintain the asphalt cement in storage within a range of 230°F to 350°F in advance of mixing operations. Maintain constant heating within these limits, and do not allow wide fluctuations of temperature during a day's production.
- G. Produce a homogeneous mixture, free from moisture and with no segregated materials, that meets all specification requirements for the mixture, including compliance with the Marshall Properties. Also apply these requirements to all mixes produced by the drum mixer process and all mixes processed through a hot storage or surge bin, both before and after storage.

3.02 PREPARATION OF APPLICATION SURFACES

- A. Prior to the laying of the mixture, clean the surface of the base or pavement to be covered of all loose and deleterious material by the use of power brooms or blowers, supplemented by hand brooming where necessary.
- B. Where an asphalt mix is to be placed on an existing pavement or old base that is irregular, and wherever the plans indicate, bring the existing surface to proper grade and cross-section by the application of patching or leveling courses.
- C. Where an asphalt mix is to be placed over a newly constructed surface treatment, sweep and dispose of all loose material from the paving area.

- D. Paint all structures which will be in actual contact with the asphalt mixture, with the exception of the vertical faces of existing pavements and curbs or curb and gutter, with a uniform coating of asphalt cement to provide a closely bonded, watertight joint.
- E. Apply a prime and tack coat on newly constructed bases and apply a tack coat, as specified in FDOT Specification Section 300, on existing pavement structures that are to be overlaid with an asphalt mix and between successive layers of all asphalt mixes.

3.03 PLACING MIXTURE

- A. Lay all asphaltic concrete mixtures, including leveling courses, other than adjacent to curb and gutter or other true edges, by the string line method to obtain an accurate, uniform alignment of the pavement edge.
- B. For each paving machine operated, use a separate crew, each crew operating as a full unit. The Contractor's Certified Paving Technician in charge of the paving operations may be responsible for more than one crew but must be physically accessible to the County at all times when placing mix.
- C. Check the depth of each layer at frequent intervals, and make adjustments when the thickness exceeds the allowable tolerance. When making an adjustment, allow the paving machine to travel a minimum distance of 32-feet to stabilize before the second check is made to determine the effects of the adjustment.
- D. In limited areas where the use of the spreader is impossible or impracticable, the Contractor may spread and finish the mixture by hand.
- E. Straightedge and back-patch after obtaining initial compaction and while the material is still hot.
- F. Upon arrival, dump the mixture in the approved mechanical spreader, and immediately spread and strike-off the mixture to the full width required, and to such loose depth for each course that, when the Work is completed, the required weight of mixture per square yard [square meter], or the specified thickness, is secured. Carry an excess amount of mixture ahead of the screed at all times. Hand-rake behind the machine as required.
- G. Construct each course in layers of the thickness as shown on FDOT Design Standards Index No. 513.
- H. Before starting any rolling, check the surface; correct any irregularities; remove all drippings, fat sandy accumulations from the screed, and fat spots from any source; and replace them with satisfactory material. Do not skin patch. When correcting a depression while the mixture is hot, scarify the surface and add fresh mixture.

3.04 APPLICATION OF LEVELING COURSES

- A. Before spreading any leveling course, fill all depressions in the existing surface more than 1-inch deep by spot patching with leveling course mixture, and then compact them thoroughly.
- B. Place all courses of leveling by the use of two (2) motor graders; equip one with a spreader box. Use other types of leveling devices after they have been approved by the County.
- C. When the total asphalt mix provided for leveling exceeds 50-lb/yds² [27-kg/m²], place the mix in two or more layers, with the average spread of any layer not to exceed 50-lb/yd² [27-kg/m²]. When using Type S-3 Asphaltic Concrete for leveling, do not allow the average spread of a layer to be less than 50-lb/yd² [27-kg/m²] or more than 75-lb/yd² [40-kg/m²]. The Contractor may vary the rate of application throughout the Project as directed by the County. When leveling in connection with base widening, the County may require placing all the leveling mix prior to the widening operation.

3.05 COMPACTING MIXTURE

- A. The coverage is the number of times the roller passes over a given area of pavement. Regardless of the rolling procedure used, complete the final rolling before the surface temperature of the pavement drops below 160°F.
- B. Seal Rolling: Provide two (2) coverages with a tandem steel-wheeled roller (either vibratory or static), weighing 5 to 12-tons, following as close behind the spreader as possible without pick-up, undue displacement, or blistering of the material. Use vibratory rollers in the static mode for layers of 1-inch or less in thickness.
- C. Intermediate Rolling: Provide five (5) coverages with a self-propelled pneumatic-tired roller, following as close behind the seal rolling operation as the mix will permit.
- D. Final Rolling: Provide one (1) coverage with a tandem steel-wheeled roller (static mode only), weighing 5 to 12-tons, after completing the seal rolling and intermediate rolling, but before the surface pavement temperature drops below 160°F.
- E. Operate the self-propelled, pneumatic-tired roller at a speed of 6 to 10-mph. For each roller, do not exceed an area of coverage of 4,000 yd²/hour; if rolling Type S Asphaltic Concrete, do not exceed an area of coverage of 3,000 yd²/hour.
- F. Use a sufficient number of self-propelled pneumatic-tired rollers to ensure that the rolling of the surface for the required number of passes does not delay any other phase of the laying operation and does not result in excessive cooling of the mixture before completing the rolling. In the event that the rolling falls behind, discontinue the laying operation until the rolling operations are sufficiently caught up.

- G. Use hand tamps or other satisfactory means to compact areas which are inaccessible to a roller, such as areas adjacent to curbs, headers, gutters, manholes, etc.
- H. Use self-propelled pneumatic-tired rollers to roll all patching and leveling courses. Where placing the initial leveling course over broken concrete pavement, use a pneumatic-tired roller that weighs at least 15-tons. For Type S-3 Asphaltic Concrete leveling courses, use a steel-wheeled roller to supplement the traffic rollers. On other leveling courses, use a steel-wheeled roller to supplement the traffic rollers on all passes after the first pass.
- I. Do not allow the rollers to deposit gasoline, oil, or grease onto the pavement. Remove and replace any areas damaged by such deposits as directed by the County. While rolling is in progress, test the surface continuously, and correct all discrepancies to comply with the surface requirements. Remove and replace all drippings, fat or lean areas, and defective construction of any description. Remedy depressions that develop before completing the rolling by loosening the mixture and adding new mixture to bring the depressions to a true surface. Should any depression remain after obtaining the final compaction, remove the full depth of the mixture, and replace it with sufficient new mixture to form a true and even surface. Correct all high spots, high joints, and honeycombing as directed by the County. Remove and replace any mixture remaining unbonded after rolling. Correct all defects prior to laying the subsequent course.
- J. Use a self-propelled pneumatic-tired roller on the first structural layer placed on a milled surface. Compact with a minimum of three passes.

3.06 JOINTS

- A. Place the mixture as continuously as possible. Do not pass the roller over the unprotected end of the freshly laid mixture except when discontinuing the laying operation long enough to permit the mixture to become chilled. When thus interrupting the laying operation, construct a transverse joint by cutting back on the previous run to expose the full depth of the mat.
- B. For all layers of pavement except the leveling course, place each layer so that longitudinal construction joints are offset 6-inches to 12-inches laterally between successive layers.
- C. When laying fresh mixture against the exposed edges of joints (trimmed or formed as provided above), place it in close contact with the exposed edge to produce an even, well-compacted joint after rolling.

3.07 SURFACE REQUIREMENTS

- A. Obtain a smooth surface on all pavement courses placed, and then straightedge all intermediate and final courses with a 15-foot rolling straightedge. Furnish a 15-foot [4.572-m] manual straightedge, and make it available at the job site at all times during the paving operation for checking joints and surface irregularities.

- B. Produce a finished surface of uniform texture and compaction with no pulled, torn, or loosened portions and free of segregation, sand streaks, sand spots, or ripples.

3.08 ACCEPTANCE REQUIREMENTS

- A. Upon completion of the final surface or friction course, the County will test the finished surface with a 15-foot rolling straightedge. Correct all deficiencies in excess of 3/16-inch.
- B. If correction is made by removing and replacing the pavement, remove the full depth of the course and extend at least 50-feet on either side of the defective area for the full width of the paving lane.
- C. If correction is made by overlaying, cover the length of the defective area and taper uniformly to a featheredge thickness at a minimum distance of 25-feet on either side of the defective area. Extend the overlay the full width of the roadway. Maintain the specified cross slope. The County may adjust, as necessary, the mix used for the overlay for this purpose.
- D. The maximum deficiency from the specified thickness as follows:
 - 1. For pavement of a specified thickness of 2-1/2-inches or more: 1/2-inch
 - 2. For pavement of a specified thickness less than 2-1/2-inches: 1/4-inch
- E. Where the deficiency in thickness is: (1) in excess of 3/8-inch for pavement of less than 2-1/2-inches in specified thickness, or (2) in excess of 3/4-inch for pavement of specified thickness of 2-1/2-inches or more, correct the deficiency either by replacing the full thickness for a length extending at least 50-feet from each end of the deficient area.
- F. For any case of excess deficiency of the pavement, if approved by the County for each particular location, correct the deficient thickness by adding new surface material, and compact it to the same density as the adjacent surface. The County will determine the area to be corrected and the thickness of new material added.

3.09 REPAIR AND RESTORATION

- A. Replace asphalt pavement or roadway surfaces cut or damaged to equal or better condition than the original, including stabilization, base course, surface course, curb and gutter, and other appurtenances.

3.10 SIGNALIZATION, PAVEMENT STRIPING AND MARKING

- A. The Contractor shall be responsible for coordinating, repairing or replacing all traffic signalization devices and traffic loops damaged during the pavement milling, removal and replacement process.

- B. The Contractor shall be responsible for coordinating, inventorying, and replacing all temporary and permanent pavement striping and markings damaged during the asphalt pavement milling, removal, and replacement process.
- C. Temporary pavement striping and markings shall be paint or reinforced retro-reflective removal tape. Foil back tape is not acceptable. Permanent pavement striping and markings shall be alkyd thermoplastic tape and raised reflective pavement markers.

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 02577
STORMWATER SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Construction of culverts, storm sewers, inlets, and other drainage structures as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

- A. Provide certification of quality by manufacturer to County 10-days prior to delivery to the job site.

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. Grates and castings
 - 2. Precast structures
 - 3. Product data for drainage piping
- B. SUBMITTALS: Submittals shall be submitted to the County for review and acceptance.
 - 1. Pipe certification of quality by manufacturer shall be delivered to County 10-days prior to delivery to the job site.

1.04 JOB CONDITIONS

- A. Existing Drainage System: Maintain operational and prevent siltation.
 - 1. Perform site survey, research public utility records and verify existing utility locations. Verify that storm system shall be installed in compliance with the Drawings and Specifications prior to installation.
 - 2. Coordinate with other utility work.

1.05 REFERENCES

- A. Applicable Codes, Standards, and Specifications: The drainage work under this contract shall be in strict accordance with the applicable provisions of the following;
 - 1. The Florida Department of Transportation "Standard Specifications for Road and Bridge Construction" Latest Edition (DOT)
 - 2. American Association of State Highway and Transportation Officials (AASHTO)

3. American Society for Testing and Materials (ASTM) including
 - a. ASTM C76: Reinforced Concrete Culvert, Storm Drain and Sewer Pipe; and
 - b. ASTM C443: Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets

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. General: The Contractor shall furnish drainage pipe as shown on the Drawings.
- B. Reinforced Concrete Pipe (RCP)
 1. Concrete pipe: Concrete pipe shall be reinforced concrete culvert pipe conforming to ASTM Designation C-76, Table III, except when otherwise indicated. Pipe joints shall be rubber gasket joints, and the pipe joint shall be manufactured to meet the requirements of the approved type of gasket to be used. Pipe joints and rubber gaskets shall conform to the requirements of Sections 941 and 942 of the FDOT Standard Specifications.
- C. Drainage Structures
 1. Brick: Brick for drainage structures shall be dense, hard burned, shale or clay brick conforming to ASTM Designation C 32, Grade MM or C 62, Grade MW, except that brick absorption shall be between 5 and 25 grams of water absorbed in 1-minute by dried brick, set flat face down, in 1/8-inch of water.
 2. Cement Mortar: Cement mortar for manhole construction shall be 1 part cement and 2 parts clean sharp sand to which may be added lime in the amount of not over 25% volume of cement. It shall be mixed dry and then wetted to proper consistency for use. No mortars that have stood for more than 1-hour shall be used.
 3. Concrete: Concrete shall be Class I that conforms to the requirements of Section 345: Portland Cement Concrete. FDOT Standard Specifications for Road and Bridge Construction (latest edition).
 4. Precast Concrete Structures: Precast concrete structures shall conform to applicable requirements of FDOT Standard Specification for Road and Bridge Construction (latest edition) and FDOT Roadway and Traffic Design Standard (latest edition).
 5. Castings: Castings for inlets and other items shall conform to the ASTM Designation A-48, Class 25. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions that would impair their strength or otherwise make them unfit for the service intended. No plugging or filling will be allowed. Casting patterns shall conform to those shown or indicated on the Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Pipe Trenches

1. Pipe trenches shall be prepared in accordance with Section 02220 "Excavating, Backfilling, and Compacting."

3.02 INSTALLATION

A. Laying Drainage Pipe

1. Join pipe and fittings with rubber gaskets in accordance with C443, and install piping in accordance with applicable provisions of ACPA "Concrete Pipe Installation Manual." All pipe shall be carefully laid true to the line and grade shown on the Drawings. Any deviation from true alignment or grade which would result in a displacement from the normal position of the gasket of as much as 1/4-inch, or which would produce a gap exceeding 1/2-inch between sections of pipe for more than 1/3 of the circumference of the inside of the pipe, will not be acceptable and where such occurs, the pipe shall be re-laid without additional compensation. No mortar, joint compound, or other filler which would tend to restrict the flexibility of the gasket joint shall be applied to the gap. Pipes having defects that have not caused their rejection are to be so laid that these defects will be in the upper half of the sewer.
2. Install gaskets, seals, sleeves, and couplings in accordance to manufacturers' recommendations for use with lubricants, cements, and other installation requirements. Before installation of the pipe gasket, the gasket and the surface of the pipe joint, including the gasket recess, shall be clean and free from grit, dirt, or other foreign matter at the time the joints are made. In order to facilitate closure of the joint, application of an approved vegetable soap lubricant immediately prior to closing of the joint shall be permitted.
3. All pipes shall be laid with bells or grooves uphill. As the pipes are laid throughout the Work, they shall be thoroughly cleaned and protected from dirt and water. No length of pipe shall be laid until the two preceding lengths have been thoroughly embedded in place to prevent any movement or disturbance of the finished joint. No walking on or working over the pipes after they are laid, except as may be necessary in tamping earth and refilling, will be permitted until they are covered to a depth of 1-foot. No pipe shall be laid except in the presence of the County. Fill placed around the pipe shall be deposited on both sides simultaneously to approximately the same elevation and uniformly compacted. Whenever the pipe laying is discontinued the unfinished end is to be securely protected from displacement and a suitable stopper shall be inserted therein.

B. Drainage Structures

1. Concrete inlets or other structures shall be constructed in conformity with the Drawings. Forms shall be designed and constructed so that they may be removed without damage to the concrete and shall be left in place for at least 24-hours after concrete is placed. Concrete shall be thoroughly cleaned, saturated with water, and pointed up with mortar.

2. Precast inlets or other structures may be used in lieu of cast-in-place structures. Grates are to be set in place in mortar to the proper line and grade.

C. Backfilling for Pipe Culverts and Drainage Structures

1. After the pipe has been installed, approved selected material at a moisture content that will facilitate compaction shall be placed along side the pipe in layers not exceeding 6-inches loose measure in depth. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Each layer shall be thoroughly compacted by rolling or tamping with mechanical rammers. This method of filling and compacting shall be continued until the fill is 12-inches above the pipe, then the remainder of the backfill shall be placed in lifts not exceeding 9-inches. The operation of heavy equipment shall be conducted so that no damage to the pipe will result. Backfill material greater than 12-inches above the top of the pipe shall be compacted to not less than 95% of maximum density as determined by AASHTO Designation T-180. Selected material for backfill shall not contain any stones or rock larger than 3-inches. Tests for density of compaction may be made at the option of the County, and deficiencies shall be corrected by the Contractor without additional cost to the County.
2. Backfill for drainage structures shall be placed and compacted in the same manner as specified above for pipe, except the concrete shall be permitted to cure for not less than 5-days before the backfill is placed.

3.03 FIELD QUALITY CONTROL

- A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction.
- B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses.
- C. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
 1. Make inspections after pipe has been installed and approximately 2-feet of backfill is in place, and again at completion of project.
- D. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects and re-inspect.

END OF SECTION

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 02667
JACKING AND BORING PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work of this section includes all labor, machinery, material, construction equipment and appurtenances required to perform in a good workman-like manner all jacking and boring of the pipeline casings at designated locations and the installation of the carrier pipe within the casing.

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."
- B. Submit certificates of inspection from the pipe manufacturer certifying that steel casing pipe supplied meets the requirements of these specifications.
- C. Submit Shop Drawings of each steel casing and carrier pipe installation prior to fabrication of piping, casing, and appurtenances.
- D. Before starting excavation, the Contractor shall submit Drawings of jack pit bracing, casing (or conduit), and jacking head proposed to be used. In addition to submitting details for the jacking pit bracing and casing and jacking head, the Contractor shall submit to the County/Professional for review and record purposes 2 copies of the Drawings, design details, and calculations for support blocks, bracing to prevent pipe shifting or flotation, and pressure cement mortar mix design, placement method, and equipment.
- E. If welding of casing pipe is required, submit welder's certification.

1.03 REQUIREMENTS

- A. Unless otherwise specified, the methods and equipment used in jacking casing or conduit shall be optional with the Contractor, provided that the proposed method is approved by the County and meet all Florida Department of Transportation (FDOT) requirements. Such approval, however, shall in no way relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein. Only workmen experienced in jacking operations shall be used in performing the Work.

- B. Only a certified welder shall perform welding operations on the casing pipe. Welder's certification shall be submitted to County/Professional.
- C. Prior to commencement of jack and bore operation, the Contractor must notify the County and Professional.

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 PIPE CASING

- A. Steel casing shall be new and unused Grade B steel pipe, minimum yield strength 35,000-psi, conforming to FDOT standards, with allowance for corrosion; and shall conform to ASTM A 139 or AWWA C 200, latest editions, for fabricated pipe. Thickness shall be as shown in the table below. Joints shall be electri-fusion (arc) welded by operators qualified in accordance with American Welding Society Standard Procedure. Steel casing sizes shown are minimum required diameters. Casing sizes only pertain to installations involving a single carrier pipe.

1. Steel Casing Pipe

<u>Carrier Pipe Nominal Diameter</u>	<u>Casing Outside Diameter</u>	<u>Casing Wall Thickness</u>
4-inch	16-inch	0.250-inch
6-inch	16-inch	0.250-inch
8-inch	18-inch	0.250-inch
10-inch	20-inch	0.250-inch
12-inch	24-inch	0.250-inch
16-inch	30-inch	0.312-inch
20-inch	36-inch	0.375-inch
24-inch	42-inch	0.500-inch
30-inch	48-inch	0.500-inch
36-inch	54-inch	0.500-inch
42-inch	60-inch	0.500-inch

2.03 CARRIER PIPE

- A. Carrier pipes shall be in accordance with Section 15062 "Ductile Iron Pipe and Fittings." Restrained joints with a pressure-rating equivalent to that of the piping and a safety factor of 2 shall be used for the carrier pipe contained within casing pipes.

2.04 JOINTS

- A. The joints of sections of casing pipe to be jacked shall be welded with a continuous circumferential weld by a certified welder. It shall be the Contractor's responsibility to provide stress transfer across the joints which is capable of resisting the jacking forces involved. Welds shall be ground smooth on the side of the casing to provide smooth bore and shall not extend more than 3/4-inches beyond pipe outside diameter. Field welds shall be complete penetration, single-level groove type joint. Welds shall be airtight and continuous.

2.05 BRACING

- A. The pipe shall be braced to prevent shifting or flotation. The details of bracing and blocking of the pipe are subject to the approval of the County.

2.06 STAINLESS STEEL CASING SPACERS

- A. Carrier pipes, inside of steel casing pipe, shall be supported by casing spacers at no more than 6-1/2-feet between spacers with double spacers on each end of the casing and spacers at a maximum of 2-feet behind the bell. Each spacer shall be a minimum 8-inches wide for pipe 12-inch diameter or less or minimum 12-inches wide for pipe 16-inch or greater and manufactured of minimum 14-gauge Type 304 stainless steel. All nuts, bolts and washers shall be 304 stainless steel and compatible with the respective 304 stainless steel shell/band. Each spacer shall have a minimum of 4 runner supports manufactured of an ultra high molecular weight polyethylene or glass reinforced polymer. The runner supports shall be of adequate height to position the carrier pipe in the center of casing with a minimum top clearance of 1-1/2-inch. All casing spacers larger than 36-inch diameter (carrier pipe) shall be factory designed, taking in consideration the weight of the carrier pipe filled with water. All calculations and Drawings produced by the manufacturer shall be submitted to County/Professional for review.

2.07 CASING END SEALS

- A. Casing ends shall be sealed with brick and cement in the annular space and casing end seals shall be used to completely close both openings on either side of the casing. These end seals shall be pull on (seamless) or wrap around with stainless steel straps for securing to the carrier pipe and the casing. End seals shall be constructed of specially compounded synthetic rubber a minimum thickness of 1/8-inch.

PART 3 - EXECUTION

3.01 GENERAL

- A. The installation of pipeline casings under public highways shall be in accordance with all the requirements of encroachment permits issued by the governing agency.
- B. Once the jacking operation has commenced, it shall be continued uninterrupted around the clock until the conduit has been jacked between the specified limits.
- C. Steel casing pipe sizes shown on the Drawings are minimum sizes. Larger pipe may be provided to facilitate the installation, at no additional cost to the County. The thickness of steel casing pipe shall be of sufficient thickness and axial strength to withstand the forces to be encountered during the jacking process. Steel casing pipe shall be of the minimum length as shown on the Drawings.

3.02 EXCAVATION

- A. Every effort shall be made to avoid any loss of earth outside the jacked casing by following:
 - 1. The rear of the cutting head from advancing in front of the leading edge of the casing by more than 1/3 times the casing diameter and in stable cohesive conditions not to exceed 8-inches.
 - 2. In unstable conditions, such as granular soil, loose or flowable materials, the cutting head is retracted into the casing a distance that permits a balance between pushing pressure, pipe advancement and soil conditions.
 - 3. Development of and maintaining a log of the volume of spoil material removal relative to the advancement of the casing.
- B. Excavated material shall be removed from the conduit as excavation progresses, and no accumulation of such material within the conduit will be permitted

3.03 GROUTING

- A. In the event that ground loss does occur that produces voids outside of the casing, the voids shall be backfilled with cement grout by drilling holes in the casing at the locations of ground loss and elsewhere where voids are suspected and shall force cement grout in to fill voids to refusal at pressures determined by the County/Professional, but not to exceed 50-psi. The cement grout shall be 1 part Portland cement to 5 parts sand by volume.

3.04 LOSS OF GROUND

- A. Should appreciable loss of ground occur during the jacking operation, the voids shall be backpacked promptly to the extent practicable with soil cement consisting of a slightly moistened mixture of 1 part cement to 5 parts granular material. Where the soil is not suitable for this procedure, the Contractor shall import suitable material at his expense. The soil cement shall be thoroughly mixed and rammed into place as soon as possible after the loss of ground.

3.05 TOLERANCES

- A. Extreme care shall be exercised by the Contractor to maintain line and grade during jacking operations, and the Contractor may be required to modify the manner in which he is conducting his jacking operation to correct any deviation when deemed necessary by the County/Professional. A maximum tolerance of 0.12-foot per 100 linear feet of jacked casing is permitted.

3.06 RESPONSIBILITY

- A. The Contractor shall be fully responsible for the structural sufficiency of the casing and the placement thereof. The details shown on the Drawings are to be considered minimum only.

3.07 UNFORESEEN CONDITIONS

- A. Casing bores not completed and abandoned because of unforeseen subsurface conditions beyond the control of the Contractor shall be left in a safe condition including filling the casing or bore to restore the structural integrity of the area to a condition equal to that prior to construction. Casing or bore shall be filled completely with cement grout as previously specified.

3.08 INSTALLATION OF CARRIER PIPE

- A. Carrier pipes installed inside of steel casing pipe shall be supported at a minimum of every 10-foot by casing spacers or 2 spacers per pipe, whichever is less.
- B. Adjust the pipe grade as required by changing the thickness of the supports to compensate for any grade variations of the casing, and to maintain carrier pipelines, grades, and dimensions, as shown on the Drawings.
- C. If the alignment of the casing is such that the carrier pipe grade cannot be met, the grade of the casing shall, if required by the County/Professional, be adjusted. If realignment is not deemed feasible by the County/Professional, another casing meeting the required grade shall be installed. The abandoned casing shall be filled with sand and the ends plugged with 12-inch thick masonry plugs. Realignment or replacement Work shall in no way result in extra cost to the County.

- D. All carrier pipe installed in a casing must be restrained for the entire length of the casing. Piping shall, at a minimum, be restrained to 1 joint outside of casing. If a fitting is present at the joint, restraint requirements shall conform to table presented in Drawings.

END OF SECTION

SECTION 02761
CLEANING SANITARY SEWER SYSTEMS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Work covered in this section consists of cleaning sewer lines and manholes prior to the internal television inspection(s) for new or existing wastewater systems.
- B. Gravity Main and Sewer Lateral Cleaning: The intent of gravity main cleaning is to remove debris that may be causing a reduction in flow capacity, potential sewer backups, or that limits the ability to evaluate the structural condition of the pipe segment. On all sewers, the Contractor shall perform sewer-cleaning work to an acceptable level as necessary to perform a thorough television inspection of the sewer. An acceptable level is defined as the removal of all debris throughout the pipe segment cleaned. If the pipe condition is such that cleaning may cause a potential collapse, then the pipe shall be televised without attempting to clean it pending approval by the County.
- C. Water for Cleaning: The Contractor will be responsible for obtaining a transient water meter and paying for water used during course of cleaning.
- D. Recovering of Equipment: The Contractor will be responsible for recovering any equipment that becomes lodged or lost in the pipeline. The Contractor will be responsible for all costs associated with required evacuation, restoration of roads and easements, and repairs to pipes and manholes as needed to restore the pipeline and appurtenances back to their original conditions.

1.02 CLEANING EQUIPMENT

- A. Hydraulically Propelled Equipment: The equipment used shall be of a movable dam type and be constructed in such a way that a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer. The movable dam shall be equal in diameter to the pipe being cleaned and shall provide a flexible scraper around the outer periphery for grease removal. Special precautions to prevent flooding of the sewers and public or private property shall be taken at all times.
- B. High-Velocity Jet (Hydro-Cleaning) Equipment: All high-velocity sanitary sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of 2 or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15° to 45° (degrees) in all size mains. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tanks, auxiliary engines, pumps, and hydraulically driven hose reel.

- C. Mechanically Powered Equipment: Bucket machines shall be in pairs with sufficient power to perform the Work in an efficient manner. Machines shall be belt operated or have an overload device. Machines with direct drive that could cause damage to the pipe will not be used. A power rodding machine shall be either a sectional or continuous rod type capable of holding a minimum of 750-feet of rod. The rod shall be heat-treated steel. To ensure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.
- D. Vacuum machines may be used for removal of materials from manholes when other cleaning equipment is used to dislodge and transport material to the access point.
- E. Combination Cleaner: For cleaning small and large diameter sewer, the Contractor may use a combination hydraulic high volume water and solids separation system. Water volume of up to 250-gpm at or above 2,000-psi will move solids to the downstream manhole in high flow conditions. The separation system will dewater solids to 95 % (passing a paint filter test) and transfer them to a dump truck, if needed, for transport to a water reclamation facility, approved landfill, or other location specified by the County or designee. Wash water will be filtered to a point where it can be used in the pump for continuous cleaning. No bypassing of sewer flows will be necessary. The unit shall be capable of 24-hour operation and the unit shall not leave the manhole until a section is fully cleaned.

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. A daily log shall be maintained to record the location of the manholes and sewer lines, lengths of the lines cleaned, method of cleaning, line sizes, identify type of cleaning (light, medium, or heavy), and type of debris moved. Observations are to be recorded on a cleaning report form.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 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 equipment shall remove dirt, grease, rocks, sand, other materials, and obstructions from the sewer mains, laterals, and manholes.

- C. A high-velocity sewer cleaner will be used for the majority of the cleaning work. Other equipment, such as bucket machines, rod machines, hydraulic root cutters, vacuum trucks and balling equipment shall be available.

3.02 CLEANING PRECAUTIONS

- A. All necessary precautions shall be taken to protect the sewer from damage during all cleaning and preparation operations. Precautions shall also be taken to ensure that no damage is caused to public or private property adjacent to or served by the sewer or its branches. The Contractor shall pay for and restore, at no additional costs to the County, any damage caused to public or private property because of such cleaning and preparation operations.
- B. Satisfactory precautions shall be taken in the use of cleaning equipment. When hydraulically propelled cleaning tools (which depend upon water pressure to provide their cleaning force) or tools which retard the flow in the sewer line are used, precautions shall be taken to ensure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant. All requirements shall be met when accessing a fire hydrant including but not limited to meters, backflow preventers, and properly trained personnel. It shall be the Contractor's responsibility to meet all state and local requirements.

3.03 CLEANING

- A. If cleaning of an entire sewer section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning attempted again. If results of the cleaning are favorable, the Contractor will proceed with the TV inspection. All sludge, dirt, sand, rocks, and other solid or semisolid materials resulting from the cleaning operation shall be removed from the downstream manhole of the section being cleaned. The Contractor shall not be responsible for removing mortar or other material that is securely attached to the pipe walls or joints.
- B. Materials shall be disposed of from the site at least once at the end of each workday. The Contractor will be responsible for the disposal of materials removed from the sewer system. All sewer-cleaning efforts shall require documentation of all quantities and types of materials removed during cleaning.
- C. The designated sewer manhole sections shall be cleaned using hydraulically propelled, high-velocity jet, or mechanically powered equipment approved by the County. Cleaning shall consist of normal hydraulic jet cleaning to facilitate the internal CCTV inspection.
 - 1. Types of cleaning of sanitary sewers:
 - a. Light cleaning of sewers consists of a maximum of 1 pass of the jet nozzle. Light cleaning of laterals will consist of flushing water into a cleanout.
 - b. Medium cleaning of sewers consists of 2 to 4 passes of the jet nozzle. Medium cleaning of laterals will consist of 1 to 4 passes with a jet nozzle.

- c. Heavy cleaning consists of 5 or more passes of the jet nozzle such as removing heavy grease, debris, and roots.
 - d. Descaling of Ductile Iron pipe: Multiple passes with mechanical equipment to remove scale build up to restore pipe to original inside diameter.
2. Selection of the equipment used shall be based on the conditions of lines at the time the Work commences. The equipment and methods selected shall be satisfactory to the County. The equipment shall be capable of removing dirt, grease, rocks, sand, debris, other materials, and obstructions from the sewer lines, laterals, and manholes.
 3. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted. The intent of preparatory cleaning is to provide sufficient cleaning to ensure camera passage and the internal conditions of the pipeline can be fully assessed.
 4. If the County establishes that a particular section of the pipeline cannot be adequately cleaned due to broken, collapsed, or void areas, then the inspection will be attempted up to the obstruction.

3.04 ROOT REMOVAL

- A. Roots shall be removed in the designated sections and manholes where root intrusion is a problem and where authorized by the County. Special attention should be used during the cleaning operation to remove roots from the joints. Any roots that could prevent the proper application of chemical sealants, or could prevent the proper seating and application of cured-in-place liners shall be removed. Procedures may include the use of mechanical equipment such as, rodding machines, bucket machines, winches using root cutters, porcupines, and equipment such as high-velocity jet cleaners. Chemical root treatment shall be used before or following the root removal operation, depending on the manufacturer's recommendation. The Contractor shall capture and remove all roots from the line.

3.05 CHEMICAL ROOT TREATMENT

- A. To aid in the removal of roots, manhole sections that have root intrusion shall be treated with an acceptable herbicide. The application of the herbicide to the roots shall be done in accordance with the manufacturer's recommendations and specifications in such a manner to preclude damage to surrounding vegetation. Any damaged vegetation, so designated by the County, shall be replaced by the Contractor at no additional cost to the County. All safety precautions as recommended by the manufacturer shall be adhered to for handling and application of the herbicide.

3.06 MATERIAL REMOVAL AND DISPOSAL

- A. All sludge, dirt, sand, rocks, grease, roots, and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Contractor shall provide appropriate screening to stop passing of materials into downstream sewers. All solid or semisolid materials dislodged during cleaning operations shall be removed from the sewer by Contractor at the downstream manhole of the sewer section being cleaned. The passing of dislodged materials downstream of the sewer segment being cleaned shall not be permitted. In such an event, as observed or detected by the County or any third party, Contractor shall be responsible for cleaning the affected downstream sewers in their entirety, at no additional cost to the County.
- B. These materials shall become the property of the Contractor, shall be removed from the site at the end of each workday, and shall be disposed of by the Contractor. Copies of records of all disposals shall be furnished to the County, indicating disposal site, date, amount, and a brief description of material disposed. Disposal manifests from the licensed disposal facility shall be submitted with invoices.
- C. The Contractor shall keep his haul route and work area(s) neat, clean, and reasonably free of odor, and shall bear all responsibility for the cleanup of any spill.

3.07 ACCEPTANCE OF CLEANING OPERATION

- A. Acceptance of sanitary sewer cleaning shall be made upon the successful completion of the television inspection and shall be to the satisfaction of the County. If television inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to re-clean and re-inspect the sewer line at no additional cost until the cleaning is shown to be satisfactory.
- B. In addition, on all sanitary sewers which have sags or dips, to an extent that the television camera lens becomes submerged during the television inspection, the Contractor shall use a high pressure cleaner to draw the water out of the pipe, or other means, to allow the full circumferential view of the pipe and identification of pipe defects, cracks, holes, and location of service connections.

END OF SECTION

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SECTION 02762
TELEVISIONING SANITARY SEWER SYSTEMS

PART 1 - GENERAL

1.01 SCOPE OF WORK

The Work covered within this Section is for the internal closed circuit television (CCTV) inspection of sanitary sewer pipes. The Contractor shall perform sewer-televising work as necessary to thoroughly document the condition of all sewers, service lateral connections, and manhole corbel, barrel and cone-sections in the study area. The sanitary sewer and service laterals shall be carefully inspected to determine alignment, grade variations, separated joints, location and extent of any deterioration, breaks, obstacles, obstructions, debris, quantities of infiltration/inflow and the locations of service connections.

The quality of all Work specified in this Section shall meet or exceed the requirements of the National Association of Sewer Service Companies (NASSCO) Recommended Specifications for Sewer Collection System Rehabilitation (latest edition), except as described in this Section. Applicable portions of this Section that inadvertently fall below those standards shall be corrected and maintained at the NASSCO standards as a minimum requirement, at no additional cost to the County.

1.02 REQUIREMENTS

- A. The Contractor shall inspect the sewer interior using a color closed circuit television camera (CCTV) and document the inspection on a digital recorder. All inspection video shall be captured in either MPEG or Windows Media Video (.WMV) file format and saved portable hard drives for submittal. Each inspected main line sewer reach, referenced manhole to manhole, and each inspected sewer lateral referenced to the property address and corresponding sewer main should have an associated MPEG or WMV file. Digital photographs (.JPG files), inspection reports (.PDF files) and any handwritten inspection logs or field maps shall accompany the video inspections for each sewer reach (manhole-to-manhole) or lateral inspected.
- B. Contractor shall provide inspection video, data and reports in accordance with the requirements specified herein. Contractor shall provide all video on portable hard drive as specified. All Work will conform to current NASSCO Pipeline Assessment Certification Program (PACP) coding conventions and all software used by the Contractor will be PACP compliant. An electronic database will be provided by the Contractor in a PACP exported format approved by the County.
- C. The Contractor shall provide comments as necessary to fully describe the existing condition of the sewer on the inspection forms.

- D. Contractor shall be responsible for modifications to equipment and/or inspection procedures to achieve report material of acceptable quality.
- E. No Work shall commence prior to approval of the submitted material by the County. Once accepted, the report material shall serve as a standard for the remaining Work.

1.03 QUALITY ASSURANCE

- A. Refer to Section 01101-"Special Requirements (Gravity Inspection Only)" for Contractor's Qualification requirements.
- B. Each CCTV field inspection supervisor shall be NASSCO PACP certified. Use of PACP certified technicians to review/document defects in the office (post process) is not acceptable.
- C. The inspection Contractor must have an internal quality assurance/quality control program in place and all inspection data shall be subjected to the procedures prior to submittal to the County. The County will perform QA/QC audits on submitted data.
- D. QA/QC shall be performed by NASSCO PACP certified personnel.

1.04 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. The following deliverables shall be submitted on a portable hard drive at the completion of inspection:
 - 1. Inspection videos saved in MPEG format or Windows Media video format
 - 2. Electronic version (.pdf) of the pipe inspection reports
 - 3. PACP export pipe inspection database (.mdb)
 - 4. Inspection digital photographs in JPEG format
 - 5. Map of sub area depicting area inspected, inspection status, asset identification numbers and mark ups
 - 6. QA/QC report
- C. The above deliverables shall be submitted monthly to the County for approval. Application for payment shall be made after review and approval by the County.
- D. The sewer inspection video, report documents, and sewer inspection database shall be in accordance with County data standards and NASSCO PACP.

1.05 NOTIFICATION

Contractor shall notify the County a minimum of 48-hours prior to performing any inspection work. No payment will be made for inspections performed without proper notification.

PART 2 - PRODUCTS

2.01 EQUIPMENT

- A. Closed Circuit Television Camera: The television camera used for the inspection shall be one specifically designed and constructed for sanitary sewer inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100 % humidity/submerged conditions. The CCTV camera equipment will provide a view of the pipe ahead of the equipment and of features to the side of the equipment through turning and rotation of the lens. The camera shall be capable of tilting at right angles along the axis of the pipe while panning the camera lens through a full circle about the circumference of the pipe. The lights on the camera shall also be capable of panning 90° (degrees) to the axis of the pipe.

The radial view camera must be solid-state color and have remote control of the rotational lens. The camera shall be capable of viewing the complete circumference of the pipe and manhole structure, including the cone-section or corbel. Cameras incorporating mirrors for viewing sides or using exposed rotating heads are not acceptable. The camera lens shall be an auto-iris type with remote controlled manual override.

If the equipment proves to be unsatisfactory, it shall be replaced with adequate equipment. The camera unit shall have sufficient quantities of line and video cable to inspect 2 complete, consecutive sewer reaches with access approximately 750-feet apart.

The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the County. The television camera, electronic systems and monitor shall provide an image that meets the following specifications, or approved equal:

1. The gray scale shall show equal changes in brightness ranging from black to white with a minimum of five stages.
2. With the monitor control correctly adjusted, the 6-colors; Yellow, Cyan, Green, Magenta, Red, and Blue, plus black and white shall be clearly resolved with the primary colors in order of decreasing luminance. The gray scale shall appear in contrasting shades of gray with no color tint.
3. The picture shall show no convergence or divergence over the whole of the picture. The monitor shall be at least 13-inches diagonally across the picture tube.
4. The live picture on the CCTV monitor shall be capable of registering a minimum of 470 lines horizontal resolution and be a clear, stable image with no interference.
5. Lighting intensity shall be remote controlled and shall be adjusted to minimize reflective glare. Lighting and camera quality shall provide a clear in-focus picture of the entire inside periphery of the sewers and laterals for all conditions except submergence. Under ideal conditions (no fog in the sewer) the camera lighting shall allow a clear picture up to 5 pipe diameter lengths away for the entire periphery of the sewer. The lighting shall provide uniform light free from shadows or hot spots.
6. The camera light head shall include a high-intensity side viewing lighting system to allow illumination of internal sections of lateral sewer connections.

7. Camera focal distance shall be remotely adjustable through a range of 6-inches to infinity.
8. Picture quality and definition shall be to the satisfaction of the County.
9. The monitor and software shall also be able to capture and save screen images of typical sewer details and all defects. Screen images shall be embedded into the pipe inspection report document submitted with the inspection video.
10. The video camera shall be capable of displaying on screen data as specified in paragraph 3.08 herein.
11. Depth gage: The camera shall have a depth gage or approved method to measure deflection in the pipe and joint separation approved by the County.
12. The camera shall have zoom capabilities to be able to view the entire depth of a 20-foot deep manhole from the bottom during inspection.

B. Lateral Video Camera

Lateral cameras may be push type or launched from the sewer main line. Lateral cameras shall be color, shall be self-leveling, and equipped with a footage counter to provide on-screen display of footage measurement. Monitor resolution shall be as specified above in paragraph 2.01 A Close Circuit Television Camera, or approved equal

C. Video Capture System

The video and audio recordings of the sewer inspections shall be made using digital video equipment. A video enhancer may be used in conjunction with, but not in lieu of, the required equipment. The digital recording equipment shall capture sewer inspection on DVD disks or hard drive, with each sewer reach inspection recorded as an individual movie file (.MPEG, .MPG, or .WMV) or approved equal. The video files will be named in accordance with the County file naming convention contained in paragraph 3.11 herein.

1. The video file names will be referenced in the inspection database and in an inspection report generated in PDF format. The pipeline collection and real time video capture and data acquisition systems shall be provided.
2. The system shall use the most current PACP compliant application software and shall be fully object oriented or approved equal. It shall be capable of printing pipeline inspection reports with captured images of defects or other related significant visual information on a standard color printer.
3. The imaging capture system shall store digitized color picture images and be saved in digital format on a DVD, hard drive or approved equal. Also, this system shall have the capability to supply the County with inspection data reports for each line segment.
4. The Contractor shall have the ability to store the compressed video files in industry standard and approved County format and be transferable with the PACP compliant inspection database.
5. The Contractor's equipment shall have the ability to "Link". "Linking" is defined as storing the video time frame code with each observation or defect with the ability to navigate from/to any previously recorded observation or defect instantaneously.
6. The system shall be able to produce data reports to include, at a minimum, all observation points and pertinent data. All data reports shall match the defect severity codes in accordance with PACP naming conventions

7. The data-sorting program shall be capable of sorting all data stored using generic sort key and user defined sort fields.
8. Camera footage, date & manhole numbers shall be maintained in real time and shall be displayed on the video monitor as well as the video character generators illuminated footage display at the control console.
9. Digital video shall be defined as ISO-MPEG Level 1 (MPEG-1) coding having a resolution of 352 pixels (x) by 240 pixels (y) (minimum) and an encoded frame rate of 29.97 frames per second. The digital recording shall include both audio and video information that accurately reproduces the original picture and sound of the video inspection. The video portion of the digital recording shall be free of electrical interference and shall produce a clear and stable image. The audio portion shall be sufficiently free of background and electrical noise so as to produce an oral report that is clear and discernible.
10. Inspection software shall be PACP compliant versions of CUES Granite XP, WinCan, Flexidata, or approved equal.
11. The CCTV equipment/software shall be capable of producing digitized images of all sewer line defects, manhole defects, and sewer line service connections in .jpeg format. Contractor shall plan to take digital still images of each defect, construction features and service connection to clearly depict it. More images may be necessary depending upon the condition of the pipe.

2.02 REPORTING CAPABILITIES

- A. The CCTV system shall be capable of printing pipeline inspection reports with pipeline schematics and captured images of defects and other related significant visual information. The system shall have the ability to display any combination of the following formats and features simultaneously.

The following information is mandatory for all inspections:

1. Inspection Information: Refers to the area of pipe to be inspected between 2 manholes or the address of the lateral to be inspected.
 - a. Project Name
 - b. Surveyed by (Operator/Surveyor's name)
 - c. Operator/Surveyor Certificate number
 - d. System Owner
 - e. Date
 - f. Drainage Area (tributary pump station number)
 - g. Time
 - h. Sheet number (report sheet number)
 - i. Street Name and Number
 - j. Locality (Orange County)
 - k. Additional Location Information (e.g. backyard, parking lot, etc)
 - l. Upstream Manhole Number (County standard Asset Number)
 - m. Upstream MH rim to invert (depth)
 - n. Downstream Manhole Number (County standard Asset Number)
 - o. Downstream MH rim to invert (depth)
 - p. Direction of inspection (Upstream or Downstream)

- q. DVD Identification Number
 - r. Flow control (e.g. plugged, lift station, bypassed, not controlled)
 - s. Type of Pipe
 - t. Pipe Height
 - u. Pipe Width
 - v. Pipe Shape
 - w. Pipe Material
 - x. Lining Material (for lined sewers)
 - y. Pipe Joint Length
 - z. Purpose of Inspection (new line, year-end warranty, CIP R/R project, etc.)
 - aa. Pre Cleaning (jetter, heavy cleaning, no pre-cleaning)
 - bb. Media Number (Video file name)
 - cc. Weather
 - dd. Additional information/Comments
2. Observation Data: Refers to the portion of pipe where an observation is discovered. Observations shall be noted by text descriptions and defect code number using PACP defects codes, still frame pictures and video clips captured and recorded. Each observation shall include the following:
 - a. Actual observation footage
 - b. Video reference
 - c. Location of defect; clock position
 - d. Code (Group/Descriptor/Modifier/Severity)
 - e. Whether it is a continuous defect
 - f. Whether the defect occurs at a joint
 - g. Severity level
 - h. DVD Identification number
 - i. DVD counter
 - j. Final footage
 - k. Video clip ID for each observation
 - l. Image reference (file name of photos)
 - m. Remarks (as appropriate or needed)
 3. Formats: Standard and/or custom designed reports shall have the following formats available and shall be able to be produced in hard copy or viewed on the monitor.
 - a. Site Observation: Displays detailed site observation reports in landscape or portrait views.
 - b. Directory Report: Displays a list of all the projects sorted by pump station number and manhole number.
 - c. Picture Reports: Displays site data and include full size single photos or half size double photos of discrepancies.
 - d. Pipe Run: Displays a graphical display of the site indicating footage, observations, and comments.
 - e. Project Data: Displays the project, client, and Contractor information.
 - f. Custom Sort: Creates user-defined reports of selected site, project, and observation data.

PART 3 - EXECUTION

3.01 GENERAL

- A. Prior to inspection the Contractor shall obtain pipe and manhole asset identification numbers from the County to be used during inspections. Inspections performed using identification numbers other than the County assigned numbers will be rejected.
- B. Inspection shall not commence until the sewer section to be televised has been completely cleaned in conformance with Specification Section 02761 "Cleaning Sanitary Sewer Systems."
- C. Inspection of newly installed sewers (not yet in service) shall not begin prior to completion of the following:
 - 1. Pipe air testing
 - 2. All manhole work, including installation of inverts
 - 3. Installation of all lateral services
 - 4. Vacuum tests of all manholes
- D. After the sewer main and/or lateral cleaning operation is completed, the line sections shall be visually inspected internally by means of color closed-circuit television. The television inspection shall be performed one line section at time.
- E. CCTV inspection shall require a minimum of 2 certified personnel with PACP certifications.
 - 1. One (1) person shall have PACP certification that will lead or supervise each field CCTV crew for inspection and a minimum of 2-years in the role of a lead person.
 - 2. One (1) person shall have PACP certification serving in the role as a QA/QC management supervisor
- F. Contractor shall perform sewer-televising work within 24-hours of said sewer being cleaned. If said sewer is not televised within the required 24-hour time limit, the sewer shall be re-cleaned prior to televising at no additional expense to the County.
- G. The Contractor shall also inspect and document all manholes included in this Work. The video recording shall begin as the camera is lowered down the manhole all the way to the preset footage and continuously throughout the pipe reach until the down stream manhole is reached.
- H. The Contractor shall lower the camera into the start manhole and record the camera entry into the sewer, observing the manhole as the camera enters.
- I. The camera shall pan the periphery of the start and finish manhole from casting to invert. To achieve this, the CCTV camera operator shall pan and zoom the manhole to obtain the best possible image of the manhole, including the wall, cone and chimney section(s).
- J. The depth of each manhole shall be measured to the nearest 1/10th of a foot and documented on the inspection forms. Estimates of manhole depths will not be accepted.

- K. The CCTV camera shall be positioned as close to the spring line as possible while maintaining the required equipment stability.
- L. Wherever possible the inspections shall be performed in the upstream to downstream direction. All sewer segments shall be recorded in a logical order in the same direction they are cleaned and televised.
- M. In the event that access to some manholes is restricted, permission may be granted by the County to direct the camera through the sewer in an upstream direction, against the flow.
- N. When sewer conditions prevent forward movement of the camera, the camera shall be withdrawn, and Contractor shall televise the line from the opposite direction.
- O. The camera shall be directed through the sewer in a downstream direction, with the flow, at a uniform, slow rate. In no case will the video camera record while moving at a speed greater than 30-feet per minute. If, during the course of the Project, the inspection is rejected due to camera speeds exceeding 30-feet per minute, the inspection recordings shall be redone, at no additional cost to the County.
- P. If a new manhole is discovered in the field that was not on current maps, a new manhole identification number will be assigned by County. The County shall assign the manhole the next number above the highest manhole number within the sub area. The data / video files shall then be re-named to include the new MH ID, and a new CCTV inspection shall be started from the new MH ID. Contractor shall consult with the County for assignment of new manhole identification numbers. Contractor shall note in the inspection form comments that a new manhole ID has been assigned as well as provide a marked up map indicating the newly found manhole and assigned manhole ID.
- Q. Flow levels within existing sewers to be inspected shall not exceed 5% of the pipe diameter. If water levels prevent adequate televising of the sewer, then conducting the Work during low flow periods or other methods like plugging and bypass pumping shall be implemented.
- R. For inspection of new sewers (not yet in service), the Contractor shall introduce clean water into the upstream manhole and keep water flowing until flow is observed at the downstream manhole location.
- S. The survey unit shall be slowed, stopped, or backed up to perform detailed inspections of significant features. The camera shall be stopped at all defects, changes in material, water level, size, side connections, manholes, junctions, or other unusual areas. When stopped at the defect or feature, the operator shall pan the camera to the area and along the circumference of the pipe.
- T. The camera unit shall be paused long enough at areas suspected of leaking to determine if a leak exists currently or if deposits have occurred.
- U. The operator shall also record audio of the type of defect or feature, clock position, footage, extent or other pertinent data.

- V. Digital photographs or screen captures shall be taken at all laterals; defects and general condition photographs shall be taken at least every 200-feet.
 - W. At the Contractor's discretion or direction of the County, the camera shall be stopped or backed up (when conditions allow) to view and analyze conditions that appear to be unusual or uncommon for a sound sewer. The lens and lighting shall be readjusted, if need be, in order to ensure a clear, distinct, and properly lighted feature.
 - X. Audio shall be recorded during each inspection by the operating technician, electronic voice text recognition or approved equal on the inspection video as the sewer is inspected and shall include the sewer location, identification of beginning and terminating manholes including location (address or cross streets), inspection direction, length of inspection, side sewer identification, flow information, complete descriptions of the sewer line conditions as they are encountered, description of the rehabilitation work, reason for termination, and other relevant commentary to the inspections. Voice descriptions should be made:
 - 1. At points of pipe failure or weakness
 - 2. At points of infiltration
 - 3. At the location of service connections
 - 4. At points where unusual conditions are noted, and
 - 5. At points where digital still photos are taken.
- In addition, the audio reports shall include the distance traveled on the specific run, a description of abnormal conditions in the sewer and side sewer connections as they are encountered, explanations for pausing, backing up, or stopping the survey, and the final measured center to center distances between consecutive manholes. The audio portion of the composite video shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of the oral report. Audio dubbing after the inspection is prohibited.
- Y. Video recordings shall include a continuous video display/readout of similar information, as described in paragraph 3.08 herein. A separate digital video file shall be made for each pipe reach inspected.
 - Z. Contractor shall coordinate with the County prior to commencement of Work to ensure inspection is accomplished in a manner acceptable to the County.
 - AA. If the video and/or audio recording is of poor quality, the County has the right to require a re-submittal of the affected sewer sections and no payment will be made until an acceptable video and audio recording is made, submitted to, and accepted by the County.
 - BB. Measurement for location of defects and actual length of pipe shall be by means of a calibrated meter on the camera with a digital readout on the video monitor. This readout shall be included in the video recording. Marking on cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Measurement will be accurate to 1-foot per 100-feet of inspected pipe.

- CC. The Contractor inspection units shall be equipped with adequate back up equipment and spare parts so field repairs to equipment can be made and down time is minimized.
- DD. The Contractor shall be responsible for all traffic control measures required to perform the Work.
- EE. Lateral inspections shall be performed from the main line using a lateral launch camera or shall be pushed from cleanouts to the sewer main using sewer rods. Lateral camera travel measurements shall be displayed on screen and on the captured video.
- FF. If lateral inspections are performed from the sewer main as part of the main line inspection, the lateral shall be logged in the main line inspection report per PACP requirements and the "comment" field of the main line inspection report shall be used to document the lateral identification number, defects observed, footage of all lateral defects, connecting pipes and clean outs. If lateral inspections are not performed as part of the main sewer inspection, a separate PACP pipe inspection record shall be created for each lateral. Refer to paragraph 3.10 for numbering requirements.

3.02 PRE-CONSTRUCTION INSPECTION

A. Procedure

1. Prior to any repair work, the entire sewer line (from manhole to manhole) shall be televised. The pre-construction inspection shall be used to determine whether the line has been cleaned sufficiently; to confirm the location and nature of defects; and to confirm that the proposed method of repair is proper method for the defects observed.
2. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30-feet per minute. Manual winches, power winches, TV cable, and power rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire manhole section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole (reverse set-up).
3. When manually operated winches are used to pull the television camera through the line, telephones, radios or other suitable means of communication shall be set up between the 2 manholes of the section being inspected to insure good communication between members of the crew.
4. The importance of accurate distance measurements is emphasized. The location of defects shall be within ± 2 feet.
5. During the internal inspection the television camera shall be temporarily stopped at each defect along the line. The Contractor shall record the nature and location of the defect. Where defects are also active infiltration sources, the rate of infiltration in gallons per minute shall be estimated by the Contractor and recorded. The camera shall also be stopped at active service connections where flow is discharging. Flows from service connections that are determined to be infiltration/inflow shall also be recorded.

B. Documentation of Television Inspection

1. Television Inspection Logs: Printed location records shall be kept by the Contractor and will clearly show the location in relation to an adjacent manhole of each infiltration point observed during inspection. In addition, other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, broken pipe, presence of scale and corrosion, and other discernible features will be recorded and a copy of such records will be supplied to the County. The Contractor shall record all visual observations on a "Television Inspection Report" form.
2. Once recorded, the digital data shall be labeled and become the property of the County. The Contractor shall have all readings and necessary playback equipment readily accessible for review by the County during the Project.

3.03 POST CONSTRUCTION INSPECTION

A. Procedure

1. After the sewer line rehabilitation has been completed, the entire sewer line from manhole to manhole shall be televised. The post construction inspection shall be used to determine whether or not all of the approved sewer line defects and infiltration sources previously located have been fully repaired to the satisfaction of the County.
2. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30-feet per minute. Manual winches, power winches, TV cable, power rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire manhole section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole or direction.(reverse-setup)
3. When manually operated winches are used to pull the television camera through the line, telephones, radios or other suitable means of communication shall be set up between the 2 manholes of the section being inspected to insure good communication between members of the crew.
4. The importance of accurate distance measurements is emphasized. The location of defects shall be within 1-foot.
5. During the internal inspection the television camera shall be temporarily stopped at each repair. The camera shall also be stopped at any unnoticed or non-repaired point source of infiltration.

3.04 SEWER BYPASSING AND DEWATERING

Contractor shall be responsible for bypassing sewer flow around his work and dewatering of sewer lines in accordance with the requirements of Section 01516 "Collection System Bypass". Where sags or submerged sections of the sewer are encountered during TV inspection, the Contractor shall first complete inspection of the entire reach to determine the extent of such areas prior to dewatering the sewer. Dewatered sections of the sewer shall then be TV inspected.

On all sewer mains which have sags or dips, to an extent that the television camera lens becomes submerged during the television inspection, the Contractor shall use a high pressure cleaner to draw the water out of the pipe, or other means, to allow inspection of the pipe and identification of pipe defects, cracks, holes and location of service connections.

3.05 LINEAR MEASUREMENT

The CCTV camera location footage counter shall be zeroed at the beginning of each inspection. The survey unit location entered on the footage counter at the start of the inspection shall allow for the distance from the accepted start of the length of the sewer to the initial point of observation of the camera (pre-set footage). In the case of resuming an inspection at an intermediate point within a sewer reach, the footage counter shall be set to start at the distance from the upstream maintenance hole to that point, as previously recorded by the counter. The Contractor shall ensure that the footage counter starts to register immediately when the survey unit starts to move.

The lateral camera shall be pushed from cleanouts to the sewer main and be equipped with a footage counter to display and record inspection footage. Maximum rate of travel shall be 30-feet per minute when recording.

Prior to commencing inspections, the Contractor shall demonstrate compliance with the linear measurement tolerance specified below:

- A. The equipment shall measure the location of the camera unit in 1-foot increments from the beginning (upstream end) of each continuous section. This footage location must be displayed on the CCTV monitor and recorded on the videotapes.
- B. The accuracy of the measured location shall be within + 0.5% of the actual length of the sewer-reach being surveyed, or 1-foot, whichever is greater.

3.06 MEASUREMENT OF SAGS

The CCTV camera shall be equipped with a measuring device capable of accurately measuring the depth of standing water up to 3-inches. The measuring device shall be mounted to the front of the unit and be capable of being read as the unit advances through the pipe.

3.07 CCTV MONITOR DISPLAY

The images displayed on the CCTV monitors will be a view of the pipe above the water surface as seen by the CCTV camera as the unit is conveyed through the sewer.

The camera lighting shall be fixed in intensity prior to commencing the survey and the white balance set to the color temperature emitted. In order to ensure color constancy, no variation in illumination shall take place during the survey.

The video equipment shall be checked using an approved test card with a color bar prior to commencing each day's survey. The camera shall be positioned centrally and parallel to the test card at a distance where the full test card just fills the monitor screen. The card shall be illuminated evenly and uniformly without any reflection.

3.08 DATA DISPLAYS

- A. The CCTV images shall include an initial data display that identifies the sewer reach being surveyed and a survey status display that provides continuously updated information on the location of the survey unit as the survey is being performed. These data displays shall be in alphanumeric form. The size and position of the data shall not interfere with the main subject of the monitor picture.
- B. The on-screen display should be white during inspections where the background behind the display is dark and, conversely, black where the background is light.
- C. At the beginning of each reach of sewer being inspected, the following information shall be electronically generated and displayed on the CCTV monitors as well as included in the audio track:
 - 1. Date of survey
 - 2. Inspection company name and inspector
 - 3. Street name or location
 - 4. Manhole number to manhole number (in order of inspection)
 - 5. Direction of survey (upstream or downstream)
 - 6. Time of start of survey
- D. During inspections, the following information shall be electronically generated, automatically updated, and displayed on the CCTV monitors:
 - 1. Survey unit location in the sewer line in feet and tenths of feet from adjusted zero
 - 2. Sewer diameter
 - 3. Upstream and downstream manholes reference numbers as per approved Drawings or County GIS.
 - 4. During Lateral inspections the video display shall contain the lateral location and the footage of the camera within the lateral.

3.09 PHOTOGRAPHS

During CCTV inspections, screen captures will be taken from the monitor images and saved electronically by the in-sewer inspection crew of typical conditions every 200-feet and at all defects, construction features, manholes and laterals. The screen capture shall have the pipe reach (identified by the upstream and downstream manholes), survey direction, footage, and date when photograph was taken. The annotation shall be clearly visible and in contrast to its background, shall have a figure size no greater than 1/4-inch, and shall be type-printed. The annotation shall be positioned on the front of the photograph so as to not interfere with the subject of the photograph. Photograph files shall be named by the video capture system and automatically referenced to the logged defect.

The image of the sewer shall fill the photographic image. Photographs must clearly and accurately show what is displayed on the monitor, which shall be in proper adjustment. Where significant features exist within 6-feet of each other, 1 photograph shall be made to record these features. Where there is a continuous feature, photographs shall not be taken at intervals of less than 6-feet unless absolutely necessary to show a change in the feature.

The images shall be kept electronically, copied to a hard drive, and submitted with the inspection videos, database and reports.

3.10 MANHOLE NUMBERING, INSPECTION FORMS AND DEFECT CODES

- A. The Contractor will be required to use the manhole numbering as shown on sewer maps provided by the County when performing the inspections for this project.
- B. The County inspection forms and standard defect codes shall be used. The defect codes, inspection forms, inspection database and inspection protocols shall be in accordance with the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP).
- C. When lateral inspections are performed as part of the main sewer inspection, lateral numbers shall be referenced in the "comment" field of the main sewer PACP report. The lateral number shall be as follows:

<Upstream Manhole ID>_<footage>_<clock position>_<L>

Example: 39550020_212_02_L

- D. When lateral inspections are not performed as part of the main sewer inspection, the main sewer inspection shall be performed first to obtain the footage and clock positions needed to identify the lateral.

3.11 DELIVERABLES

The Contractor will be required to submit the following deliverables at the completion of the post construction video inspection. The pre-construction video inspection deliverables shall be as defined in 3.02 of this specification.

- A. Inspection Reports to include:
 - 1. Inspection session header information (see required fields above)
 - 2. Defect log report including photo captures from CCTV video
 - 3. Schematic drawing of pipe showing defects
 - 4. Format:
 - a. Adobe Acrobat PDF files: 1 report PDF per pipe
 - b. Main sewer inspection report file name:

<upstream MH ID>_<downstream MH ID>_<Date (year_mo_day format)>.PDF

Example: 30060002_30060001_2010_02_16.pdf

c. Lateral inspection report file name:

<upstream MH ID>_<footage>_<clock position>_<L>_<Date (year_mo_day format)>.PDF_

Example: 30060002_210_02_L_2010_02_16.pdf

B. Inspection video files on portable hard drive, typed labels shall be attached to the face of each hard drive. The typed index labels shall include the following information:

1. Content (CCTV)
2. Contractor name
3. Purpose of Survey
4. Tributary Pump station number
5. Reaches included (from Manhole Number ## to Manhole Number ##)
6. Date of survey
7. Contract Number / Delivery Order Number (if applicable)

C. Main sewer video files shall be MPEG or Windows Media File named according to the following standard:

<Upstream MH ID>_<Downstream MH ID>-<Inspection>_<Date (year month day)>.wmv

Example: 39540008-39540007_20090805.wmv

In instances where a reverse set up is necessary to perform or complete the inspection the file name shall incorporate a "R" at the end of the file name to indicate "reverse" direction. Using the file example above, if the inspection from the upstream end was halted due to an obstruction and the pipe was televised from the opposite end, the video file from the downstream to upstream direction would be assigned the following file name:

Example:39540008-39540007_20090805_R.wmv

D. Lateral connection inspection video files shall be MPEG or Windows Media File named according to the following standard:

<Upstream MH ID>_<footage>_<clock position>_<L>_<date (year_mo_day format)>.wmv

Example: 39540008_145_10_L_2009_08_05.wmv

E. Electronic Inspection Data stored and exported in a NASSCO Pipeline Assessment and Certification Program (PACP) compliant Microsoft Access database (.MDB) version 4.4 or newer delivered on DVD or portable hard drive.

F. Inspection photograph digital files (jpeg) indexed to NASSCO PACP compliant database.

G. Map of sub area depicting area inspected, inspection status, asset identification numbers and mark ups,

H. Acceptable media for the video recordings portable hard drive.

- I. Inspection data noted above shall be provided to the County weekly throughout the inspection work.
- J. Contractor Quality Control report detailing data validation performed, pipe inspection records reviewed and results.
- K. All inspection data shall be submitted on a portable hard drive. Each hard drive shall be filled with as much data as practical to minimize the number of hard drives submitted. Sections of a single segment of sewer main shall not be recorded to more than 1 hard drive. Video footage of recorded segments shall be grouped by area and shall be submitted in sequential order relating to the area mapping designation.
- L. Upon approval by the County of all, or portions of, the data delivered via the portable hard drives, the approved CCTV data shall be delivered to the County on a portable hard drive labeled with project information. The hard drive shall clearly indicate the date of the inspection, the designated segment(s) of sewer mains(s) contained on the disk, the name of the project, the project CIP number, the pump station number, and Contractor name. The hard drive shall contain separate digital files for each manhole-to-manhole section.
- M. The database shall be comprehensive for the entire project, and additional data shall be added to the database each week.

3.12 ACCEPTANCE

- A. Inspection deliverables will be validated to check conformance with the specified requirements for file names, formats, quantity, resolution, data table references, in addition to checks for null fields, asset numbers, duplicate records, connectivity, material, size, and depth. Any data not passing the data validation checks will be returned to the Contractor for resubmittal.
- B. Inspection submittals will be reviewed for quality control. A minimum of 5% of the submitted inspections will be randomly reviewed. A quality control check will be performed for each CCTV operator and each operator must exceed 90% accuracy. Reference Section 01101 "Special Requirements (Gravity Inspection Only)."
- C. Throughout the duration of the project, should the County discover inaccuracies in data or quality issues with any of the videos, Contractor shall re-inspect those segments at no additional cost to the County. The County will provide comments regarding acceptance of the data within 21-days of receiving the data from the Contractor. Neither the CCTV inspections nor the WORK inspected is accepted by the County until such time that an acceptance letter is issued by the County.

END OF SECTION

SECTION 02763
TELEVISION SANITARY SEWER LATERALS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The Work consists of furnishing all labor, materials, accessories, equipment, tools, transportation, services and technical competence for performing all operations required to execute the internal closed circuit television (CCTV) inspection to inspect service lateral after lateral clean outs have been installed.
- B. The CCTV inspection shall show all defects and determine amount of infiltration entering the service laterals.
- C. The post CCTV lateral inspection shall also be performed for any laterals after the laterals have been lined or replaced.

1.02 GENERAL

- A. After cleaning as specified in Section 02761 "Cleaning Sanitary Sewer Systems" (including special cleaning involving the mechanical removal of roots, grease, and/or tuberculation where authorized), and before and after repair/replacement work, the lateral shall be visually surveyed by means of closed circuit television. The CCTV inspection shall be performed 1 lateral at a time.
- B. Pre and post construction survey video shall be delivered to the County on DVD or portable hard drive accompanied with the corresponding TV logs for sewer laterals surveyed. The video shall be direct from a live video source into a video file, MPEG or Windows Media File format and of good quality for viewing. The recording of multiple laterals on a single DVD or hard drive is acceptable.

1.03 SOFTWARE

- A. The Contractor shall utilize a NASSCO Pipeline Assessment Certification Program (PACP compliant software to capture the lateral inspections), unless otherwise approved by the County.

1.04 EQUIPMENT

- A. The television camera used for the lateral survey shall be one specifically designed and constructed for such survey. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing a minimum 700-line resolution color video picture. The Contractor shall maintain the camera in clear focus at all times. Picture quality and definition shall be to the satisfaction of the County, and if unsatisfactory, equipment shall be removed and replaced with adequate equipment at no additional cost to the County.
- B. The camera used from a cleanout shall be able to be launched from the cleanout and travel down to the sewer mainline up to 100-feet. The camera system shall be able to inspect 3, 4, and 6-inch lateral connections.
- C. The video camera shall include a titling feature capable of displaying on the video the following information.
 - 1. County
 - 2. Date/Time
 - 3. Contractor's Name
 - 4. Pipe Size (Diameter) and Material
 - 5. Lateral ID (provided by County)
 - 6. On-going Footage Counter

1.05 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. The Contractor's submittals shall include description of the software to be used and a sample of the video titles to be used, along with a sample of the television survey log to be used.

1.06 QUALIFICATIONS

- A. The qualifications of the CCTV Contractor shall be submitted and shall include detailed descriptions of the following:
 - 1. Name, business address and telephone number of the CCTV Contractor
 - 2. Name(s) of all supervisory personnel to be directly involved with this Project
 - 3. NASSCO PACP certification of on-site operator performing inspections or subject to County approval, resume of proposed CCTV operator displaying similar inspection experience
 - 4. The Contractor shall sign and date the information provided and certify that to the extent of his knowledge, the information is true and accurate, and that the supervisory personnel will be directly involved with and used on this Project. Substitutions of personnel and/or methods will not be allowed without written authorization of the County.

5. Specialty technicians shall be certified by the equipment manufacturer and/or its authorized representative. Certifications shall be submitted to the County.

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. All inspection information and data (including video) shall be written to digital media (DVD or portable hard drive).

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION SURVEY

- A. Procedure
 1. Prior to any repair work, the entire service lateral (from mainline to property line or cleanout, whichever is farther from the mainline) shall be televised.
 2. Measurement for location of defects shall be above ground by means of a meter, roll-a-tape, or other suitable device. Linear footage shall be shown on screen during recording.
 3. Movement of the television camera shall be temporarily halted for a minimum of 10-seconds at each visible defect or point of flow until the source and flow rate from that point are determined.
 4. The inspection shall be performed from either the main sewer or the cleanout with the proper equipment.
- B. Field Documentation
 1. Television CCTV Logs: The Contractor shall obtain lateral identification numbers from the County. All inspection logs shall reference the applicable lateral ID. In addition, the upstream manhole number, distance from the upstream manhole, lateral connection to the main line (left, center or right), and address of the customer serviced by the lateral shall be noted on the television survey log. Inspections shall be recorded in NASSCO PACP/Lateral Assessment Certification Program compliant software unless otherwise approved by the County. Reports shall be generated from the software. Printed and electronically stored location records shall be kept by the Contractor and will clearly show the location in relation to the cleanout or the mainline of each infiltration point observed during survey. Footage shall be shown on the log. In addition, other points of significance such as unusual conditions, roots, broken pipe, presence of scale and corrosion, and other discernible features will be recorded and a copy of such records will be supplied to the County.
 2. Photographs: Digital photographs of the television picture of problems shall be taken by the Contractor upon request of the County.

3. Video Recordings: Individual video files shall be created for each lateral inspected. Each file shall be in MPEG or Windows Media video format. Video files shall be named with the lateral ID and date of inspection. Video files shall be submitted on DVD or portable hard drive. The purpose of video recording shall be to supply a visual and audio record of problem areas in the lines which may be replayed. Once recorded, the video shall become the property of the County.
4. Audio: All lateral inspection videos shall have an audio record. As a preamble, at the beginning of the inspection, the Contractor shall state the following "(Contractor's Name) is performing a pre/post TV survey of laterals for (each sub area)". State date, time, operator's name, area, pipe size and material, upstream County asset manhole number, and depth. The Contractor shall verbally state the position of the lateral with respect to the upstream manhole and describe defects. At the end of each line, state: "end of line and total linear footage".

3.02 POST CONSTRUCTION SURVEY

A. Procedure

1. The same procedure shall be used as indicated in sub-section "3.01 Preconstruction Survey."
2. In addition, the Contractor shall stop the camera at all point repairs and inspect entire repaired pipe sections.
3. The Contractor shall invert white foreground to black as needed in line sections with light background.
4. In the case of a post liner survey, the Contractor shall fully televise both ends of the liner so that the fit of the liner to the host pipe can be evaluated.
5. The post liner and/or replaced lateral and/or point repaired lateral CCTV inspection shall be done within 2-weeks of installation.

B. Documentation

The same documentation shall be provided as indicated in paragraph 3.01 "Preconstruction Survey" of these specifications.

END OF SECTION

SECTION 02771

CURE-IN-PLACE PIPE FOR SANITARY SEWER RENEWAL

PART 1 - GENERAL

1.01 REQUIREMENTS

- A. The Work within this Section consists of the installation and testing cured-in-place pipe (CIPP). The CIPP shall provide a structurally sound, joint-less and water-tight new pipe within a pipe. The Contractor is responsible for proper, accurate and complete installation of the CIPP using the system selected by the Contractor.
- B. The finished liner shall extend over the installation length in a continuous, tight fitting, watertight pipe-within-a-pipe and shall be fabricated from materials which, when installed, will be chemically resistant to withstand internal exposure to domestic sewage.
- C. Neither the CIPP system, nor its installation, shall cause adverse effects to any of the County's facilities or processes. The use of the product shall not result in the formation or production of any detrimental compounds or by-products at the treatment facilities. The Contractor shall test and monitor the levels of by-products produced as a result of the installation operations. The Contractor shall conduct installation operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians, businesses, and property owners or tenants.

1.02 INSTALLER EXPERIENCE AND QUALIFICATIONS

- A. The Contractor's staff experience shall meet as a minimum the following requirements. The inability to document such experience may be grounds for rejecting the proposed installer's staff.
 - 1. The proposed **Superintendent** must have a minimum of three (3) years of CIPP lining supervisory field experience on projects totaling a minimum of 150,000 LF of 8-inch or greater CIPP liner installation using the methods and materials proposed for this Work, as documented by verifiable references. Superintendent's resume of projects. Each reference project shall include the pipe dimensions, length of installation, size/type of flow control required to perform the Work, description of the actual work performed including installation method, owner's name, telephone number and contact person, date of installation. It is required that the Superintendent(s) named are the Superintendent(s) assigned to this project and on site during construction. The Contractor is required to have at least 1 qualified Superintendent on site at all times during the construction activities. All referenced experience shall be for projects completed within the United States or Canada and shall have used the same installation method, CIPP liner and resin combination proposed for this project. References will be checked.

2. **Installation Crew:** At least 1 person other than the Superintendent from the CIPP installation crew shall have a minimum of 1-year of CIPP experience totaling at least 20,000 lineal feet of 8-inch or greater installed liner. The crewmember with listed qualifications must be on the project site during all installation activities.
3. **Boiler Technician:** Contractor shall provide the name and information for the boiler technician who will perform the actual Work. The boiler technician must have a minimum of 2 projects totaling at least 10,000 lineal feet of CIPP lining in which a similar position was held.
4. **Lateral Cutter Technician:** Contractor shall provide the name and information for the technician who will perform the actual Work. The lateral cutter technician must have a minimum of 2 projects totaling at least 10,000 lineal feet of CIPP lining in which a similar position was held.
5. **Lead CCTV inspector** shall be NASSCO PACP certified to report liner defects.
6. The final decision to accept or reject the product, manufacturer, and/or installer lies solely with the County. The named Manufacturer, Field Superintendent, CIPP Lead Installer, Boiler Technician, and Lateral Cutter must be employed to perform the Work, unless changes are specifically authorized by the County.

1.03 PERFORMANCE WORK STATEMENT

- A. The Contractor shall submit, before any lining WORK is performed, to the County a Performance Work Statement (PWS) which clearly defines the CIPP product delivery in conformance with the requirements of these contract documents. The PWS shall contain at a minimum the following:
 1. Contractor's certificate of compliance that clearly indicates that the CIPP will conform to the project requirements as outlined in Specification Section 01010 Summary of Work and as delineated in these specifications.
 2. A detailed installation plan describing:
 - a. All preparation work (cleaning operations, pre-CCTV inspections, by-pass pumping, and traffic control)
 - b. Installation procedure and method of curing
 - c. Service reconnection
 - d. Quality control and testing to be performed
 - e. Post-CCTV inspection
 - f. Warrantees
 - g. Description of the proposed CIPP lining technology.
 3. A detailed plan for identifying all active service connections during mainline installation.
 4. The qualifications of the Contractor.
 - a. Name, business address and telephone number
 - b. Personnel names, experience, and certifications for Field Superintendent, CIPP lead Installer, Lateral Cutter, Boiler Technician, and Lead CCTV NASSCO PACP Certificated Inspector to be directly involved with this project. The Contractor shall sign and date the information provided and "certify that to the extent of his knowledge, the information is true and accurate, and that the supervisory personnel will be directly involved with and used on this project". Substitutions of personnel and/or methods will not be allowed without written authorization of the County.

- c. Specialty technicians shall be certified by the equipment manufacturer and/or its authorized representative. Certifications shall be submitted to the County/Professional.
5. Proposed manufacturer's technology data shall be submitted for all CIPP products and all associated technologies to be furnished.
6. All tools and equipment required for a complete installation of the CIPP.
 - a. Clearly describe all equipment including proposed back-up equipment to be furnished for this project.
 - b. Identify redundant tools and equipment to be kept on the job site in the event of equipment breakdown.
 - c. The Contractor shall outline the mitigation procedure to be implemented in the event of key equipment failure during the installation process for the CIPP.
7. A detailed description of the Contractor's proposed procedures for the removal of any existing blockages in the pipeline that may be encountered during the cleaning process.
8. Detailed public notification plan for stage notification to residences affected by the CIPP installation.
9. An odor control plan that will ensure that project specific odors will be minimized at the project site and surrounding area.
10. Outline specific repair or replacement procedures for potential defects that may occur in the installed CIPP. Repair or replacement procedures shall be as recommended by the CIPP system manufacturer and shall be submitted prior to any Work.
 - a. Repairable defects that may occur in the installed CIPP shall be specifically defined by the Contractor based on the manufacturer's recommendations, including a detailed step-by-step repair procedure, resulting in a finished product meeting the requirements of the specifications.
 - b. Un-repairable defects that may occur to the CIPP shall be clearly defined by the Contractor based on the manufacturer's recommendations, including a recommended procedure for the removal and replacement of the CIPP.

1.04 REFERENCES

A. Codes, Specifications, and Standards

1. Codes, specifications, and standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise shown or specified.
2. All American Society for Testing and Materials (ASTM) Standards noted below shall be to the latest revised version.
 - D543 – Standard and Practice for Evaluating the Resistance of Plastics to Chemical Reagents
 - D638 – Standard Test Method for Tensile Properties of Plastics
 - D790 – Standard Test Methods for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials
 - D792 – Standard Test Methods for Density and Specific Gravity of Plastics by Displacement
 - D2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

- D2837 – Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
- D2990 – Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics
- D3567 – Standard Practice for Determining Dimensions of Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings
- D3681 – Standard Test Method for Chemical Resistance of “Fiberglass (Glass Fiber Reinforced Thermosetting Resin) Pipe and Fittings
- D5813 – Standard Specification for Cured-in Place Thermosetting Resin Sewer Pipe
- F1216 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Inversion and Curing of a Resin-impregnated Tube
- F1743 – Standard Practice for Rehabilitation of existing pipelines and conduits by pulled-in-place installation of cured-in-place thermo setting resin pipe
- F2019 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)
- F2561 - Standard Practice for Rehabilitation of a Sewer Service lateral and Its Connection to the Main Using a One Piece Main and Lateral Cured-in-Place Liner

1.05 PRE-TREATMENT OF REGULATED CHEMICALS TO DISCHARGE INTO SEWER

- A. CIPP liner systems using resins containing styrene or other regulated chemicals that will be discharged into the wastewater system shall be required to reduce the concentration of Styrene in the cure water prior to discharge to the sanitary sewer. The discharge limits are as follows:

	Discharge Limits to South WRF Service Area		Discharge Limits to Northwest WRF Service Area		Discharge Limits to Eastern WRF Service Area	
	Maximum Styrene Concentration Limit for Discharge to South WRF (PPM)	Maximum Total Pounds per Day of Styrene to be Discharged to South WRF (Pounds/Day)	Maximum Styrene Concentration Limit for Discharge to Northwest WRF (PPM)	Maximum Total Pounds per Day of Styrene to be Discharged to Northwest WRF (Pounds/Day)	Maximum Styrene Concentration Limit for Discharge to Eastern WRF (PPM)	Maximum Total Pounds per Day of Styrene to be Discharged to Eastern WRF (Pounds/Day)
< 500,000	7	29	1	4	3.5	14
< 250,000	14	29	2	4	7.0	14
< 100,000	35	29	5	4	17.5	14

- 1. A single day’s or line segment water discharge in excess of 500,000 gallons per day shall require approval by the County’s Environmental Compliance Section for separate concentration limit evaluation and approval.”

- B. CIPP liner systems using resins containing styrene or other regulated chemicals that will be discharged into the wastewater system shall require a pre-treatment plan to remove the regulated chemicals to acceptable levels prior to discharge. The Contractor shall submit the pre-treatment plan to the County for approval prior to discharge. The information required shall include:

1. MSDS for all chemicals used in the process and that will be discharged into the wastewater system
 2. Representative analytical data that was performed in the past for the proposed process, as collected from the wastewater stream
 3. The addresses and mapped locations of the discharge
 4. The total duration of discharge request
 5. The anticipated discharge temperature. Discharges in excess of 140°F are not permitted
 6. The Contractor shall submit for approval a summary table of pre-treatment design calculations in Excel containing the following information:
 - a. Dates of discharge of each section
 - b. Lining section numbers using the OCUD numbering system
 - c. Length and diameter of each section
 - d. Volume (in gallons) of inversion water of each section
 - e. Volume (in gallons) of cool down water of each section
 - f. Total volume (in gallons) of inversion and cooling water of each section
 - g. Regulated chemical (in pounds) in discharge volume of each section
 - h. Reduction chemical (in pounds) to meet post-treatment concentration limit
 - i. Reaction time period (in hours) to achieve post-treatment concentration limit
 - j. Cool down time period (in hours)
 - k. Regulated chemical post-treatment concentration limit (in PPM)
 7. The Contractor shall provide pre-treatment and post-treatment sampling and laboratory analysis of the process wastewater and submit the results to the County for verification.
- C. After curing, the Contractor shall obtain a post-treatment cure water sample at each site and submit for laboratory analysis. ,
1. The following laboratory analysis is required:
 - a. One (1) sample to be collected from the treated water line segment and analyzed for “Styrene” using EPA Method 8260.
 - b. One (1) “Trip Blank” sample, analyzed for “Styrene” using EPA Method 8260.
 2. The Contractor shall submit the analytical report to the County for approval.
 3. The Contractor shall be responsible for all costs related to laboratory analytical testing of the water samples collected.
 4. Sampling shall continue for each successive lining segment until the laboratory results verify the Contractor’s competency in determining the amount of styrene reduction tablets/material required for a given water volume. Competency will be determined by meeting the stated discharge limits.
 5. Once the sample results demonstrate that the discharge limits have been met the Contractor shall follow similar styrene reduction procedures for subsequent lining segments, but sampling will not be required.
 6. Should samples from three locations not meet the discharge limits, the County may require the Contractor to hold cure water in place until laboratory results confirm the water is below the discharge limits.
 7. The County reserves the right to obtain samples at any site on any line segment to ensure compliance with the discharge limits.”

- D. The service areas for each of the proposed lining subareas are as follows:
1. (Subarea Name) (Subarea Number) is/are located in the Eastern WRF service area.
 2. (Subarea Name) (Subarea Number) is/are located in the South WRF service area
 3. (Subarea Name) (Subarea Number) is/are located in the Northwest WRF service area.

1.06 RESPONSIBILITY FOR OVERFLOWS AND SPILLS

- A. It shall be the responsibility of the Contractor to schedule and perform his work so as to result in no overflows or spills of sewage or combined sewage from the system. If sewage flows are such that they interfere with the Contractor's ability to perform work, the Contractor shall be responsible for scheduling his work during low flow periods or provide bypass pumping. Bypass pumping shall be provided only with the specific written approval of the County.
- B. In the event of overflows caused by the Contractor's work activities, the Contractor shall immediately take appropriate action to contain and stop the overflow, clean up the spillage, disinfect the area affected by the spill, and notify the County in a timely manner.
- C. Contractor will indemnify and hold harmless the County for any fines or third-party claims for personal or property damage arising out of a spill or overflow that is fully or partially the responsibility of the Contractor. Should fines subsequently be imposed as a result of any overflow for which the Contractor is fully or partially responsible, the Contractor shall pay all such fines and all of the County's legal, engineering, and administrative costs in defending such fines and claims associated with the overflow.
- D. If the Contractor is required to hold cure water due to unacceptable styrene testing results, the Contractor shall be required to provide bypass pumping or other means to insure wastewater service is not disrupted during the hold period.

1.07 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." Submittals shall include the following:
1. Performance Work Statement shall be provided with a table of contents and tabbed sections.
 2. Product:
 - a. A list of projects from the Manufacturer that total a minimum of 500,000 linear feet of liner installed in the United States. An Excel spread sheet shall be included listing as a minimum the name of projects, linear footage of main, completion date, contract amount, name of owner, address, contact person, and phone number.
 - b. Fabric tube – manufacturer and description of product components
 - c. Flexible membrane (coating) material and recommended repair (patching) procedure if applicable
 - d. Raw resin data – manufacturer and description of product components

- e. Manufacturer's shipping, storage and handling recommendations for all components of the CIPP system
 - f. All MSDS sheets for all materials to be furnished
 - g. Tube wet-out and cure method including:
 - (1) A complete description of the proposed wet-out procedure for the proposed technology
 - (2) The manufacturer's recommended cure method for each diameter and thickness of CIPP liner to be installed including the curing medium and the method of application
3. Quality Control Plan
- a. Defined responsibilities of the Contractor's personnel for assuring that all quality requirements are met. These will be assigned by the Contractor to specific personnel.
 - b. Proposed procedures for quality control, product sampling and testing shall be defined and submitted as part of the Plan.
 - c. Proposed methods for product performance controls, including the method of and frequency of product sampling and testing both in raw material form and cured product form.
 - d. Inspection forms and guidelines for quality control inspections shall be prepared in accordance with the standards specified within this specification.
 - e. The manufacturer shall furnish a check list containing key elements of the CIPP installation criteria that is important for the County to ensure that quality control and testing requirements are performed in accordance with these specifications.
4. Engineering design calculations shall be submitted in a timely fashion prior to construction, in accordance with the Appendix of ASTM F-1216, for each length of liner to be installed including the thickness of each proposed CIPP. It will not be acceptable for the Contractor to submit a design for the most severe line condition and apply that design to all of the line sections. All calculations shall include data that conforms to the requirements of these specifications.
- a. These calculations shall be performed and certified by a Professional Engineer registered in the State of Florida.
 - b. The manufacturer shall certify as to the compliance of its materials to the values used in the calculations.
5. The liner manufacturer shall submit a tabulation of time versus temperature. This tabulation shall show the lengths of time that exposed portions of the liner will endure without self-initiated cure or other deterioration beginning. This tabulation shall be at 5°F (degrees Fahrenheit) increments ranging from 70°F to 100°F. The manufacturer shall also submit his analysis of the progressive effects of such "pre-cure" on the insertion and cured properties of the liner
6. Certified copies of test reports of factory tests required by the applicable standards and this Section.
7. Manufacturer's installation instructions and procedures.
8. CIPP Installation Record (Shot Record) to include shot number and corresponding manhole to manhole pipe reaches for each scheduled installation, design thickness, actual thickness delivered to the site, pipe diameter, relength, total length of shot, and number of laterals.

9. Wastewater pre-treatment plan including data, measurements, assumptions, calculations and procedures for the pre-treatment of CIPP process wastewater containing regulated chemicals.
10. Manufacturer's detailed procedures for repairing liners that have been installed incorrectly or that have failed during installation.
11. Contractor's procedures and materials for service renewal including time and duration of sewer service unavailability and a complete description of the methods he intends to use to reconnect the existing laterals.
12. Sampling procedures and locations for obtaining representative samples of the finished liner.
13. Sampling tests for compliance by an independent laboratory shall be made according to the applicable ASTM specification and the manufacturer's quality control program.

B. A final certificate of compliance with this specification shall be provided by the manufacturer for all lining material furnished.

1.08 WARRANTY

- A. The materials used for the project shall be certified by the manufacturer for the specified purpose. The Contractor shall warrant the liner material and installation for a period of one (1) year. During the Contractor warranty period, any defect which may materially affect the integrity, strength, function and/or operation of the pipe, shall be repaired at the Contractor's expense in accordance with procedures in these specifications and as recommended by the manufacturer.
- B. On any work completed by the Contractor that is defective and/or has been repaired, the Contractor shall warrant this work for an additional one (1) year.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall be responsible for the delivery, storage, and handling of products. No products shall be shipped to the job site without the approval of the County.
- B. Keep products safe from damage. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.
- C. The wet-out facility shall write the Shot number, total wet-out length, thickness, pipe width, and resin type on each bag delivered to the project.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The materials used shall be designed, manufactured, and intended for sanitary sewer pipe relining and the specific application in which they are used. The materials shall have a proven history of performance in sewer relining and rehabilitation.

- B. Pipe lining products pre-approved by the County include: Insituform Technologies (CIPP Liner), National Liner (CIPP Liner), LMK Enterprises (Performance Liner), Stevens Technologies (CIPP Liner 2 part 100% epoxy), Inner Cure Technologies (Reichold/Dion CIPP Liner), Lanzo Lining Services (Lanzo CIPP Lining System), and Premier Pipe (Premier Pipe CIPP Lining System), Layne Inliner (CIPP Liner), and Miller Pipeline (CIPP Liner). All products must meet the specification herein and will require approval prior to installation.
- C. All materials, shipped to the project site, shall be accompanied by test reports certifying that the material conforms to the ASTM listed herein. Materials shall be shipped, stored, and handled in a manner consistent with written recommendations of the CIPP system manufacturer to avoid damage. Damage includes, but is not limited to, gouging, abrasion, flattening, cutting, puncturing, or ultra-violet (UV) degradation. On site storage locations, shall be approved by the County. All damaged materials shall be promptly removed from the project site at the Contractor's expense and disposed of in accordance with all current applicable agency regulations.
- D. The finished pipe liner in place shall be fabricated from materials which when complete are chemically resistant to and will withstand internal exposure to domestic sewage having a pH range of 5 to 11 and temperatures up to 150°F.
- E. Take all necessary field measurements of the existing pipe (including diameter, ovality and length) prior to manufacturing liners.
- F. The minimum length shall be that deemed necessary by the Contractor to effectively span the distance from the inlet to the outlet of the respective manholes unless otherwise specified. The Contractor shall verify the lengths in the field before manufacturing.

2.02 STRUCTURAL REQUIREMENTS

- A. Each CIPP shall be designed to withstand internal and/or external loads as dictated by the site and pipe conditions. The CIPP design shall assume no bonding to the original pipe wall.
- B. The Contractor must have performed long-term testing for flexural creep of the CIPP pipe material installed by his company. Such testing results are to be used to determine the long-term, time dependent flexural modulus to be utilized in the product design. The long-term modulus shall not exceed 50 percent of the short-term value for the resin system and shall be verifiable through testing. The materials utilized for the contracted project shall be of a quality equal to or better than the materials used in the long-term test with respect to the initial flexural modulus used in the CIPP design.
- C. The Contractor shall submit, prior to installation of the lining materials, certification of the compliance with these specifications and/or the requirements of the CIPP system. Certified material test results shall be included that confirm that all materials conform to these specifications. Materials not complying with these requirements will be rejected.

- D. The design thickness of the CIPP shall be arrived at using standard engineering methodology as found in ASTM F1216 and the physical properties. In no case shall the finished thickness of the cured liner be less than 4.5 millimeters. The required cured structural CIPP wall thickness shall be based, as a minimum, on the physical properties described in TABLE 02771 - 1 Minimum Physical Properties and per the design of the Professional Engineer and in accordance with the design equations in ASTM F 1216 Appendix X1 and the following design parameters:

Design Considerations	Criteria
Tube Design	ASTM F 1216 Appendix X1
Hydrostatic Buckling	ASTM F 2561 Section 6.1 and 6.1.1
Design Safety Factor	2.0
Retention Factor for Long Term Flexural Modulus to be used in Design	50 % of the short-term value of the resin system
Ovality	2 %
Groundwater Depth*	100% depth from pipe invert to surface
Soil Depth*	As indicated on the plans
Lining enhancement factor (K)	7
Soil Modulus**	1,000 psi
Soil Density**	120 pcf
Live Load**	One (1) H20 passing truck
Design Condition	Fully deteriorated
Minimum Long-Term Life	50 years

*Denotes multiple line segments may require a table of values

**Denotes information required for fully deteriorated design conditions

TABLE 02771-1
Minimum Physical Properties

Property	Standard	Cured Composite per ASTM F1216 (PSI)
Flexural Strength (short term)	ASTM D790	4,500
Flexural Modulus of Elasticity (short term)	ASTM D790	250,000

- E. When multiple layers are present, the layers of the finished CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or such that the knife blade moves freely between the layers. If separation of the layers occurs during testing of the field samples, new samples will be cut from the work. The composite of the materials will, upon installation inside the host pipe, exceed the minimum test standards specified by the American Society for Testing Methods. Any reoccurrence may be cause for rejection of the work.

2.03 CURED-IN-PLACE LINER

A. Fabric

1. The Contractor shall determine the minimum tube length necessary to effectively span the designated run between manholes. The Contractor shall verify the lengths in the field prior to ordering and prior to impregnation of the tube with resin, to ensure that the tube will have sufficient length to extend the entire length of the run. The Contractor shall also measure the inside diameter of the existing pipelines in the field prior to ordering liner so that the liner can be installed in a tight-fitted condition.
2. The sewn tube shall consist of one or more layers of absorbent non-woven felt fabric and meet the requirements of ASTM F-1216, ASTM F1743, or ASTM D5813. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe, and stretch to fit irregular pipe sections.
3. The wet out tube shall have a relatively uniform thickness that when compressed at installation pressures will equal or exceed the calculated minimum design CIPP wall thickness.
4. The flexible tube shall be fabricated to a size that when installed will neatly fit (minimum 99.75%) the internal circumference of the existing sanitary sewer lines (including services). Allowance shall be made for circumferential stretching during insertion so that the final cured product is snug against the wall of the host pipe.
5. The outside layer of the tube shall be coated with an impermeable, flexible membrane that will contain the resin and allow the resin impregnation (wet out) procedure to be monitored.
6. The tube shall contain no intermediate or encapsulated elastomeric layers. No material shall be included in the tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be evident.
7. The wall color of the interior pipe surface of CIPP after installation shall be a relatively light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.
8. Seams in the tube shall be stronger than the non-seamed felt material.
9. The tube shall be marked for a distance at regular intervals along its entire length, not to exceed five feet. Such markings shall include the Manufacturers name or identifying symbol.
10. Unless otherwise specified, the Contractor will use a polyester filter felt tube and a resin and catalyst system compatible with the inversion process and having the minimum physical properties for the cured pipe identified in Table 02771 - 1 Minimum Physical Properties.

B. Resin

1. The resin system shall be a corrosion resistant polyester or vinyl ester resin and catalyst system or epoxy and hardener system that when properly cured within the tube composite, meets the minimum requirements of ASTM F1216, ASTM F1743 or F2019, the physical properties given herein these specifications Section 02771 and those, which are to be utilized in the design of the CIPP for this project.
2. The resin used shall not contain non-strength enhancing fillers.
3. The Contractor shall submit the resin characteristics, including filler identification, to the County for approval prior to lining activities.

4. The resin shall produce a CIPP that will comply with the structural and chemical resistance requirements of the specification.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prior to any lining of a pipe so designated.
 1. It shall be the responsibility of the Contractor to remove all internal debris and clean the existing sewer line and/or lateral in accordance with the recommendations of the liner manufacturer prior to installation of the liner and in accordance with Section 02761 "Cleaning Sanitary Sewer Systems." Both mainline and lateral line shall be cleaned.
 - a. Preparation of the interior surface shall be accomplished by a thorough high-pressure water-jet cleaning. The pipe shall be left free of all loose sand, rock, or other deleterious materials. Any roots in the pipe shall be either removed or cut off flush with the interior.
 - b. If conditions such as broken pipe and major blockages are found that will prevent proper cleaning or where additional damage would result if cleaning is attempted or continued, the Contractor shall notify the County immediately. The County will determine what course of action will be taken to complete the project.
 - c. Precautions shall be taken by the Contractor to ensure that no damage or flooding of public or private property is caused by the cleaning operation.
 - d. The County shall inspect the prepared pipe for cleanliness and smoothness before the Contractor is authorized to proceed with pipe lining operations.
 2. Certified PACP personnel trained in locating breaks, obstacles and service connections by closed circuit television shall perform inspection of existing sewer lines. The interior of the line shall be carefully inspected in accordance with Section 02762 "Televising Sanitary Sewer Systems" to determine the location of laterals in any condition that may prevent proper installation of the liner pipe into the lines. Such conditions shall be noted so they can be corrected. A digital data video and a suitable log shall be prepared by the Contractor during the Work and provided to the County a minimum of two weeks prior to liner installation.
 3. The Contractor shall provide for the flow of sewage around the section or sections of pipe designated for lining as specified in Section 01516 "Collection System Bypass."
 - a. Flow control shall be exercised as required to ensure that no flowing sewage comes into contact with sections of the sewer under repair.
 - b. A sewer line plug shall be inserted into the sewer upstream from the section to be repaired. The plug shall be so designed that all or any portion of the sewage flows can be released. During the review, testing and installation portion of the operation, flows shall be shut off in order to properly install the cured-in-place pipe lining. The upstream manholes shall be constantly monitored for degree of surcharging. After the installation is complete, flows shall be restored to normal level.
 - c. Wherever lines are blocked off and the possibility of backing up the sewage and causing harm to public and private property is foreseen, it shall be the Contractor's responsibility to bypass flow from manhole to manhole.

- d. Bypassing shall be accomplished using sewer plugs with pump connections, by pumping down surcharged manholes, or by other methods acceptable to the County. All bypassed flow must be discharged to a sanitary sewer. Bypassed flow shall not be allowed to enter any storm line, drainage ditch or street gutter.
 - e. During a bypass operation, the pump shall be manned continuously; the Contractor shall maintain the pump and bypass equipment; and shall be responsible for any damages to public or private property due to the malfunction of same.
4. The Contractor shall clear the line of obstructions such as solids, dropped joints, protruding service connections or collapsed pipe that will prevent the insertion of the liner pipe. If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, then the County shall be notified immediately.
 5. Do not install liner if ground water temperatures and/or ambient temperatures are excessive for the product installation procedures.
 6. Notification of Public or Customers: Customers shall be notified by the Contractor with door hangers at least 3 days prior to the shutdown of any lateral services. The door hanger shall be approved by the County and advise the customers of when the Work will begin, expected date of completion, the type of work, and contact person for any questions and the door hanger. When it is necessary to shut down a private sewer lateral while work is in progress and before the laterals are reconnected, the customers shall be notified by the Contractor. No sewer or water service is to remain shut down for more than a period of 8-hours unless the Contractor provides substitute services for the residents. Commercial sewer services shall be maintained at all times that the business is open. No sewage from the services or main line shall be discharged on the ground or in waterways.
 7. Contractor shall coordinate pump stations, force main and sanitary sewer operation, bypass and shutdown control with the County
 8. Traffic Control: The Contractor shall provide all traffic control measures required for the safety of the public, workers and equipment during the Work and in accordance with FDOT and the County.
 9. The Contractor shall provide critical backup equipment to insure that the lining operation progresses without interruption. Required backup equipment shall include at a minimum 1 additional lateral cutter system and 1 additional CCTV camera system.

3.02 INSTALLATION OF LINER

- A. The CIPP liner shall be installed and cured in the host pipe per the manufacturer's specifications as described and submitted in the Performance Work Statement. CIPP installation shall be in accordance with the applicable ASTM Standards with the following modification:
 1. Prior to installation and as recommended by the manufacturer remote temperature gauges or sensors shall be placed inside the host pipe to monitor the temperatures during the cure cycle. Liner and/or host pipe interface temperature shall be monitored and logged during curing of the liner.

2. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing heat source. Another such gauge shall be placed between the impregnated reconstruction tube and the pipe invert at the remote manhole to determine the temperatures during cure. The resin manufacturer shall recommend temperature in the line during the cure period.
3. The wet-out tube shall be positioned in the pipeline using the method specified by the manufacturer. Care should be exercised not to damage the tube as a result of installation. The tube shall be inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point. Sufficient excess resin will be provided to insure excretion into cracked pipe and/or joints of the host pipe after curing.
4. After inversion is completed, the Contractor shall supply suitable heat source and recirculation equipment. The equipment shall be capable of delivering the heat source throughout the section uniformly to raise the temperature above the temperature required to affect a cure of the resin. This temperature shall be determined by the resin/catalyst system employed. Temperatures shall be monitored and recorded throughout the installation process to ensure that each phase of the process is achieved at the manufacturer's recommended temperature levels. Copies of these records shall be given to the County at the completion of each installation.
5. Curing shall be accomplished by utilizing the appropriate medium in accordance with the manufacturer's recommended cure schedule. The curing source input and output temperatures shall be monitored and logged during the cure cycles if applicable. The manufacturer's recommended cure method and schedule shall be used for each line segment installed, and the liner wall thickness and the existing ground conditions with regard to temperature, moisture level, and thermal conductivity of soil, per ASTM Standards as applicable, shall be taken into account by the Contractor.
6. For heat cured liners, if any temperature sensor or multiple sensors do not reach the temperature as specified by the manufacturer to achieve proper curing or cooling, the installer can make necessary adjustments to comply with the manufacturer's recommendations. The system computer should have an output report that specifically identifies each installed sensor station in the length of pipe, indicates the maximum temperature achieved and the sustained temperature time. Each sensor should record both the maximum temperature and the minimum cool down temperature and comply with manufacturer's recommendations.
7. For UV cured liners, all light train sensor readings, recorded by the tamper proof computer, shall provide output documenting the cure along the entire length of the installed liner. The cure procedure shall be in accordance with the manufacturer's recommendation as included in the performance work statement.
8. Temperatures and curing data shall be monitored and recorded by the Contractor throughout the installation process to ensure that each phase of the process is achieved as approved in accordance with the CIPP system manufacturer's recommendations.
9. The Contractor shall immediately notify the County of any delays taking place during the insertion operation. Such delays shall possibly require sampling and testing by an independent laboratory of portions of the cured liner at the County's discretion. The cost of such test shall be borne by the Contractor and no extra compensation will be allowed. Any failure of sample tests or a lack of immediate notification of delay shall be automatic cause for rejection of that part of the Work at the County's discretion.

10. Initial cure shall be deemed to be completed when inspection of the exposed portions of cured pipe appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of a duration recommended by the resin manufacturer, as modified for the cured-in-place inversion process, during which time the recirculation of the heat source and cycling of the heat exchanger to maintain the temperature continues. Contractor shall retain a resin-impregnated sample (wick) to provide verification of the curing process taking place in the host pipe.
11. The Contractor shall cool the hardened pipe to a temperature below 100°F before relieving the static head in the inversion standpipe. Cool-down may be accomplished by the introduction of cool water into the inversion standpipe to replace water being drained and disposed per the approved pre-treatment plan. Care shall be taken in the release of the static head so that a vacuum will not be developed that could damage the newly installed pipe.
12. Seal the area where the line enters or leaves each manhole. Finish the inside of the manhole with a quick set cement grout to raise the invert to the grade of the liner pipe. Also use this grout to dress up around the end of the liner. This space may be sealed with a mechanical seal, chemical seal, or combination of both. The Contractor shall seal the liner at all manhole reconnections with an approved product, compatible with the liner, to completely seal any annular space present.
13. If the pipe liner fails to make a tight seal due to broken or misaligned pipe at the manhole wall or other reason, the Contractor shall apply a seal at that point.
14. The temperature of water discharged to the sewer system from processing liners shall not exceed 100°F maximum or the level allowed by State or Local standards. When draining water, care shall be exercised not to create a vacuum in the line.
15. After the liner has been installed, all active, existing services shall be temporarily reinstated. This shall be done without excavation in pavement areas, and in the case of non-man-entry pipes, from the interior of the pipeline by means of a 360° (degree) television camera and a cutting device that re-establishes the service connection. When a remote cutting device is used and a cleanout is available, then a mini-camera down the service may also be used to assist the operator in cutting or trimming. All coupons shall be recovered at the downstream manhole and removed.
16. The cost for maintaining sanitary sewer service for the property owners shall be included in the prices bid and no additional compensation will be allowed.

3.03 POST INSTALLATION

A. Service Lateral Renewal

1. The number of service connections on some sewer segments may exceed the number of buildings actually served. It is the Contractor's responsibility to determine through dye testing, or other acceptable methods, the services that are live and require reinstatement prior to commencing lining of the sewer main.
2. Inactive services to vacant parcels shall be renewed, unless otherwise directed by the County.

3. The exact location and number of service connections or side sewers shall be verified during the initial television inspection. It shall be the Contractor's responsibility to accurately field locate all existing service connections or side sewers and establish means for access for flow control. The Contractor shall reconnect all service connections or side sewers to the liner pipe as indicated in accordance with the Contract Documents.
 4. The Contractor shall be responsible for restoring/correcting, without any delay, all missed or faulty reconnections, as well as any damage caused to property owners for not reconnecting the services soon enough or for not giving notice to the property owners.
 5. Any lateral not initially reinstated by the Contractor that proves to be active shall be reinstated by the Contractor at no additional cost to the County and the Contractor shall be responsible for any resulting property damage of floods.
 6. All existing service connections shall be reconnected by a remote controlled cutting device directed internally by a television camera or by internal manual cutting. Cuts shall be made by experienced operators so that no blind attempts or holes are made in the liner pipe. Locations shall be verified carefully to match earlier tapes for accurate lateral location, especially where dimples are not well defined. The County reserves the right to require service connection by excavation at the Contractor's expense at any location if the quality or workmanship of the cut is not satisfactory.
 7. A 2-pass process of utilizing a cutter to open the lateral followed by wire brush (or similar) attachment to complete the cutting flush with the lateral walls should be utilized, or approved alternate. It shall be properly aligned, invert to invert, to the existing connection with no obstructions to the flow. Resin slugs shall be removed as necessary from reinstated service connections. Any mis-cuts shall be repaired at no cost to the County and shall be performed utilizing an additional thinner liner to prevent water from entering behind the liner to the full satisfaction of the County. All coupons cut from the liner for reopening of lateral connections shall be retrieved from the sewer, accounted for by the Contractor, and turned over to the County.
 8. Service connections shall be reinstated to at least 95% of the original area as it enters the host pipe.
 9. All service connections and side sewers to be reconnected to the main sewer, shall be cleaned up to a length of 1-foot from the inside face of the existing wall of the main pipe. All deposits within the first foot of the service connection or side sewer in the service connections shall be removed and laterals reinstated.
 10. Contractor shall provide a sound, smooth transition from laterals/side sewers to the main sewer. Contractor shall submit for approval a detailed repair plan for the permanent repair of any gaps between the installed liner and the face of the lateral/side sewer connections.
 11. For PVC laterals or laterals that have been previously lined with cured-in-place pipe the Contractor shall take care during the reinstatement to avoid damage to the lateral pipe.
- B. Each pipe lined shall be post-CCTV inspected in accordance with Section 02762 "Televising Sanitary Sewer Systems" as soon as practical after processing to assure complete curing.

1. The Contractor shall not reactivate any section of lined sewer pipe until authorized to do so by the County. Segments not fully conforming to these Specifications must be immediately brought to the County's attention with a proposed method of correction.
2. Immediately prior to conducting the post-lining CCTV, the Contractor shall thoroughly clean the newly installed liner removing all debris and build-up that may have accumulated, at no additional cost to the County.
3. The post-CCTV inspection documentation shall be submitted within 5 working days of the liner installation. The County may at its discretion suspend any further installation of CIPP until the post-installation documentation is submitted.
 - a. As a result of this suspension, no additional working days will be added to the contract, nor will any adjustment be made for increase in cost

C. Defects

1. The liner shall be continuous and free of all visual and material defects except those resulting from pre-lined conditions (such conditions shall be brought to the attention of the County prior to lining).
2. There shall be no damage, deflection, holes, delaminating, uncured resin or other visual defects in the liner.
3. The liner surface shall be smooth and free of waviness throughout the pipe.
4. No visible leakage through the liner or at manhole or service lateral connections will be allowed.
5. Any defects located during the inspection shall be corrected by the Contractor to conform to the requirements of the specifications and to the satisfaction of the County.
6. Defects in the installed CIPP shall be identified and defined as specified in Section 02762 Televising Sanitary Sewer Systems.
7. Repairable defects that may occur in the installed CIPP shall be specifically defined by the Contractor based on manufacturer's recommendations, including a detailed step-by-step repair procedure, resulting in a finished product meeting the requirements of these contract specifications.
8. Un-repairable defects that may occur to the CIPP shall be clearly defined by the Contractor based on the manufacturer's recommendations, including a recommended procedure for the removal and replacement of the CIPP.

D. Manhole Connections

1. Where liners of any type are installed in 2 or more continuous manhole segments, the liner invert through the intermediate manholes shall be left intact. Final finishing of the installation in those intermediate manholes shall require removal of the top of the exposed liner and neat trimming of the liner edge where it touches the lip of the manhole bench.
2. Reinstate openings for all manhole drop assemblies after relining mainline sewer
 - a. Outside drop assemblies shall be lined with a cured-in-place liner compatible with the mainline liner, for the full length of the drop assembly and bend.
 - b. Inside drop assemblies are not required to be relined.
3. A seal consisting of a resin mixture or hydrophilic seal compatible with the installed CIPP shall be applied at manhole/wall interface in accordance with the CIPP system manufacturer's recommendations.

- E. Portions of any piece of liner material removed during installation shall be available for inspection and retention by the County.

3.04 TESTING

- A. The physical properties of the installed CIPP shall be verified through field sampling and laboratory testing. All testing shall be furnished by the Contractor. All materials testing shall be performed at the Contractor's expense, by an independent third party laboratory selected by the County as recommended by the CIPP manufacturer. All tests shall be in accordance with applicable ASTM test methods to confirm compliance with the requirements in these documents.
- B. The Contractor shall pay for all testing included in this section
- C. The Contractor shall provide samples for testing from the actual installed CIPP liner. The Contractor shall determine sampling location and procedures to ensure representative samples are obtained from the finished liner, subject to the approval by the County. The contractor shall provide removable sizing sleeves, when possible, to collect liner samples, which accurately replicate the host pipe diameter.
 - 1. A minimum of 1 sample shall be taken of the first segment installed or as directed by the County.
 - 2. A minimum of 2 samples shall be taken for each 2,500 lineal feet of liner material installed or for each manufacturing lot, if less, or as directed by the County.
 - 3. A minimum of 6 samples per project shall be taken for each type of liner furnished or as directed by the County.
 - 4. A sample shall be cut from a section of cured liner that has been inverted or pulled through a like diameter pipe which has been held in place by a suitable heat sink such as sand bags.
 - 5. All curing, cutting, and identification of samples shall be witnessed by the County.
- D. Tests of the samples shall be conducted in accordance with ASTM standards
 - 1. Short term flexural properties: The initial tangent flexural modulus of elasticity and flexural strength shall be measured in accordance with test methods in ASTM D790.
 - 2. Fiber reinforced flexural properties: specimens should be sampled in accordance with ASTM F1743, section 8.1.2 and flexural properties shall be determined in accordance with ASTM F1743, section 8.1.3 along the longitudinal and circumferential axis of the install CIPP.
 - 3. Fiber reinforced tensile properties: Where the CIPP is reinforced with oriented continuous or discontinuous fibers to enhance the physical properties of the CIPP, specimens shall be sampled in accordance with ASTM F1743, section 8.1.2 and tensile properties shall be determined in accordance with ASTM D3039 and tested along the longitudinal axis and circumferential axis of the installed CIPP.

4. CIPP wall thickness shall be determined in a manner consistent with ASTM D5813, section 8.1.2. Thickness measurements shall be made in accordance with the practice in ASTM D3567 for ASTM D5813, section 8.1. Deduct from the measured values the thickness of any plastic coating or CIPP layer not included in the structural design of the CIPP. The average thickness shall be calculated using all measured values and shall meet or exceed the minimum design thickness. The minimum wall thickness at any point shall not be less than 87.5% of the approved specified thickness.
- E. The installed CIPP thickness shall be measured for each liner shipment to the job site. If the CIPP thickness does not meet that specified in the contract and submitted as the approved design by the Contractor, then the liner shall be repaired or removed. The samples shall be made by core drilling 2-inch diameter test plugs at random locations selected by the County. As an alternative the Contractor may use industry proven, non-destructive methods for confirming the thickness of the installed CIPP if it can be shown the calibrated thickness is the same as core test plugs.

3.05 ACCEPTANCE

A. Liner

1. It is the intent of these specifications that the completed liner with all appurtenances shall be essentially equivalent in final quality and appearance to new sewer installation.
2. The finished liner shall be continuous over the entire segment between manholes and homogenous throughout.
3. The finished liner shall be fully rounded and as free as commercially practicable from visible defects, including but not limited to damage, deflection, holes, delamination, ridges, cracks, uncured resin, foreign inclusions or other objectionable defects.
4. Where a defect in the liner requires removal of a section of the liner in the County's opinion, the Contractor shall make all repairs as required by the County and shall install a segmental liner, compatible with the liner, to accomplish a continuous finished liner.
5. The pipe shall be neatly and smoothly cut off at each manhole. The manhole trough shall be raised to the invert of the liner to preclude snagging and shoaling of debris.

B. Defects: Any defect which will or could affect the structural integrity, strength of the lining, flow impairment, or leaks shall be repaired as outlined below or in accordance with the approved repair or replacement procedures as recommended by the CIPP system manufacturer. The repair or replacement of the defects will be at the Contractor's expense.

1. Leaks

- a. There shall be no visible infiltration through the liner, around the liner at manhole connections, at lined service connections or in lined services. Contractor shall repair any visible leaks and the repair method shall be approved by the County.

2. Wrinkles/Fins

- a. Wrinkles outside the flow line of the pipeline:
 - (1) Wrinkles/fins in height up to a maximum of 5% of the inside diameter of the host pipe are acceptable

- (2) Wrinkles/fins over 5%, particularly those of a longitudinal configuration, may be acceptable and should be evaluated, by the project engineer for acceptance, on a case-by-case basis.
 - b. Wrinkles in the flow line:
 - (1) Wrinkles/fins projecting more than 5% into the flow that are generally longitudinal in their orientation may be deemed acceptable by the County on a case-by-case basis by considering any potential operation and maintenance issues that would result from their being left in place.
 - (2) Wrinkles/fins in the lower third or flow line of the finished CIPP (based upon the depth of flow) that are generally circumferential in their orientation should not exceed 0.5-inches, whichever is smaller. Acceptability of larger wrinkles/fins meeting this characterization shall be, on a case-by-case basis by the County with consideration given to potential operations and maintenance issues that would result from their being left in place.
 - c. Repair when wrinkles/fins are removed:
 - (1) Wrinkles should be fully cured, tight and the resin should be homogeneous across the full width of the wrinkle.
 - (2) In most cases, when wrinkles/fins are removed from the installed CIPP, the resin in the liner pipe is fully cured and homogeneous and no further repair is required. If a repair is required the manufacturer should be contacted for the correct repair procedure.
- 3. Blisters should be probed and punctured to determine the existence of water behind the blister.
 - a. No action required unless the pipe is leaking at the blisters.
- 4. Lifts in Liner
 - a. Soft lifts should be re-processed by the Contractor to fully cure the CIPP.
 - b. Hard lift shall be removed and a new short liner as required being equivalent to the original installed CIPP.
- 5. A bulge in the invert caused by residual debris left in the pipe that impedes the flow characteristics of the pipeline should be cut out.
 - a. Cut out the section of the bulge and replace with a new short liner equivalent to the original product or as recommended by the manufacturer.
- 6. Pinholes: the area where the liner has pinholes should be patched with a short-liner repair or the liner removed and replaced as recommended by the manufacturer.
- 7. Soft spot in liner needs to be reheated and hardened or cut out and replaced or as recommended by the manufacturer.
- 8. Dry tube or white spots are not acceptable and shall be removed and a patch repair shall be performed or as recommended by the manufacturer.
- 9. Liner surface peeled off
 - a. Cut out a representative sample of the CIPP
 - b. Test physical properties and remaining CIPP thickness to verify that the contract design requirements are met.
 - c. Replace liner or as recommended by the manufacturer
- 10. Hole in the liner is not acceptable
 - a. Small holes can be repaired with epoxy
 - b. Short liner installed over larger holes or as recommended by the manufacturer
- 11. Cracks in liner are unacceptable and shall be repaired

12. Loose liner seam tape shall be removed to prevent potential hang-up of debris.
13. Annular space between host pipe and liner at manhole
 - a. If leaking between the host pipe and the CIPP, inject a hydrophilic type grout to stop the leakage.
 - b. If the pipe is located in groundwater, inject a hydrophilic type grout to stop possible future leakage.
 - c. If the pipe is not in groundwater, a cementitious grout can be used to fill the space.
14. Liner delamination
 - a. Cut out the section of delaminated liner and replace with a new short liner equivalent to the original product or as recommended by the manufacturer.
15. CIPP discoloration
 - a. Obtain a sample for testing the CIPP physical properties. Follow manufacturer's recommendations for repair.
 - b. Remove and replace the CIPP physical if the physical properties do not meet the contract minimum requirements.
 - c. No action required if the tested samples meet the physical properties.
16. Improper repair of CIPP: duct tape is not an acceptable repair for any situation.
17. The CIPP should fit tight inside the host pipe.
 - a. If the CIPP does not fit tightly against the original pipe at its termination point(s), the full circumference of the CIPP exiting the existing host pipe should be sealed by filling with a resin mixture compatible with the CIPP.
18. Overcut connection not allowed
 - a. Opening cut to match bottom of service pipe to eliminate debris build-up
 - b. If an overcut is made, grout the interface between the connection and the mainline
 - c. Install a connection hat
 - d. Install a short liner, then re-cut the service connection opening
19. Leakage between CIPP and host pipe at service connection
 - a. Leakage shall be stopped
 - b. Grout the interface between the connection and the mainline
 - c. Install a connection hat
20. Connection hat issue
 - a. Coating from mainliner not removed before installing the hat
 - b. Loose material shall be removed
 - c. Remove and replace the connection hat as recommended by the manufacturer
21. Undercut service connection
 - a. Finish cut with brush to create a smooth opening
22. Resin slug in service connection
 - a. If not blocking the flow from the service connection and slug does not impede more than 20% of the connection opening, no action required
 - b. If blocking the flow, remove slug or dig up and replace the connection

C. Service Connections

1. The CIPP lateral lining shall not inhibit the CCTV post video inspection of the mainline or service lateral pipes.
2. Reinstatement of all lateral connections shall be done neatly and smoothly.

3.06 CLEAN-UP AND RESTORATION

- A. The Contractor shall not allow the site of the Work to become littered with trash and waste material, but shall maintain the site in a neat and orderly condition throughout the construction period.
- B. On or before completion, the Contractor shall clean and remove from the site of the Work all surplus and discarded materials, temporary structures, stumps and portions of trees, and debris of any kind. He shall leave the site of work in a neat and orderly condition, similar or equal to that prior to construction.
- C. All private and public property along or adjacent to the Work disturbed by construction operations shall be restored to a condition similar or equal to that existing prior to construction.
- D. Before final acceptance by the County, the Contractor shall replace and/or restore any water, sewer, drain, and gas lines and appurtenances; electrical, telephone, telegraph conduits and wires, both underground and aboveground, and appurtenances; traffic signals, fire and police alarm systems and appurtenances; sidewalks, curbs, gutter, drainage ditches and pavements and all other public utility facilities and appurtenances along or adjacent to the Work that may have been disturbed by construction operations.
- E. Conditions permitting, property cleanup and restoration shall begin and be prosecuted to completion on a timely basis as set forth herein.

3.07 PROGRESSIVE CIPP INSTALLATION RECORD (SHOT RECORD)

- A. The Contractor shall provide a progressive CIPP Installation Record (Shot Record) with monthly application for partial payments. The progressive shot record shall indicate quantities actually installed and deviations to the parameters included in the shot record (i.e. shot number and corresponding manhole to manhole pipe reaches for each scheduled installation, design thickness, actual thickness delivered to the site, pipe diameter, reach length, total length of shot, and number of laterals).
- B. Monthly partial payments will not be approved without prior approval of the progressive CIPP Installation record (Shot Record) including verification and acceptance of all quantities by the County.

3.08 WARRANTY INSPECTION

- A. The County shall conduct the warranty television inspection within 1-year following completion of the project. If it is found that any of the CIPP has developed abnormalities since the completion of the project, the abnormalities shall be repaired and/or replaced by the Contractor promptly as per these specifications and as recommended by the manufacturer.

END OF SECTION

SECTION 02773

SERVICE LATERAL CLEAN-OUTS FOR TELEVISION ACCESS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The Contractor shall install service lateral cleanouts on gravity mains, not being replaced, to perform the CCTV inspection of the service laterals. All costs of material, equipment, labor and other costs due to the unspecified field conditions shall be borne by the Contractor.
- B. Record Information: The Contractor shall submit to the County the locations and elevations of the clean-out tops.

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. Polyvinyl Chloride Pipe and Fittings: Polyvinyl Chloride (PVC) Pipe shall meet the requirements of Section 15064 "Polyvinyl Chloride Pipe and Fittings."
- B. Concrete and Reinforcing Steel: Concrete and reinforcing steel shall conform to the requirements of Division 3 - Concrete. Concrete classes for the various purposes shall be as follows:
 - 1. Manhole bottoms, Class A
 - 2. Precast manholes, Class A (4,000-psi)
 - 3. Pipe and riser encasement, Class C
 - 4. Protective slabs, Class C
- C. Cement Mortar: Cement mortar for manhole construction shall comply with ASTM Designation C 270, Type M, except that the cement shall be Portland Type II only. No mortars that have stood for more than 1-hour shall be used.

PART 3 - EXECUTION

3.01 PREPARATION

- A. The interior of all pipe shall be thoroughly cleaned of all foreign material before being installed and shall be kept clean.

3.02 INSTALLATION

A. Sewer Pipe

1. PVC Pipe

- a. Handling PVC pipe: The handling of PVC pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Sections of pipe with deep cuts and gouges shall be removed and discarded at no expense to the County.

2. Building Laterals/Service Connections

- a. Service lateral connections shall be constructed in accordance with the details as indicated on the Drawings.
- b. All connections and changes of direction shall be made using standard fittings designed for that purpose.
- c. Locator balls shall be placed under all sanitary sewer service cleanouts.
- d. On curbed streets, the exact location for each service connection shall be marked by etching or cutting an "S" in the concrete curb. Where no curb exists or is planned, locations shall be marked by a method approved by the County.

3.03 FIELD QUALITY CONTROL

- A. Workmanship: Clean-outs shall be built watertight.

B. Closed Circuit Television Inspection

- 1. Internal gravity sewer video inspection shall be performed by the Contractor to check for alignment and deflection. The television inspection shall also be used to check for cracked, broken, or otherwise defective pipe and overall pipe integrity.

END OF SECTION

SECTION 02774
WASTEWATER GRAVITY COLLECTION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Construction of sanitary sewers, sewer connections and appurtenances as shown on the Drawings or specified herein.

1.02 QUALITY ASSURANCE

- A. Storage: PVC pipe shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the PVC pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes. Where necessary, due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.
- B. Tests: Certified records of tests made by the manufacturer or by a reliable commercial laboratory shall be submitted with each shipment of pipe. All pipe shall be inspected upon delivery and that which does not conform to the requirements of these specifications shall be rejected and must be immediately removed by the Contractor. The Contractor shall furnish and provide samples of pipe for the performance of such additional tests as the County may deem necessary.

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. Precast manholes
 - 2. Manhole frames, covers, and other castings
 - 3. Manufacturer's certified test report on castings
 - 4. Certification of admix installation from pre-caster
 - 5. Certified test records for polyvinyl chloride pipe
 - 6. Mill Test Certificates on ductile iron pipe
 - 7. Manhole pipe connections
 - 8. Coal tar epoxy
 - 9. Special interior linings
- B. Record Information: The Contractor shall submit to the County the elevations of the center of the manhole covers and inverts of all pipes in the manholes.

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. Ductile Iron Pipe and Fittings: Ductile iron pipe shall meet the requirements of Section 15062 "Ductile Iron Pipe and Fittings."
- B. Polyvinyl Chloride Pipe and Fittings: Polyvinyl Chloride (PVC) Pipe shall meet the requirements of Section 15064 "Polyvinyl Chloride Pipe and Fittings."
- C. Precast Concrete Manholes
 - 1. Precast manholes shall conform to the requirements of ASTM Designation C 478.
 - a. The minimum shell thickness shall be 5-inches.
 - b. Lifting holes through the structures are not permitted.
 - c. The design of the structure shall include a precast base of not less than 8-inches in thickness poured monolithically with the bottom section of the manhole walls.
 - d. Where drop structures are required, the design of the structure shall include a precast base, for the drop structure, of not less than 8-inches in thickness poured monolithically with the bottom section of the manhole walls.
 - e. New manholes shall contain a crystalline waterproofing concrete admix. Crystalline waterproofing concrete admix shall be added to the concrete during the batching operation. Admix concentration shall be added based upon manufacturer design percent concentration of admixture to the required weight of cement. The amount of cement shall remain the same and not be reduced. A colorant shall be added to verify the admix was added to the concrete for all precast manholes. Colorant shall be added and provided at the admix manufacturing facility, not at the concrete batch plant. Contractor shall provide certification from the pre-caster that the admix was installed in accordance with the manufacturers recommendations.
 - 2. Top sections shall be eccentric, except that concrete top slab shall be used where shallow cover requires a top section less than 3-feet deep.
 - 3. New manholes shall be lined with Interior Linings where shown on the Drawings.
- D. Concrete and Reinforcing Steel: Concrete and reinforcing steel shall conform to the requirements of Division 3 - Concrete. Concrete classes for the various purposes shall be as follows:
 - 1. Manhole bottoms, Class A
 - 2. Precast manholes, Class A (4,000-psi)
 - 3. Pipe and riser encasement, Class C
 - 4. Protective slabs, Class C

- E. Castings: Gray iron castings for manhole frames, covers, adjustment rings, and other items shall conform to the ASTM Designation A 48, Class 30. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength, or otherwise make them unfit for the service intended. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Casting patterns shall conform to those shown or indicated on the Drawings. The words SANITARY and ORANGE COUNTY, FLORIDA shall be cast in all manhole covers as shown on the Drawings. All manhole frames and covers shall be traffic bearing to meet AASHTO H-20 loadings unless otherwise specified.
- F. Brick: Brick for manhole construction shall be dense, hard burned, shale, or clay brick conforming to ASTM Designation C 32, Grade MM or C 62, Grade MW, except that brick absorption shall be between 5 and 25-grams of water absorbed in 1-minute by dried brick, set flat face down, in 1/8-inch of water.
- G. Cement Mortar: Cement mortar for manhole construction shall comply with ASTM Designation C 270, Type M, except that the cement shall be Portland Type II only. No mortars that have stood for more than 1-hour shall be used.
- H. Pipe Adapter: Connection of PVC gravity sewer lines to precast manholes and wetwells shall be made by using a flexible boot type manhole coupling adapter.
- I. Interior Linings (existing structures): Interior surfaces of existing manholes and wetwells shall be coated or lined to resist corrosion where shown on the Drawings. Coatings and linings shall meet the requirements of Section 09901 Coatings and Linings.
- J. Interior Linings (proposed structures): Interior surfaces of new wetwells shall be lined. Interior surfaces of new manholes shall be lined where shown on the Drawings. Coatings and linings shall meet the requirements of Section 09901 Coatings and Linings.
- K. Joint Sealer: Joint sealer material for precast manhole structures shall be pre-formed flexible plastic conforming to Federal Specification SS-S-00210 (GSA-FSS). Seal all exterior joints with Portland Type II cement after setting of joint sealer and placement of manhole section to form a watertight joint.
- L. Non-Shrink Mortar: Non-shrink mortar shall be used for filling annular spaces and holes in precast manholes and wetwells.
- M. Manhole Encapsulation: Manhole cones, riser rings, iron frame, cover, and all joints shall be encapsulated with a heat shrink-wrap with a minimum thickness of 98-mils (2.5-mm).
 - 1. Wrap shall have a cross-linked polyolefin backing coated with a protective heat activated adhesive. The wrap shall effectively bond to the substrate via primer provided by the manufacturer. The wrap shall be applied with a high intensity propane torch.
 - 2. Heat shrink-wrap for all barrel section joints of manholes shall be a minimum 9-inch width. Corbel section, riser rings, and ring and cover shall have a minimum 12-inch width wrap.
 - 3. Adhesive tap materials shall not be allowed.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Upon satisfactory excavation of the pipe trench, as specified in Section 02220 "Excavating, Backfilling and Compacting" a continuous trough for the pipe barrel and recesses for the pipe bells shall be excavated by hand digging so that, when the pipe is laid in the trench, true to line and grade, the pipe barrel will receive continuous uniform support and the bell will receive no pressure from the trench bottom.
- B. The interior of all pipe shall be thoroughly cleaned of all foreign material before being lowered in the trench and shall be kept clean during laying operations by means of plugs or other approved methods.

3.02 INSTALLATION

A. Sewer Pipe

1. General

- a. Laying of pipe shall proceed upgrade with spigot ends pointing in the direction of flow. Before pipe is joined, gaskets shall be cleaned of all dirt, stones, and other foreign material. The spigot ends of the pipe and/or pipe gaskets shall be lubricated lightly with a lubricant as specified by the pipe manufacturer and approved by the County. Sufficient pressure shall be applied to the pipe so as to properly seat the socket into the bell of the pipe. Any damage to the pipe due to over-exertion shall be replaced at the Contractor's expense. All pipe shall be laid straight, true to the lines and grades shown on the Drawings.
- b. Variance from established line and grade, at any point along the length of the pipe, shall not be greater than 1/32-inch per inch of pipe diameter and not to exceed 1/2-inch, provided that any such variation does not result in a level or reverse sloping invert.
- c. Any pipe, which is disturbed or found to be defective after installation, shall be taken up and relayed or replaced at the Contractor's expense.
- d. Approved utility crossing signs shall be placed on the pipe alignment at each side of any waterway crossing.

2. PVC Pipe

- a. Handling PVC pipe: The handling of PVC pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Sections of pipe with deep cuts and gouges shall be removed and discarded at no expense to the County.
- b. Lowering pipe into trench: Care shall be exercised when lowering pipe into the trench to prevent damage to or twisting of the pipe.

3. Building Laterals/Service Connections

- a. Service connections shall be constructed in accordance with the details as indicated on the Drawings.
- b. Sewer lateral pipe shall be extended to the right-of-way and plugged at the right-of-way line to avoid leakage (unless otherwise indicated on the Drawings). All connections and changes of direction shall be made using standard fittings designed for that purpose.
- c. Locator balls shall be placed under all sanitary sewer service cleanouts.

- d. On curbed streets, the exact location for each service connection shall be marked by etching or cutting an "S" in the concrete curb. Where no curb exists or is planned, locations shall be marked by a method approved by the County.
4. PVC C-900 DR 14 Pipe Section: PVC C-900 DR 14 pipe shall be substituted for the specified PVC pipe where:
 - a. The sewer or service pipe is to be constructed with less than 30-inches of cover between the top of the pipe and the final top of pavement or ground line.
 - b. The PVC sewer main crosses over a water main, or is at a depth which results in less than 18-inches clear distance between pipes when crossing under a water main. The DR 14 pipe shall extend a minimum of 10-feet on each side of the point of crossing.
 - c. The lateral separation of the sewer pipe and potable water piping is less than 10-feet.

B. Manholes:

1. Manhole excavation and bedding at manhole junctions shall be performed in accordance with the provisions of Section 02220 "Excavating, Backfilling and Compacting" of these specifications.
2. The invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section using 2,500-psi concrete. Steep slopes outside the invert channels shall be avoided. Changes in size and grade shall be made gradually and evenly. Changes in the direction of the sewer or entering branch shall be a smooth curve with radius as long as practicable. Invert channels shall also be formed for pipe stubouts.
3. The first pipe joint outside the manhole shall be located a minimum distance of 24-inches from the outside surface of the manhole.
4. Precast manhole tops shall terminate at such elevations to permit laying brick courses under the manhole frame to make allowance for future street grade adjustments.
5. Frames and covers shall be set accurately to conform to the finished grade.
6. Outside drop connections shall be made in accordance with the details shown on the Drawings.
7. Drop connection base slab extensions on precast manholes shall be manufactured monolithically with the manhole elements at the casting yard. The manufacturer shall submit for approval the method of drop manhole construction.
8. Where additional pipe connections or modifications of existing factory made openings are required on new or existing precast concrete manholes or wetwells, all cutting relative thereto shall be performed only by a power driven abrasive wheel or saw. It is specifically noted that such connections to existing manholes or wetwells shall be installed in accordance with the details for new units shown on the Drawings, and shall be caulked watertight with non-shrink grout.
9. Connection of the pipe entering the manhole shall be made by using a flexible boot type manhole coupling adapter. At the entry into the manhole, no part of the horizontal pipe shall rest against the concrete.
10. Manholes shall be completed as the work progresses so that testing may be conducted as prescribed in paragraph 3.03 Field Quality Control.

- C. Concrete encasement: Class C concrete encasement shall be constructed in accordance with details shown on the Drawings.

1. The County may order the line encased when:
 - a. The sewer main crosses over a water main, or is at a depth which results in less than 18-inches clear distance between pipes when crossing under a water main. Encasement shall extend a minimum of 10-feet on each side of the point of crossing. In lieu of encasement, the sewer line may be constructed of PVC DR 14 pipe and shall be laid such that both joints will be a distance of 10-feet from the crossing.
 - b. The maximum width for trench excavations is exceeded. The Contractor shall construct concrete encasement around the pipe for the length of the excessive excavation. No payment will be made for the concrete encasement required due to excessive trench widths.
2. The points of beginning and ending of pipe encasement shall be not more than 6-inches from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

D. Concrete protective slabs: Concrete protective slabs as shown on the Drawings shall be constructed over gravity sewers that have less than 3-feet of cover from finished grade.

E. Connections to existing structures: Proposed sewer lines shall be connected to the existing manholes by core drilling the proper size opening and installing a flexible boot type manhole adapter as specified in paragraph 2.01.H of this Section.

F. Invert channels (benching) shall be provided for all new manholes and existing manholes which are connected into. No brick shall be allowed in construction of the manhole invert. Inverts shall be poured using 2,500-psi concrete.

3.03 FIELD QUALITY CONTROL

A. Workmanship: Sewers and appurtenances shall be built watertight. The sewage must be pumped for disposal and special care and attention must be paid to securing watertight construction. Upon completion, the sewers, or sections thereof, will be tested and gauged and if leakage is above the allowable limits specified, the sewer will be rejected.

B. Inspection: On completion of each block or section of sewer, or such other times as the County may direct, the block or section of sewer shall be cleaned, tested, and inspected.

1. Each section of the sewer shall show, on examination from either end, a full circle of light between manholes.
2. Each manhole or other appurtenance to the system shall be of the specified size and form, be watertight (no leakage allowed by visual inspection), and be constructed with the top set permanently to specified position and grade. All repairs shown necessary by the inspection shall be made; broken or cracked pipe replaced; all deposits removed and the sewer left true to line and grade, entirely clean and ready for use.
3. No pipe shall exceed a deflection of 5%. After the final backfill has been in place at least 30-days, the Contractor shall perform deflection testing using a rigid ball or mandrel with a diameter of not less than 95% of the base inside diameter or average inside diameter of the pipe, depending which is specified in the ASTM standard to which the pipe is manufactured. If the mandrel does not pass the completed section of sewer, the entire section of sewer will be rejected.

C. Closed Circuit Television Inspection:

1. Internal gravity sewer video inspection shall be performed by the Contractor to check for alignment and deflection. The television inspection shall also be used to check for cracked, broken, or otherwise defective pipe and overall pipe integrity.
2. The video internal inspection will be performed in 2 stages. The first inspection shall be within 30-days after the installation of the gravity sewer pipe provided the road base is in place and the manhole rings and covers are to grade. The second inspection of the gravity sewer pipe shall be before the end of the 1-year warranty period.
3. If the first or second video inspection reveals cracked, broken, or defective pipe, or pipe misalignment resulting in vertical sags in excess of 1-1/2-inch or a ring deflection in excess of 5%, the Contractor shall be required to repair or replace the pipeline. Successful passage of both the low-pressure air exfiltration test and video inspection is required before acceptance by the County.
4. Prior to repair or replacement of failed sewer pipe, the method of repair or replacement shall be submitted to the County for approval. Pressure grouting of pipe or manholes shall not be considered as an acceptable method of repair.

D. Low Pressure Air Exfiltration Testing:

1. The Contractor shall provide all labor, equipment, and materials and shall conduct all testing required under the direction of the County
2. Low pressure air testing shall conform to the requirements of UNI-B6-79 "Recommend Practice for Low-Pressure Air Testing of Installed Sewer Pipe", as published by UNI-Bell Plastic Pipe Association.
3. During sewer Construction, all service laterals, stubs, and fittings into the sewer test section shall be properly capped or plugged so as not to allow for air loss that could cause an erroneous air test result. Where necessary, the Contractor shall restrain caps, plugs, or short pipe lengths such that blowouts are prevented.
4. Each test section shall not exceed 400-feet in length and shall be tested between adjacent manholes.
5. Before testing, Contractor shall install monitoring wells at each manhole to determine groundwater level and adjust test pressure accordingly. In no case shall the test pressure exceed 9.0-psig. All pressurizing equipment shall include a regulator or relief valve set no higher than 9.0-psig to avoid over-pressurizing.
6. Low-pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0-psig greater than the average backpressure of any groundwater above the invert of the pipe, but not greater than 9.0-psig.
7. When temperatures have been equalized and pressure stabilized at 4.0-psig greater than the average groundwater backpressure, the air hose from the control panel to the air supply shall be shut off or disconnected. The continuous monitoring pressure gauge shall then be observed while the pressure is decreased to no less than 3.5-psig greater than the average groundwater backpressure. At a reading of 3.5-psig greater than the average groundwater backpressure, timing shall commence with a stopwatch or other timing device that is at least 99.8% accurate.
8. If the time shown in the table, for the designated pipe size and length, elapses before the air pressure drops 1-psig; the section under-going test shall have passed. The test may be discontinued once the prescribed time has elapsed.

9. If the pressure drops 1-psig before the appropriate time shown in the table has elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test.
10. Should the section fail to meet test requirements, the Contractor shall determine the source or sources of leakage, and make all necessary repairs and shall repeat the test until the test section is within established limits. All corrective work shall be at the Contractor's expense.

E. Correction of Non-Conforming work:

1. All non-conforming work shall be repaired or replaced by the Contractor at no additional expense to the County. Non-conforming work shall be defined as failure to adhere to any specified or implied directive of these technical special provisions and/or the Drawings, including but not limited to pipe not laid straight, true to the lines and grades as shown on the Drawings, damaged or unacceptable materials, misalignment or diameter ring deflection in pipe due to bedding or backfilling, water standing in any pipe segment or structure, visible or detectable leakage, and failure to pass any specified test or inspection.

**Table 02774-1
Test Time Table**

TEST TIME:											
For sewer diameter between 8 inches and 36 inches inclusive, the pipe shall be tested between adjacent manholes. The test time for the air pressure to drop the specified one pound shall be as listed below:											
SPECIFICATION TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP											
1 Pipe Dia. (in.)	2 Minimum Time (min:sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)	Feet							
				100	150	200	250	300	350	400	450
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.148 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:26	71:13	89:02	106:50	124:38	142:26	160:15
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

END OF SECTION

SECTION 02775
WASTEWATER MANHOLE REHABILITATION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Sanitary sewer manhole rehabilitation including:
 - 1. Rehabilitation and leak proofing of manholes by lining with spray applied or centrifugally cast light-weight structural reinforced concrete, spray applied epoxy resin systems, or equal as determined by County.
 - 2. The repair and sealing of the manhole base, bench, invert, walls, corbel/cone, and chimney of brick, block, or precast manholes, including the removal of any unsound material.
 - 3. The inspection and testing of the various types of work to insure compliance.

1.02 REFERENCES

- A. Codes, Specifications, and Standards (Not Used)
- B. Testing and Materials Standards
 - 1. American Society of Testing and Materials (ASTM)
- C. Related Sections
 - 1. Section 01516 "Collection System Bypass"
 - 2. Section 02774 "Wastewater Gravity Collection Systems"
 - 3. Section 09901 "Coatings and Linings"
 - 4. Section 09910 "Prefabricated Fiberglass Liners"

1.03 DEFINITIONS (NOT USED)

1.04 RESPONSIBILITY FOR OVERFLOWS AND SPILLS

- A. It shall be the responsibility of the Contractor to schedule and perform his work so as to result in no overflows or spills of sewage from the system. If sewage flows are such that they interfere with the Contractor's ability to perform work, the Contractor shall be responsible for scheduling his work during low flow periods or provide bypass pumping. Bypass pumping shall be provided only with the specific written approval of the County.
- B. In the event of overflows caused by the Contractor's work activities, the Contractor shall immediately take appropriate action to contain and stop the overflow, clean up the spillage, disinfect the area affected by the spill, and notify County in a timely manner.

- C. Contractor will indemnify and hold harmless the County for any fines or third-party claims for personal or property damage arising out of a spill or overflow that is fully or partially the responsibility of the Contractor. Should fines subsequently be imposed as a result of any overflow for which the Contractor is fully or partially responsible, the Contractor shall pay all such fines and all of the County's legal, engineering, and administrative costs in defending such fines and claims associated with the overflow.

1.05 SHOP DRAWINGS AND SUBMITTALS

- A. Shop Drawings shall be submitted to the County for review and acceptance prior to starting construction in accordance with the General Conditions and 01300 "Submittals" for the following:
 - 1. Manhole Liner
- B. Submittals shall be submitted to the County for review and acceptance at least 14-days prior to starting manhole rehabilitation in accordance with the General Conditions and Division 1 for the following:
 - 1. Manufacturers' Certificate of Compliance certifying compliance with the applicable Specifications and Standards. The certifications shall list all materials furnished under this Section.
 - 2. Certified copies of factory tests required by the applicable Standards, the Manufacturer, and this Section.
 - 3. Manufacturer's handling, storage, and installation instructions and procedures.
 - 4. Recommended lining thickness design to withstand groundwater pressure as specified in Part 3 of this Section.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Materials
 - 1. All materials furnished for this work shall be in accordance with the "List of Materials and Approved Manufacturers" as appended to these Specifications.
 - 2. The materials used shall be designed, manufactured, and intended for sewer manhole rehabilitation and the specific application in which they are used. The materials shall have a proven history of performance in sewer manhole rehabilitation. The materials shall be delivered to the job site in original unopened packages clearly labeled with the manufacturer's identification and printed instructions. All materials shall be stored and handled in accordance with recommendations of the manufacturer. All materials shall be mixed and applied in accordance with the manufacturer's written instructions.
 - 3. The Contractor shall warrant and hold harmless the County against all claims for patent infringement and any loss thereof.
 - 4. Handle and store all materials and dispose of all wastes in accordance with applicable regulations.

5. Each lining system shall be designed for application over wet surfaces (but not active running water) without degradation of the final product and/or the bond between the product and the manhole surfaces.
- B. The following shall be used for stopping active leaks in concrete and masonry manholes:
1. A premixed fast-setting, volume-stable waterproof cement plug consisting of hydraulic cement, graded silica aggregates, special plasticizing, and accelerating agents. It shall not contain chlorides, gypsum's, plasters, iron particles, aluminum powder, or gas-forming agents, or promote the corrosion of steel it may come in contact with. Set time shall be approximately 1-minute. Ten (10) minute compressive strength shall be approximately 500-psi.
 2. A silicate-based liquid accelerator field mixed with neat Portland cement. The set time shall be approximately 1-minute.
 3. The elastomeric polyurethane resin-soaked method, using dry twisted jute oakum, or resin-rod with polyurethane resin (water activated).
- C. The following shall be used for patching, repointing, filling, and repairing non-leaking holes, cracks, and spalls in concrete and masonry manholes:
1. A premixed non-shrink cement-based patching material consisting of hydraulic cement, graded silica aggregates, special plasticizing and accelerating agents, which has been formulated for vertical or overhead use. It shall not contain chlorides, gypsums, plasters, iron particles, aluminum powder, or gas-forming agents or promote the corrosion of steel with which it may come into contact. Set time (ASTM C-191) shall be less than 30-minutes. One-hour compressive strength (ASTM C-109) shall be a minimum of 200-psi and the ultimate compressive strengths (ASTM C-882-Modified) shall be a minimum of 1,700-psi.
- D. Spray applied or centrifugally cast structural reinforced cement manhole lining
1. The material applied to the surface of the manhole shall be a cementitious blend of calcium aluminate cement and manufactured calcium aluminate aggregates for constructing a liner that is impervious to the flow of water, is resistant to sulfide attack, and restores structural integrity to existing manhole walls.
 2. A monolithic liner shall be formed which covers all interior manhole surfaces and shall have the following minimum requirements at 28-days:

Compressive Strength (ASTM C-579B)	3,000-psi
Tensile Strength (ASTM C-496)	300-psi
Flexural Strength (ASTM C-293) (Modified)	600-psi
Shrinkage (ASTM C-596)	0% at 90% R.H.
Bond (ASTM C-321)	130-psi
Density, when applied	105± pcf
- E. Spray applied epoxy resin system manhole lining.
1. The material sprayed onto the surface of the manhole shall be an epoxy resin system formulated for application within a sanitary sewer environment. The resin will exhibit suitable corrosion resistance and enhance the structural integrity of the existing manhole.

- F. Multi-component stress skin panel liner system.
1. The material applied onto the surface of the manhole shall be a multi-component stress skin panel liner system designed to withstand the effects of hydrogen sulfide without any deterioration to the liner. The liner shall be a solvent free, two-component polymeric, moisture/chemical barrier specifically developed for the wastewater environment.
 2. The cured epoxy resin system shall conform to the following minimum Structural Standards:

Table 02775-1
Minimum Structural Standards

Cured Product	Test Method	Results
Tensile Stress	ASTM D-638	7,000-psi
Flexural Stress	ASTM D-790	13,000-psi
Flexural Modulus	ASTM D-790	500,000-psi
Compressive Strength	ASTM D-695	13,000-psi

PART 3 - EXECUTION

3.01 REHABILITATION OF MANHOLE STRUCTURE

A. General Procedures

1. **Safety:** The Contractor shall perform all work in strict accordance with all applicable OSHA, state, local, and manufacturer's safety standards. Each method of manhole rehabilitation in this Section requires some degree of manhole entry by workers. Particular attention is drawn to those safety requirements regarding confined space entry and respiratory protection from airborne particulate materials during cleaning, product mixing, and application.
2. **Cleaning:** All concrete and masonry surfaces to be rehabilitated shall be clean. All grease, oil, laitance, coatings, loose bricks, mortar, unsound brick or concrete, and other foreign materials shall be completely removed. Water blasting utilizing a 210°F steam unit and proper nozzles shall be the primary method of cleaning; however, other methods such as wet or dry sandblasting, acid wash, concrete cleaners, degreasers, or mechanical means may be required to properly clean the surface. All surfaces on which these methods are used shall be thoroughly rinsed, scrubbed, and neutralized to remove cleaning agents and their reactant products. Debris resulting from cleaning shall be removed from the manhole and not discharged downstream.
3. **Stopping Infiltration:** After surface preparation and prior to the application of mortars and coatings, infiltration shall be stopped either by plugging with a waterstop compound or chemical grout sealing.
4. **Patching:** All large holes or voids around joints, or pipes and all spalled areas and all holes caused by missing or cracked brick shall be patched. All missing mortar shall be repointed using a non-shrink patching mortar. All cracked or disintegrated material shall be removed from the area to be patched or repointed, exposing a sound sub base. All cracks not subject to movement and greater than 1/16-inch in width shall be routed out to a minimum width and depth of 1/2-inch and patched with non-shrink patching mortar.

5. Flow Control: The Contractor shall be responsible for plugging or diverting the flow of sewage as needed for repair and lining of manhole inverts and benches.
6. Remove all loose grout and rubble from existing channel. Rebuild channel if required by reshaping and repairing slope of shelves or benches. Work shall include aligning inflow and outflow ports in such a manner as to prevent the deposition of solids at the transition point. All inverts shall follow the grades of the pipe entering the manhole. Changes in direction of the sewer and entering branch or branches shall have a true curve with the largest possible radius and shall be shaped to allow easy entrance of maintenance equipment including buckets or T.V. camera.
7. Each lining system shall be installed in accordance with the manufacturer's recommendation to withstand groundwater pressures. For manholes greater than 12-feet in depth, the lining shall withstand the pressures associated with a groundwater depth equal to the manhole depth. Linings for all other manholes shall withstand the pressures associated with groundwater depth of 12-feet. Measure groundwater depth from manhole bench to top of ground surface.
8. Application of products shall be by factory certified applicators.

3.02 SPRAY APPLIED LIGHT-WEIGHT STRUCTURAL REINFORCED CEMENT

- A. The surface prior to spraying shall be damp without noticeable free water droplets or running water. Materials shall be spray-applied to a minimum uniform thickness to insure that all cracks, crevices, and voids are filled and a somewhat smooth surface remains after light troweling. The light troweling is performed to compact the material into voids and to set the bond.
- B. The first application shall have begun to take an initial set (disappearance of surface sheen, which could be 15-minutes to 1-hour depending upon ambient conditions) before the second application to assure a minimum total finished thickness of 1/2-inch. The final finished thickness may need to be greater than 1/2-inch as recommended by the manufacturer to withstand groundwater pressures. A depth gauge shall be used during application, at various locations, to verify the required thickness. The surface then shall be trowelled to smooth finish with care taken not to over trowel so as to bring additional water to the surface and weaken it. Manufacturer's recommendations shall be followed whenever more than 24-hours have elapsed between applications.
- C. The bench covers used to catch debris shall be removed and the bench and invert sprayed such that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than 1/2-inch. The wall-bench intersection shall be rounded to a uniform radius the full circumference of the intersection.
- D. No application shall be made to frozen surfaces or if freezing is expected to occur within the manhole for 24-hours after application. If ambient temperatures are in excess of 95°F, precautions shall be taken to keep the mix temperature at time of application below 90°F, using ice if necessary.
- E. The final application shall have a minimum of 4-hours cure time before being subjected to active flow.

3.03 CENTRIFUGALLY CAST STRUCTURAL REINFORCED CEMENT

- A. Application procedures shall conform to the recommendations of the manufacturer.
- B. The rotating casting applicator shall be positioned to evenly apply the material and be withdrawn at a rate to assure a final minimum thickness of 1-inch. The final finished thickness may need to be greater than 1-inch as recommended by the manufacturer to withstand groundwater pressures. A depth gauge shall be used during application, at various locations to verify the required thickness.
- C. The bench covers used to catch debris shall be removed and the bench and invert sprayed or hand applied so that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than 1/2-inch. The wall-bench intersection shall be rounded to a uniform radius the full circumference of the intersection.
- D. No application shall be made to frozen surfaces or if freezing is expected to occur within the manhole for 24-hours after application. If ambient temperatures are in excess of 95°F, precautions shall be taken to keep the mix temperature at time of application below 90°F.
- E. The final application shall have a minimum of 1-hour cure time as recommended by the manufacturer before being subjected to active flow.

3.04 SPRAYED APPLIED EPOXY RESIN SYSTEM

- A. Application procedures shall conform to the recommendations of the manufacturer.
- B. The epoxy resin shall be sprayed onto the surfaces of the manhole walls, benches, and inverts to produce a smooth coating and yield the required structural integrity and corrosion resistance. A depth gauge shall be used during application at various locations to verify the required thickness.
- C. The epoxy resin shall be applied to a minimum thickness of 0.125-inches (125-mils) at the top of the manhole and gradually thickened in accordance with manufacturer's recommendations to withstand groundwater pressures. The application shall have a minimum cure time as recommended by the manufacturer before being subjected to active flow.
- D. The sloped surface of the manhole bench shall be made non-skid by broadcasting aluminum oxide or sand into the surface prior to gelatin/set.

3.05 MULTI-COMPONENT LINER SYSTEM

- A. Application procedures shall conform to the recommendations of the manufacturer.

- B. The liner system shall be sprayed onto the surfaces of the manhole walls, benches, and inverts to produce a smooth surface. The spray equipment shall be specifically designed to accurately ratio and apply the liner system.
- C. Final installation shall be a minimum of 500-mils.
- D. The application shall have a minimum cure time as recommended by the manufacturer before being subjected to active flow.

3.06 SANITARY SEWER LATERAL CONNECTIONS TO MANHOLES

- A. Sanitary sewer lateral connections to rehabilitated manholes shall be reinstated to provide a seamless, leak free, and unobstructed flow connection between the new manhole lining or coating system and the lateral connection per 3.01A.
- B. Sanitary sewer laterals requiring rehabilitation shall be renewed per Section 02772 "Cured-In-Place Pipe (CIPP) For Lateral Renewal."

3.07 MANHOLE REHABILITATION ACCEPTANCE

- A. Test all rehabilitated manholes using the vacuum test method as per ASTM C 1244 "Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test", following the manufacturer's recommendations for proper and safe procedures. Vacuum testing of manholes and structures shall be performed after curing of linings. Any visible leakage in the manhole or structure before, during, or after the test shall be repaired regardless of the test results.
- B. All pipes for vacuum testing entering the manhole shall be installed at the top access point of the manhole. A vacuum of 10-inches of mercury (5.0-psi) shall be drawn on the manhole, and the time shall be measured for the vacuum to drop to 9-inches of mercury (4.5-psi). Manholes will be considered to have failed the air test if the time to drop 1-inch of mercury is less than what is shown in the following table:

**Table 02775-2
Vacuum Test Timetable**

Vacuum Test Timetable Manhole Diameter – Inches				
Depth – feet	48-inches	60-inches	72-inches	96-inches
4	30 sec.	30 sec.	30 sec.	30 sec.
8	30 sec.	30 sec.	32 sec.	38 sec.
12	30 sec.	39 sec.	48 sec.	57 sec.
16	40 sec.	52 sec.	64 sec.	76 sec.
20	50 sec.	65 sec.	80 sec.	95 sec.
24	60 sec.	78 sec.	96 sec.	114 sec.
+ Each 2'	+5 sec.	+6.5 sec.	+8.0 sec.	+9.5 sec.

- C. Manhole depths shall be rounded to the nearest foot. Intermediate values shall be interpolated. For depths above 24-feet, add the values listed in the last line of the table for each 2-feet of additional depth.
- D. If the manhole or structure fails the vacuum test, the Contractor shall perform additional repairs and repeat the test procedures until satisfactory results are obtained.
- E. After the manhole rehabilitation work has been completed, the manhole shall be inspected by the Contractor in the presence of the County and the work shall be accepted if found satisfactory to the County. No evidence of visible leaks shall be allowed. Non-uniformity, sagging, lamination, holidays or other defects will be cause for rejection of the coating. All surfaces shall be tested for the presence of holidays and pinholes via spark testing at 100-volts per millimeter. The Contractor shall provide the testing equipment and perform the testing in the presence of the County. Any holidays or pinholes found during the testing shall be repaired and the surface re-tested until the surfaces are completely free of holidays and pinholes.

3.08 CLEANUP

- A. After the installation work has been completed and the testing is acceptable, the Contractor shall clean up the entire project area. The Contractor shall dispose of all excess material and debris. The work area shall be left in a condition equal to or better than the prior condition.

3.09 WARRANTY

- A. The Contractor shall guarantee his work for a warranty period of 1-year from the date of acceptance.
- B. If at anytime during the warranty period any leakage, cracking, loss of bond, or other discontinuity is identified, the Contractor shall remove and replace the manhole liner with new material at no cost to the County. No field repair shall be approved.
- C. Furnish an extended warranty for manhole rehabilitation materials from the Contractor and liner manufacturer for a total of 5-years from date of final completion.

END OF SECTION

SECTION 02784
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This section specifies aluminum coated steel chain link fence, nominally 6-feet high, complete with gates to be constructed around the area indicated on the Drawings.

1.02 QUALITY ASSURANCE

- A. Chain link fences and gates shall be constructed in accordance with specified standards, as well as all pertinent codes and regulations. Where provisions of pertinent codes conflict with the specifications, the more stringent provisions shall govern.
- B. Chain link fences and gates shall be manufactured by established, reputable manufacturers that have been engaged in the manufacture of chain link fencing for at least 10-years.

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. The Contractor shall submit layout drawings of all fence and gate installations along with details and manufacturer's literature of all fence and gate materials in the Project.
- C. The Contractor shall submit all motor data, connection diagrams, wiring diagrams, and O&M instructions for all gate operators in the Project.

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. Fabric: The fabric shall be aluminum coated steel chain link, 72-inches high, No. 9-gauge wire woven in a 2-inch mesh. The fabric shall conform to the requirements of ASTM Designation A491. The aluminum coating shall be a minimum of 0.40-ounces per square foot of wire surface for No. 9-gauge fabric. The fabric shall have a minimum tensile strength of 75,000-psi. The weight of the coating shall be determined by the strip test as defined in ASTM Designation A428. The fabric shall be coated with an ultra violet stable black PVC coating which meets ASTM standards F688 Class I.
- B. Post and Other Appurtenances: All posts and other appurtenances used in the construction of this fence shall be hot dipped galvanized with a minimum of 1.8-ounces per square foot of surface. Pipe sections shall conform to the requirements of ASTM Designation A120. All posts, rails, and fittings shall be coated with an ultra violet stable black PVC coating which meets ASTM standards F688 Class I.
- C. Sizes of Posts, Gate Frames, and Rails:

COMPONENT	DIMENSIONS	
	Nominal Diameter	NPS Pipe Schedule
1. End, corner & pull posts	3-inch	40
2. Gateposts (one leaf width 8-feet or less)	3-inch	40
3. Intermediate posts	2-3/8-inch	40
4. Gate Frames	1-5/8-inch	40
5. Braces	1-5/8-inch	40
6. Top Rails	1-5/8-inch	20

D. Gates

1. Swing Gates: Gates shall be complete with latches, stops, keepers, and hinges. Gate frames shall be constructed of round tubular members continuously welded at all corners or assembled with fittings. Welds shall be painted with aluminum or zinc based paint prior to application of PVC coating. Gate filler shall be of the same fabric as specified for the fence and shall be attached securely to the gate frame with No. 9 tie wires at intervals not exceeding 12-inches. Hinges shall be of adequate strength for the gate and with large bearing surfaces for clamping in position. The hinges shall not twist or turn under the action of the gate. The gates shall be easily operable by one person. Latches, stops, and keepers for all gates, along with 1-inch stainless steel chain and padlock, shall be provided.
2. Sliding Gates: Sliding gates shall be complete with latches, stops, keepers, rollers, and roller tracks. Gate shall ride on a double wheel carrier. Gateposts shall be 3-inch Sch. 40 and frame shall be 1-5/8-inch Sch. 40. Slide pipe tracks shall be 1-5/8-inch Sch. 40. Safety post (outside of gatepost) shall be 3-inch Sch. 40. Fabric shall match fence.

3. Gate padlocks shall be the County standard, case brass, shackle-case hardened steel, 1-inch links with 12-inch chain, 606 finish and keyed alike when more than one.
- E. Top Rail: The top rail shall be provided with couplings approximately every 20-feet. Couplings are to be the outside sleeve type, at least 6-inches long.
- F. Concrete: Concrete shall have a minimum compressive strength of 2,500-psi at 28-days.
- G. Hardware: Miscellaneous hardware shall be of steel, malleable iron or ductile iron of standard design and conform to the requirements of the Chain Link Fence Manufacturer's Institute. All parts shall be galvanized except ties and clips may be aluminum.
- H. Power Gate Operators: The operators for sliding gates shall be Robot Industries, Inc. Model LSG-100, Venco Model SJH, or acceptable equal units designed for use on cantilever sliding gates. Operator motors shall be 1 horsepower and shall be wound for 208 volt, 3 phase, and 60 Hz power supply. Units shall provide gate speed of not less than 75-feet per minute. Units shall be arranged for ground level mounting on 6-inch concrete pads. A quick disconnect for manual operation with a padlock control shall be provided. The cover for the operator shall be of galvanized steel, and the units shall be provided with electric overload protection.

PART 3 - EXECUTION

3.01 ARRANGEMENT

- A. Posts: Posts shall be uniformly spaced, not to exceed 10-feet on centers. Intermediate posts shall have waterproof tops, which have integrally cast openings through which the top rails shall pass. Terminal posts shall consist of end, corner, and pull posts.
- B. Braces: Braces shall be provided at each gate, corner, pull, and end post.
- C. Top Rails: The top rails shall pass through the line post tops and form a continuous brace from end to end of each stretch of fence. The top rail shall be securely fastened to the terminal posts by heavy pressed steel brace bands and malleable end connections.
- D. Bottom Tension Wire: The bottom tension wire shall be No. 7-gauge aluminum coated spring coil or crimped wire. Minimum weight of aluminum coating shall be 0.40-ounces per square foot of wire surface. The tension wire shall be stretched taut between terminal posts and securely fastened to each intermediate post 2-inches above the finish grade line. Tension wire shall be attached to the fence fabric with aluminum hog rings every 24-inches.
- E. Stretcher Bars: Stretcher bars shall be no less than 3/16-inch by 3/4-inch in cross section and shall have minimum length 2-inches longer than the fabric height. Stretcher bars shall be used for attaching the fabric to all terminal posts by threading through the fabric and being attached to the posts with No. 9-gauge tension bands, or other positive mechanical means, spaced at 24-inch centers. One (1) stretcher bar shall be provided for each gate and end post and 2 for each corner and pull post.

- F. Ties and Clips: Fabric shall be fastened to all intermediate posts with 9-gauge tie wires, spacing not to exceed 12-inches apart. Fabric shall be tied to top rail with 9-gauge tie wires, spacing not to exceed 24-inches on centers.

3.02 INSTALLATION

- A. Post Setting: Line and terminal posts shall be set in holes 12-inches in diameter, 42-inches deep with 36-inch post embedment. After the post has been set and plumbed, the hole shall be filled with concrete. The exposed surface of the concrete shall be crowned to shed water.
- B. Terminal and Gateposts: Terminal and gateposts shall be set as specified above and shall be braced to the nearest post with a galvanized horizontal brace used as a compression member and a galvanized 3/8-inch steel truss rod and turnbuckle used as a tension member.
- C. Fabric: Fabric shall not be stretched until concrete footings have cured a minimum of 3-days. Chain link fabric shall be placed on the side designated by the County and shall be stretched taut approximately 2-inches above finish grade and securely fastened to all posts. Rolls of wire fabric shall be joined by weaving a single strand into the ends of the rolls to form a continuous mesh.

END OF SECTION

SECTION 03100
CONCRETE FORMWORK

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This Section specifies all labor, materials and equipment necessary for providing and installing formwork for concrete.
- B. Related Work Described Elsewhere:
 - 1. Section 03200 "Concrete Reinforcement"
 - 2. Section 03300 "Cast-in-Place Concrete"
- C. General Design: The Contractor shall be responsible for the design of all formwork and for safety in its construction, use and removal.

1.02 QUALITY ASSURANCE

- A. Qualifications: Formwork shall be constructed in accordance with the specified standards, as well as all pertinent codes and regulations. In cases where requirements of pertinent codes conflict with the requirements of these specifications, the more stringent shall govern.
- B. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:
 - 1. Standard Building Code
 - 2. ACI 347 "Recommended Practice for Concrete Formwork"
 - 3. Local codes and regulations

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Materials: Submit manufacturer's literature on form ties, spreaders, corner formers, form coatings and bond breakers.

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. Form Lumber: Use form lumber when in contact with exposed concrete, conforming to the following or acceptable equivalent.
- B. Lumber: Douglas Fir/Larch No. 2 grade, seasoned, surfaced on four sides.
- C. Plywood: "Plyform", Class I or II, bearing the label of the Douglas Plywood Association. (Minimum 3/4-inch thickness).
- D. Form Ties: Use form ties which do not leave an open hole through the concrete and which permit neat and solid patching at every hole. Use embedded rods with integral waterstops and cones to provide a 1-inch breakback. Wire ties and wood spreaders will not be permitted.
- E. Form Coatings: Form release coating shall be a paraffin base oil or mineral oil coating which effectively prevents absorption of moisture; prevents bonding with concrete; is non-staining to concrete; and leaves the concrete with a paintable surface.
- F. Chamfer Strips: Chamfer strips shall be polyvinyl strips or acceptable equal, designed to be nailed in the forms to provide a 3/4-inch chamfer (unless indicated otherwise) at exposed edges of concrete members.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Construction of Formwork: Forms shall be sufficiently strong to withstand the pressure resulting from the placement and vibration of concrete and shall be sufficiently rigid to maintain specified tolerances. Forms shall be sufficiently tight to prevent loss of mortar, and shall be adequately braced against lateral, upward or downward movement.
- B. Coating of Forms: Apply form coating to board forms prior to placing reinforcing. Keep form coatings off steel reinforcing, items to be embedded, and previously placed concrete.
- C. Form Erection:
 - 1. Provide a means of holding adjacent edges, ends of panels, and ends of sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects of the finished concrete. Insure that forms may be removed without damage to the surface of the finished concrete.
 - 2. Provide a positive means of adjustment of shores and struts. Insure that all settlement is taken up during concrete placing.
 - 3. Temporary openings shall be provided in wall forms to limit the free fall of concrete to a maximum of 6-feet unless an elephant trunk is used. Such openings shall be located to facilitate placing and consolidation and shall be spaced no more than 8-feet apart. Temporary openings shall also be provided in the bottom of the wall, column forms, and elsewhere as necessary to facilitate cleaning and observation immediately prior to placing.

4. Do not embed any form-tying device or part thereof other than metal in concrete.
5. Form surfaces of concrete members except where placement of the concrete is against the ground. The dimensions of concrete members shown on the Drawings apply to formed surfaces, except where otherwise indicated.

D. Form Reuse: Reuse only forms which maintain a uniform surface texture on exposed concrete surfaces. Apply light sanding between uses to obtain such a uniform texture. Plug unused tie rod holes with corks, shave flush, and sand the concrete surface side of the plug.

E. Removal of Forms

1. Forms and shoring for elevated structural slabs, girders, and/or beams shall remain in place until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Do not remove supports and re-shore. The following table indicates the minimum allowable time after the last concrete is placed before forms, shoring, and/or bracing may be removed.

Structural Item	Minimum Allowable Time
Bottom side of slabs, girders, beams	When concrete reaches specified 28-day compressive strength
Vertical sides of girders, beams	48-hours
Walls not supporting vertical or horizontal loads	48-hours
Walls supporting vertical or horizontal loads	When concrete reaches specified 28-day compressive strength
Footings, pipe encasements, pipe supports	24-hours

2. Do not remove forms from concrete which has been placed with outside air temperature below 50° F without first determining if the concrete has properly set regardless of the minimum times specified in the table above. Do not apply heavy loading on recently poured concrete. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.

F. Formed Openings: Openings shall be of sufficient size to permit final equipment alignment without deflection or offsets of any kind. Where the items pass through the wall, allow space for packing to ensure watertightness. Provide openings with continuous keyways with waterstops where required. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide reinforcement as indicated and specified. Reinforcing steel shall be at least 2-inches clear from the opening.

G. Embedded Items: Set anchor bolts and other embedded items accurately and hold securely in position in the forms until the concrete is placed and set. Check all special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after concrete pour. Check all nailing, blocks, plugs, and strips necessary for the attachment of trim, finish, and similar work prior to concrete pour.

H. Pipes and Wall Spools Cast in Concrete

1. Install wall spools, wall flanges, and wall anchors before placing concrete. Do not weld, tie or otherwise connect the wall spools to the reinforcing steel.
2. Support pipe and fabricated fittings to be encased in concrete on concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement will be possible during Construction.

I. Form Tolerances

1. Failure of the forms to produce the specified concrete surface tolerance shall be grounds for rejection of the concrete work. Rejected Work shall be repaired or replaced at no cost to the County.
2. The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

	Maximum Tolerance
Sleeves and inserts	+1/4-inch to -1/4-inch
Projected ends of anchors	+1/4-inch to -0.0-inch
Anchor bolt setting	+1/4-inch to -1/4-inch
Finished concrete	+ 1/4-inch to -1/4-inch in 10 feet of length

The planes or axes from which the above tolerances are to be measured shall be as follows:

Sleeves and inserts	Centerline of sleeve or insert
Projected ends of anchors	Plane perpendicular to the end of the anchor as located on the Drawings
Anchor bolt setting	Centerline of anchor bolts
Finished concrete	The concrete surface as located on the Drawings

3. Where equipment is to be installed, comply with manufacturer's tolerances if more stringent than above.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This Section specifies reinforcing steel and welded wire mesh for cast-in-place or precast concrete structures.
- B. Related Work:
 - 1. Section 03100 "Concrete Formwork"
 - 2. Section 03300 "Cast-in-Place Concrete"
 - 3. Section 03410 "Precast Concrete Structures"

1.02 QUALITY ASSURANCE

- A. Standards: Unless otherwise indicated, all materials, workmanship, and practices shall meet all requirements of the current editions of the following standards:
 - 1. Standard Building Code
 - 2. ACI 318 Building Code Requirements for Reinforced Concrete
 - 3. ACI 315 Details and Detailing of Concrete Reinforcement
 - 4. CRSI Manual of Standard Practice, MSP-2

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Complete shop drawings shall be submitted for comment, including bar lists and placing drawings. Drawings shall show the type, spacing, and location of metal bar supports, the grade of the reinforcing and the name of the manufacturer. The type of coupler splice devices shall be designated.

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. Reinforcing Bars: ASTM A615, Grade 60, deformed billet steel bars of a USA manufacturer.
- B. Welded Wire Fabric: ASTM A185, galvanized.
- C. Metal Bar Supports: CRSI MSP-2, Chapter 3, Class 2, Type B, Stainless Steel Protected Bar Supports.
- D. Coupler Splice Devices: Cadweld tension couplers capable of developing the ultimate strength of the bar, as manufactured by Erico Products, Incorporated, Solon, Ohio, or equal where acceptable to the County.

2.03 FABRICATION

- A. Fabrication shall meet all requirements of the specified standards. Unless otherwise indicated, the following shall apply:
 - 1. Hooks shall be standard hooks.
 - 2. Bottom bars shall extend a minimum of 6-inches into supporting members.
 - 3. Minimum cover shall be measured to the outermost stirrup, tie or bar.
 - 4. Splices are permitted only where indicated on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Supporting Reinforcing: Bar supports shall be provided as required by CRSI MSP-2 and AC1315. Top and bottom bars in slabs formed on earth shall be supported on precast concrete block supports except where such bars are properly supported from formwork. Precast concrete block supports are not required in slabs formed on tremie concrete but may be used at the Contractor's option.
- B. Placing Reinforcing: Placing of reinforcing steel and welded wire fabric shall conform to CRSI MSP-2, ACI 315, and the Drawings. Reinforcing shall be securely tied and supported to prevent displacement during concrete placement.
- C. Welded Wire Fabric: Splices in welded wire fabric shall be such that the overlap between outermost cross wires of each fabric sheet is not less than the spacing of the cross wires, plus 2-inches. Fabric shall not be extended through expansion joints or construction joints in slabs on grade except as otherwise indicated on the Drawings.
- D. Coupler Splice: Unless indicated on the Drawings or where conventional lap splices cannot be achieved, full positive tension connections shall be provided. Such devices shall be installed in accordance with the recommendations of the manufacturer.

- E. Dowels: Dowels shall be wired in position prior to placing concrete.
- F. Field Bending: Heat shall not be used to bend bars. Bars shall not be bent after being embedded in concrete.
- G. Welding: Welding of reinforcing will not be permitted.
- H. Place reinforcement a minimum of 2-inches clear of any metal pipe or fittings.

END OF SECTION

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SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This Section specifies cast-in-place concrete including all materials, mixing and transport, and performing all labor for the proportioning, mixing, transporting, placing, consolidating, finishing, and curing of concrete.
- B. Related Work Described Elsewhere:
 - 1. Section 03100 "Concrete Formwork"
 - 2. Section 03200 "Concrete Reinforcement"

1.02 QUALITY ASSURANCE

- A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the requirements of the following standards:
 - 1. Standard Building Code
 - 2. Local Codes and Regulations
 - 3. ACI 318-83, Building Code Requirements for Reinforced Concrete
- B. Plant Qualification: Plant equipment and facilities shall meet all requirements of the checklist for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C 94.
- C. Evaluation and Acceptance of Concrete: Evaluation and acceptance of concrete will be in accordance with ACI-318, Chapter 4.

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. Materials and Shop Drawings: The following information shall be submitted for review. No concrete shall be furnished until the County has reviewed submittal and no exceptions taken or other favorable response has been returned.
 - 1. Plant Qualification: Satisfactory evidence shall be submitted indicating that the plant and operators have sufficient experience in providing the applicable design mix.

2. Materials: Satisfactory evidence shall be submitted indicating those materials to be used (including cement, aggregates and admixtures) meet the specified requirements.
3. Design Mix: The design mix to be used shall be prepared by qualified persons and submitted for review. Submit affidavit as to design mix performance over the preceding 6-months. The design of the mix is the responsibility of the Contractor subject to the limitations of the Specifications. Acceptance of this submission will be required only as minimum requirements of the Specifications have been met. Such acceptance will in no way alter the responsibility of the Contractor to furnish concrete meeting the requirements of the Specifications relative to strength and slump.
4. Ready Mix Concrete: Provide delivery tickets or weigh master's certificate per ASTM C 94, including weights of cement and each size aggregate, amount of water in the aggregate, and amount of water added at the plant. The amount of water added on the job shall be written on the ticket.

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. Cement

1. Cement for all concrete shall be domestic Portland cement that conforms to the requirements of ASTM Designation C 150 Type I, Type II or Type III. All sanitary sewer manholes, wetwells, pumping stations, tanks and structures exposed to wastewater shall be constructed with Type II cement. Type III cement for high early strength concrete shall be used only for special locations and only with the review and acceptance of the County. Type I cement may be used for buildings and tremie concrete.
2. Only 1 brand of cement shall be used in any individual structure unless acceptable by the County. Cement that has become damaged, partially set, lumpy or caked shall not be used and the entire contents of the sack or container that contains such cement will be rejected. No salvaged or reclaimed cement shall be used.
3. Fly ash shall not be used in either Class A or Class B concrete.

B. Aggregates:

1. ASTM C 33. Coarse aggregates shall be size No. 57. Block cell fill shall be size No. 89.
2. In addition to requirements of ASTM C 33 for structures exposed to wastewater, the following shall apply:
 - a. Soft particles: 2% (2.0 percent)
 - b. Chert as a soft impurity (defined in Table 3 of ASTM C 33): 1% (1.0 percent)
 - c. Total of soft particles and chert as a soft impurity: 2% (2.0 percent)
 - d. Flat and elongated particles (long dimension > 5 times short dimension): 15%.

- C. Water: Clean and free from injurious amounts of deleterious materials.
- D. Air Entraining Admixture: ASTM C 260.
- E. Water Reducing and Retarding Admixture: ASTM C 494, Type D. Admixture shall not contain calcium chloride.
- F. Epoxy Bonding Agent: Sikastix 370, Sikadur Hi Mod, Concrevice 1001-LPL or acceptable equal.
- G. Waterproofing Material: Concrete admixture shall be manufactured and supplied by an approved manufacturer as shown in the Appendix D "List of Approved Products."

2.03 MIXES

A. General Requirements

1. Mix Design: Proportioning shall be on the basis of field experience and/or trial mixtures as specified in ACI 318, Section 4.3. Data on consecutive compression tests and standard deviation shall be submitted. Proportioning for small structures may be by the water/cement ratio under special review and acceptance by the County. Concrete mix design shall comply with the Standard Building Code requirements.
2. Air Content: 5% plus or minus (\pm) 1% (Class A and B).
3. Slump: 4-inches plus or minus (\pm) 1-inch. 8-inches plus or minus (\pm) 1-inch for tremie concrete.
4. Water/cement ratio = 0.45 maximum (all concrete exposed to hydrostatic loading), 0.50 maximum (all other concrete).
5. Minimum Compressive Strength at 28-days
 - a. Class A, 4,000-psi: Water and wastewater structures inclusive of tanks, ditches, pumping stations, tremie concrete and other structures in contact with process water.
 - b. Class B, 3,000-psi: Building structures, curb and gutters, slabs, walks, encasements, thrust blocks, and pipe supports, etc. not in contact with process water.
 - c. Class C, 2,500-psi: Mix wherever specified in the standard drawings such as A103, A112, A303, A406 and A407-2.

B. Production of Concrete

1. General: Concrete shall be ready mixed and shall be batched, mixed and transported in accordance with ASTM C 94, except as otherwise indicated.
2. Air Entraining Admixture: Air entraining admixture shall be charged into the mixture as a solution and shall be measured by means of an acceptable mechanical dispensing device. The liquid shall be considered a part of the mixing water.

3. Waterproofing admixture: New concrete structures shall contain a crystalline waterproofing concrete admixture. Crystalline waterproofing concrete admixture shall be added to the concrete during the batching operation. The admixture concentration shall be added based upon manufacturer design percent concentration of admixture to the required weight of cement. The amount of cement shall remain the same and not be reduced. A colorant shall be added to verify the admixture was added to the concrete for all precast structures. Colorant shall be added and provided at the admixture manufacturing facility, not at the concrete batch plant. It is recommended that the admixture be added first to the rock and sand and blended thoroughly before adding cement and water or per the manufacturer's recommendations. Concrete structures without crystalline waterproofing admixture or admixture without colorant for field verification shall be rejected. Contractor shall provide certification the admixture was installed in accordance with the manufacturer's recommendations.
 4. Water Reducing and Retarding Admixture: Water reducing and retarding admixture shall be added and measured as recommended by the manufacturer. The addition of the admixture shall be completed within 1-minute after addition of water to the cement has been completed, or prior to the beginning of the last 3/4 of the required mixing, whichever occurs first. Admixtures shall be stored, handled and batched in accordance with the recommendations of ACI 68.
- C. Delivery Tickets: In addition to the information required by ASTM C 94, delivery tickets shall indicate the cement content and the water/cement ratio.
- D. Temperatures: The temperature of the concrete upon delivery from the truck shall not exceed 90° F.
- E. Modifications to the Mix: No modifications to the mix shall be made in the plant or on the job which will decrease the cement content or increase the water/cement ratio beyond that specified.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Preparations before Placing: No concrete shall be placed until the review and acceptance of the County has been received. Acceptance will not be granted until forms are clean and reinforcing and all other items required to be set in concrete have been placed and thoroughly secured. The County shall be notified a minimum of 24-hours before concrete is placed.
- B. Conveying:
1. General: Concrete shall be handled from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete. No concrete shall be placed more than 90-minutes after mixing has begun for that particular batch.

2. Buckets and Hoppers: Buckets and hoppers shall have discharge gates with a clear opening equal to no less than 1/3 of the maximum interior horizontal area, or 5 times the maximum aggregate size being used. Side slopes shall be no less than 60° (degrees). Controls on gates shall permit opening and closing during the discharge cycle.
3. Runways: Extreme care shall be exercised to avoid displacement of reinforcing during the placing of concrete.
4. Elephant Trunks: Hoppers and elephant trunks shall be used to prevent the free fall of concrete of more than 6-feet.
5. Chutes: Chutes shall be metal or metal lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20-feet long and chutes not meeting the slope requirements may be used only if they discharge into a hopper before distribution.
6. Pumping Equipment: Pumping equipment and procedures shall conform to the recommendations contained in the report of ACI Committee 304 on "Placing Concrete by Pumping Methods," ACI 304.2R-71. The specified slump shall be measured at the point of discharge. The loss of slump in pumping shall not exceed 1-1/2-inches.
7. Conveying equipment Construction: Aluminum or aluminum alloy pipe for tremies or pump lines and chutes, except for short lengths at the truck mixer shall not be permitted.
8. Cleaning: Conveying equipment shall be cleaned at the end of each concrete operation.

3.02 APPLICATION

A. Placing:

1. General: Concrete shall be deposited continuously, or in layers of such thickness (not exceeding 2-feet in depth) that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness.
2. Supported Elements: At least 2-hours shall elapse after depositing concrete in columns or walls before depositing in beams, girders, or slabs supported thereon.
3. Segregation: Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to procedures that will cause segregation.
4. Concrete Underwater: All concrete, except that indicated on the Drawings as tremie concrete, shall be placed in the dry.

B. Seals and Tremie Concrete

1. General

- a. Wherever practicable, all foundation excavations shall be dewatered and the concrete deposited in the dry. Where conditions are encountered which render it impracticable to dewater the foundation before placing concrete, a concrete foundation seal shall be placed. The foundation shall then be dewatered, and the balance of the concrete placed in the dry.

- b. When seal concrete is required to be placed, the satisfactory performance of the seal in providing a watertight excavation for placing structural concrete shall be the responsibility of the Contractor. Seal concrete placed by the Contractor, which subsequently fails to perform properly, shall be repaired as necessary to perform its required function, at the expense of the Contractor.
 2. Method of Placing: Concrete deposited underwater shall be carefully placed in the space in which it is to remain by means of a tremie, a closed-bottom dump bucket of not less than 1-cubic yard capacity, or other approved method, and shall not be disturbed after it is deposited. All seal concrete shall be deposited in 1 continuous pour. No concrete shall be placed in running water. All formwork designed to retain concrete underwater shall be watertight, and the design of the formwork and excavation sheeting shall be by a Professional Engineer, registered in the State of Florida.
 3. Use of Tremie: The tremie shall consist of a tube having a minimum inside diameter of 10-inches, and shall be constructed in sections having tight joints. No aluminum parts that have contact with the concrete will be permitted. The discharge end shall be entirely seated at all times, and the tremie tube kept full to the bottom of the hopper. When a batch is dumped into the hopper, the tremie shall be slightly raised (but not out of the concrete at the bottom) until the batch discharges to the bottom of the hopper, after which the flow shall be stopped by lowering the tremie. The means of supporting the tremie shall be such as to permit the free movement of the discharge end over the entire top surface of the Work, and shall permit it being lowered rapidly when necessary to choke off or retard the flow. The flow shall preferably be continuous, and in no case shall be interrupted until the Work is completed. Special care shall be exercised to maintain still water at the point of deposit.
 4. Use of Bottom-dump Bucket: When the concrete is placed by means of a bottom-dump bucket, the bucket shall be lowered gradually and carefully until it rests upon the concrete already placed. The bucket shall then be raised very slowly during the discharge travel; the intent being to maintain, as nearly as possible, still water at the point of discharge and to avoid agitating the mixture. Aluminum buckets will not be permitted.
 5. Time of Beginning Pumping: Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure, and in no case earlier than 72-hours after placement of the concrete.
- C. Consolidating Concrete:
1. General: Concrete shall be consolidated by means of internal vibrators operated by competent workmen.
 2. Vibrators: Vibrators shall have a minimum head diameter of at least 2-inches, a minimum centrifugal force of 700-pounds and a minimum frequency of 8,000 vibrations per second.
 3. Vibrators for Confined Areas: In confined areas, the specified vibrators shall be supplemented by others having a minimum head diameter of 1-1/2-inches, a minimum centrifugal force of 300-pounds and a minimum frequency of 9,000 vibrations per second.

4. Spare Vibrator: One (1) spare vibrator for each 3 in use shall be kept on the site during all concrete placing operations.
 5. Use of Vibrators: Vibrators shall be inserted and withdrawn at points approximately 18-inches apart. The duration of each insertion shall be from 5 to 15-seconds. Concrete shall not be transported in the forms by means of vibrators.
- D. Protection: Rainwater shall not be allowed to increase the amount of mixing water, or to damage the surface finish. Concrete shall be protected from construction over-loads. Design loads shall not be applied until the specified strength has been attained.

3.03 CONCRETE FINISHING AND CURING

- A. All slabs exposed to view shall receive a steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.
- B. All other slabs and footings shall receive a smooth steel trowel finish.
- C. All walls of structures or parts of buildings exposed to view shall receive the following:
 1. Repair defective concrete, remove fins, fill depressions 1/4-inch or deeper, and fill tie holes.
 2. Any surface not receiving a special applied finish, shall receive a slurry finish consisting of 1 part cement and 1-1/2 parts sand by damp loose volume. Dampen surfaces and then apply the slurry with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap.
 3. Surfaces that will receive a special applied finish shall be of even color, have no pits, pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff bristle fiber brush shall produce no dusting or dislodging of cement or sand.
- D. All concrete shall be wet cured a minimum of 7-days; or if not to receive special finishes, coatings or concrete toppings, an acceptable curing compound may be utilized.
- E. All surface defects shall be repaired by removing defective concrete down to sound concrete and repairing with patching mortar. Finished repair shall match adjacent concrete and be cured as specified.

3.04 TESTING

- A. A testing laboratory, acceptable by the County, shall perform required testing. The Contractor shall pay for all tests indicating a failure to comply with the Specifications. The Contractor shall keep the laboratory informed of his schedule.

- B. Standard laboratory compressive test cylinders shall be obtained by the laboratory when concrete is discharged at the point of placing (i.e., discharge end of pumping equipment), and cylinders shall be made and cured in accordance with the requirements of ASTM Designation C 31. A set of 4 cylinders shall be obtained for each 50-cubic yards, or fraction thereof, placed each day for each type of concrete. The cylinders shall be cured under laboratory conditions and shall be tested at 7 and 28-days of age in accordance with the requirements of ASTM Designation C 39.

- C. The testing laboratory shall make slump tests of Class A and Class B concrete as it is discharged from the mixer at the point of placing. Slump tests shall be made for each 25-cubic yards or "pour" of concrete placed. Slump tests may be made on any batch, and failure to meet specified slump requirements shall be sufficient cause for rejection of that batch.

END OF SECTION

SECTION 03410
PRECAST CONCRETE STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This Section specifies the materials, labor and equipment required to construct manholes, wetwells, valve vaults, mitered end sections, meter boxes and all other precast concrete structures, as shown on the Drawings and as specified herein.

1.02 QUALITY ASSURANCE

- A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards.
 - 1. Standard Building Code
 - 2. Local Codes and Regulations
 - 3. ACI Building Code Requirements for Reinforced Concrete
 - 4. American Society for Testing and Materials (ASTM)
 - 5. American Concrete Institute (ACI)
- B. The forms, dimensions, concrete, and construction methods shall be acceptable to the County in advance of construction.

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. The Contractor shall submit Shop Drawings to the County, showing all details of construction, reinforcing and joints.
- C. Submit manufacturer's data on certifications and testing for concrete waterproofing additive, joint mastic, gaskets and grout material to be used.

1.04 INSPECTION

- A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and acceptance by the County. Such inspection may be made at the place of manufacture or 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 acceptable 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. All damaged sections will be rejected. If damaged sections have already been installed; they shall be acceptably repaired if authorized by the County, or removed and replaced at the Contractor's expense.
- B. At the time of inspection, the sections will be carefully examined for compliance with the ASTM designation specified and the acceptable manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch strength", blisters, cracks, roughness, and soundness. The surface shall be dense and close textured.
- C. Imperfections may be repaired subject to the review and acceptance of the County after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final review and acceptance. Cement mortar used for repairs shall have a minimum compressive strength of 4,000-psi at the end of 7-days and 5,000-psi at the end of 28-days, when tested in 3-inch by 6-inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the review and acceptance of 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 PRECAST CONCRETE SECTIONS

- A. Precast concrete wetwell sections, manhole barrel and eccentric top sections shall conform to specifications for precast reinforced concrete manhole sections, ASTM Designation C478, except as otherwise specified below or as shown on the Drawings. Details of precast sections shown on the Drawings, including thickness and reinforcing, shall supersede ASTM C-478 when such details are more stringent than ASTM C-478. The method of construction shall conform to the detailed Drawings appended to these specifications and the following additional requirements:
 - 1. The minimum wall thickness for the various size barrel sections shall be 5-inches, or as indicated in the Drawings.
 - 2. Barrel sections shall have tongue and groove joints. Joints shall be sealed with cold adhesive preformed plastic gaskets set in double rows on the tongue and in the groove prior to setting the next section. Gaskets shall be K.T. Snyder "Ram-Nek", Conseal "CS-102" or acceptable equal. All extension joints shall be sealed with Portland Type II cement after setting of gasket and placement of manhole section into a watertight joint.

3. Type II cement shall be used except as otherwise accepted.
4. New concrete structures shall contain a crystalline waterproofing concrete admix for all new concrete structures including but not limited to manholes, ARV vaults, wetwells, and wetwell top slabs. Crystalline waterproofing concrete admix shall be added to the concrete during the batching operation. Admixture concentration shall be added based upon manufacturer's design percent concentration of admixture to the required weight of cement. The amount of cement shall remain the same and not be reduced. A colorant shall be added to verify the admixture was added to the concrete. Colorant shall be added and provided at the admixture manufacturing facility, not at the concrete batch plant. It is recommended that the admixture be added first to the rock and sand and blended thoroughly before adding cement and water or per the manufacturer's recommendations. Concrete structures without crystalline waterproofing admixture or admixture without colorant for field verification shall be rejected. Contractor shall provide certification from the pre-caster that the admixture was added in accordance with the manufacturer's recommendations. Concrete admixture shall be manufactured and supplied by an approved manufacturer as shown in Appendix D "List of Approved Products."
5. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section. Each section must be inspected and stamped by an accredited testing laboratory.
6. Sections shall be cured by an acceptable method for at least 28-days.
7. Manhole top sections shall be eccentric except that precast concrete slabs shall be used where cover over the top of the pipe is less than 4-feet for all manholes. Lift rings or non-penetrating lift holes shall be provided for handling precast manhole sections. Non-penetrating lift holes shall be filled with non-shrink grout after installation of the manhole sections.
8. Precast concrete slabs over top section, where required, shall be capable of supporting the overburden plus a live load equivalent to ASHTO H 20 loading.
9. The tops of bases shall be suitably shaped to mate with the adjoining precast section.
10. Precast leveling rings for setting cast iron frames over manholes shall be 2-inch thick and have 1 (one) Number 2 continuous reinforcing steel bar.
11. Concrete surfaces shall have form oil, curing compounds, dust, dirt, and other interfering materials removed by brush sand blasting and shall be fully cured prior to delivery.
12. Interior surfaces of manholes, wetwells and valve vaults shall be lined in accordance with Appendix D "List of Approved Products."
13. Manholes to be installed around existing gravity sewers shall consist of a cast-in-place concrete base slab and precast concrete barrel and top sections; lined per Section 3410 – 2.01.11. The base slab shall be as shown on the Drawings and include a joint which is compatible with the bottom barrel section and acceptable to the County. The bottom barrel section shall include an inverted "U-shaped" slot to allow installation of the section over existing pipes. Flow channels shall be provided within the manholes as shown on the Drawings. Annular space between the existing pipe and slot shall be made watertight with non-shrink grout. Existing pipes shall be removed within the manhole and outlets plugged watertight with non-shrink grout as shown on the Drawings.

14. The manholes shall have an invert channel shaped to correspond with the lower half of the pipe. The top of the shelf shall be at the elevation indicated and shall be sloped to drain toward the flowing through channel. Every effort shall be made by the Contractor to construct watertight structures.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All manholes and other precast structures shall be set in the dry.
- B. Manholes and other precast structures shall be constructed to the dimensions as shown on the Drawings and as specified herein.
- C. The base structure may be cast-in-place concrete as specified in Division 3. The concrete structure shall be placed on the required crushed stone base as shown in the Drawings over a dry sub base of structural fill that has been compacted to 95% (percent) of the maximum dry density as determined by the modified proctor test, ASTM D1557. The tops of the cast in place bases shall be shaped to mate with the precast barrel section and shall be adjusted in grade so that the top of the dome section is at the correct elevation.
- D. Precast bases conforming to all requirements of ASTM C478 and other requirements for precast sections may be used and shall be set on a sub base as described above.
- E. Precast concrete structure sections shall be set vertically with sections in true alignment with a 1/4-inch maximum tolerance per 5-feet of depth. The outside and inside joint shall be filled with a non-shrink mortar and finished flush with the adjoining surfaces. Allow joints to set for 24-hours before backfilling. Backfilling shall be accomplished bringing the fill up evenly on all sides. If leaks appear in the structures, the inside joints shall be caulked with non-shrink grout to the satisfaction of the County. The Contractor shall install the precast sections in a manner that will result in a watertight joint.
- F. Lift rings or non-penetrating lift holes shall be provided for handling pre-cast manhole sections. Non-penetrating lift holes shall be filled with non-shrink grout after installation.
- G. Where holes must be cut in the precast sections to accommodate pipes, cutting shall be done prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.
- H. Cast iron frames shall be placed over precast concrete leveling rings, shimmed and set in cement mortar to the required grade. No more than 3 courses of leveling rings shall be used.

END OF SECTION

SECTION 03600

GROUTING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This Section specifies the grouting of the annular space between the host pipe and the new liner and the grouting of the space left void in the abandonment of the existing pipelines and structures. The Work consists of furnishing all labor, equipment and materials, and performing all Work connected with the placement of the cementaceous grout to fill the void.

1.02 QUALITY ASSURANCE

- A. Grouting shall be performed by a crew under the direct supervision of a superintendent that has experience in grouting of this nature.
- B. Storage, mixing, handling and placement shall be in accordance with manufacturer's instructions and 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. In addition, the following shall be submitted to the County for review and acceptance prior to construction.
 - 1. A detailed description of equipment and operational procedures to accomplish the grouting operation.
 - 2. Grout mixture design data, grout mixer type, grout samples, and test data.
 - 3. A detailed description of the grouting time schedule.

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 GROUT MATERIAL

- A. The grout shall be a "flowable fill" consisting of a mixture of Type 1 Portland Cement, Type "F" Flyash (ASTM 618), sand and water.

The following is a suggested trial grout mixture for a 1-cubic yard yield:

Cement: 500-pounds
Fly Ash: 500-pounds
Water: 350-pounds (42-gallons)
Sand: 2,248-pounds
Darex (W.R. Grace): 3-ounces (Air Entrainment Additive or equivalent)

The actual grout mixture to be used shall meet the minimum requirements specified below.

- B. The mixture shall contain a minimum of 500-pounds cement and minimum of 400-pounds flyash per cubic yard of grout.
- C. Samples of the grout mixture when set aside in a standard concrete test mold shall show less than 1% of the mixture height of free water on the surface after standing not less than 12-hours.
- D. One (1) set of 3 (three) 3-inch by 6-inch sample test cubes shall be made for each mix preparation. The minimum 28-day strength shall be no less than 1,000-psi. The minimum required slump is 5-inches. The maximum allowable slump is 9-inches. Slump should be as low as practical to maintain viscosity, proper flow, and still retain the ability to pump.

2.03 EQUIPMENT

- A. All grout shall be mixed with a high shear, high-energy colloidal type mixer to achieve the best uniform density.
- B. The grout shall be pumped with a non-pulsating centrifugal or tri-plex pump.
- C. The mixer shall be capable of continuous mixing. Batch mixing shall not be permitted.

PART 3 - EXECUTION

3.01 GROUTING OF ABANDONED PIPE

- A. Where utility pipes are to remain in place (inactive) they shall be filled with a sand/cement grout as specified herein.
- B. The grouting program shall consist of pumping sand-cement grout with suitable chemical additives at pressures necessary to fill the pipe sections in order to prevent the potential for future collapse.

- C. Grouting of pipes shall be in sections not exceeding 300 linear feet.
- D. Grout shall be placed in a maximum of 3 stages, with the initial stage volume equal to or greater than 50% of the total volume for that section of pipe being grouted. The maximum time wait between grouting stages shall be 24-hours.
- E. For each stage, mix and pump the material in one continuous process so as to avoid partial setting of some grout material during that stage; thus, eliminating voids and possible subsequent surface damage due to cave-ins.
- F. Each section shall be grouted by injecting grout from the lowest point and allowing it to flow toward the highest point to displace water from the annulus and assure complete void-free coverage. Grout shall be placed through tubes installed in the bulkheads at the insertion pits or manholes. Grout tubes shall be at least 2-inch nominal diameter.
- G. After the ends of each section of pipe are exposed, the entire space, not to exceed 300 linear feet end to end, shall be sealed by controlled pumping of grout until it flows from the pipe at the opposite end of the grouting. Grouting shall be carried out until the entire space is filled. The ends of these sections shall be capped and/or plugged.
- H. Grout pressure in the void space is not to exceed 5-psi above maximum hydrostatic groundwater level. An open ended, highpoint tap or equivalent vent must be provided and monitored at the bulkhead opposite to the bulkhead through which grout is injected. This bulkhead will be blocked closed as grout escapes to allow the pressuring of the annular space.

3.02 FIELD QUALITY CONTROL

- A. The quality of the grout, application of the equipment, and installation techniques are the responsibility of the Contractor. The review and acceptance or approval of specific mix design, equipment, or installation procedures shall in no way relieve the Contractor of his obligation to provide the final product as specified herein.
- B. The County may stop the grouting operations at any time if the operation does not comply with these Specifications.

END OF SECTION

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SECTION 04050

MASONRY

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This section specifies the labor, materials, equipment, and incidentals required to construct all masonry work as shown on the Drawings and specified herein.
- B. The work under this Section includes, but is not necessarily limited to, the following:
 - 1. Split-face concrete masonry units (CMU)
 - 2. Reinforced CMU block and lintels
 - 3. Masonry reinforcing, ties, and anchors
 - 4. Grouting for masonry work

1.02 QUALITY ASSURANCE

- A. Prior to construction of any masonry buildings, sample wall sections shall be constructed in location(s) approved by the County, to establish a standard of quality for masonry construction for the entire Project. A sample wall section shall be constructed for each type of concrete masonry units (standard, split-face, etc.) to be used on the Project. Include 1 complete exterior and interior control joint to be caulked. Each sample wall section shall have a minimum of 50-square feet of wall face and shall be at least 6 block courses high and 12.67-feet long. For multi-colored, split-face CMU sample walls, at least 3-courses shall be constructed for each color of split-face CMU to be used on the Project. The sample wall(s) will be inspected and approved by the County and shall be maintained by the Contractor throughout the length of the project for use as the "standard of quality" for comparative purposes with masonry walls constructed on the Project. Sample wall section(s) shall be removed by the Contractor upon substantial completion of the Project.

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 manufacturer's certifications that all masonry units meet or exceed all specified standards.
- C. Product data for split-face CMU types indicating composition, shape, surfaces, and dimensions.

- D. Submit 3-color samples for integral colored split-face concrete masonry units and colored mortar mixers.
- E. Submit catalog data for metal ties and anchors, joint reinforcement, and control joint material.
- F. Samples of split-face CMU illustrating face profile, color range, surface, and texture.
- G. Installation instructions.

1.04 PROTECTION OF MATERIALS

- A. All perishable materials for the work of this Section shall be delivered, stored, and handled so as to preclude damage of any nature. Manufactured materials, such as cement and lime, shall be delivered and stored in their original containers, plainly marked with identification of material and maker. Materials in broken containers or in packages showing water marks or other evidence of damage shall not be used and shall be removed from the site.
- B. All masonry shall be shipped stacked with hay or straw protection or other suitable protective device and shall be similarly stacked off the ground on the site. Any masonry damaged or chipped during shipment, storage, or installation shall be rejected and removed from the site. In addition, all masonry stored on the site shall be protected from the weather and staining with the use of tarpaulins or other covering accepted by the County.

1.05 COLD WEATHER CONSTRUCTION

- A. Masonry construction in cold weather shall conform to the applicable requirements of "Construction and Protection Recommendations for Cold Weather Masonry Construction" Section 2.3.2.2, Specifications for Masonry Structures ACI 530.1 of the Technical Notes on Brick and Tile Construction by the Brick Institute of America.

1.06 HOT WEATHER CONSTRUCTION

- A. Masonry construction in hot weather shall conform to the applicable requirements of hot weather construction, Section 2.3.2.3, Specifications for Masonry Structures ACI 530.1.

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. MASONRY

1. Split-face concrete masonry units
 - a. Standard and lightweight CMU shall conform to ASTM C90, Grade N, Type I, as shown on the Drawings.
 - b. CMU shall be free from substances that will cause staining or pop-outs and shall be fine, even textured with straight and true edges. All units shall have been wet steam cured for at least 18-hours and then air cured in covered storage for not less than 28-days before delivery. Units shall have a maximum linear drying shrinkage of 0.25% (percent) (ASTM C426) and have a moisture content at time of delivery not exceeding 30% (percent) of total absorption.
 - c. Split-face CMU's for interior and exterior walls where indicated on the Drawings, shall be as manufactured by DeMaco Corporation, Rockblock, Inc., or approved equal. Units shall have 8-inch by 16-inch nominal face size. Matching end and corner units shall be selected from samples provided by the block manufacturer. Split-face units shall be high strength units having a minimum compressive strength of 3,000-psi for any 1-unit, and an average compressive strength of 3,500-psi for an average of 3-units. Minimum acceptable water absorption rate shall be 6% of the oven dry weight of the masonry unit in pounds per cubic feet. Split-face CMU's shall be factory prefinished with an integral coloring agent that is added during the mixing process. The coloring agent used for this project shall be from the same lot and batch numbers. The color for the split-face CMU's shall be selected by the County from the CMU manufacturer's standard color samples.
 - d. CMU noted as fire rated on the Drawings shall conform to Underwriters Laboratories, Inc. Standard for Concrete Masonry Units UL618, and shall have a 2-hour fire resistant rating.
 - e. All split rib CMU shall have a height minimum of 7-1/2-inch equally spaced 3/4-inch deep by 3/4-inch wide bevels. The projected face shall have a rough texture.
 - f. Units shall be obtained from 1 manufacturer to ensure even color and texture.
 - g. Provide special units required by the Drawings including solid, corner, pilaster, lintels, and jamb units.
 - h. Split-face CMU units shall be Dillon Company, Swords Creek, Virginia or DeMaco Concrete Products, Sarasota, Florida or equal. Equivalent design patterns are subject to the approval of the County.
2. Concrete Masonry Units
 - a. CMU's for structures shall conform to ASTM C90, Grade N, Type II normal weight units with minimum compressive strength of 3,000-psi.
 - b. Vertical Reinforcing: Provide as shown on the Drawings.

B. REINFORCING, TIES, ANCHORS, AND MISCELLANEOUS MATERIALS

1. Reinforcement shall be welded wire units prefabricated in straight lengths of not less than 10-feet with matching corner and tee units fabricated from cold drawn steel wire complying to ASTM A82, with deformed continuous side rods and plain cross-rods, crimped for cavity wall construction, if required, and a unit width of 1-1/2-inches to 2-inches less than thickness of wall or partition. Reinforcement for decorative masonry block shall be 2-inches wide. Reinforcement shall be placed at every other course (16-inches on center) unless otherwise noted on Drawings.
2. Reinforcing Steel: ASTM Designation A615, Grade 60, unless otherwise specified. Single width reinforcement shall be ladder or truss type, fabricated with a single pair of galvanized 9-gauge side rods and continuous 9-gauge cross-rods spaced not more than 16-inches on center
3. Galvanized dovetailed anchor slots shall be Heavy Filled, Catalog Number 8334 by Vulcan Metal Products, Inc. or equal, and shall be 5-inches long, 16-gauge galvanized.
4. Dovetail anchors shall be placed at 16-inches on center for anchorage to concrete framework or walls.
5. Corrugated non-ferrous 16-gauge metal ties manufactured for use with the anchor slots provided shall be spaced at a maximum of 8-inches on center vertically and 16-inches on center horizontally.
6. The Contractor shall provide and install miscellaneous anchors and attachment members required both for the anchorage of his own work and that of other trades requiring attachment to masonry, which are not specifically provided under separate sections.
7. Control joints shall be factory extruded preformed styrene-butadiene-rubber compound, conforming to ASTM D2000 2AA805 and shall be as manufactured by Dur-O-Wal, Hohmann and Bernard, Inc., AA Wire Products or equal. Control joints shall be installed as shown on the Drawings.
8. Weep holes shall be 1/4-inch outside diameter by 4-inches long, clear plastic tubing that will not strain brickwork, by Hohmann and Bernard, Inc., or equal.
9. Cleaning compound shall be mild, non-caustic detergent solution such as 801 Super Real Clean by Superior Manufacturing Co., or 600 Sureclean by Process Solvent Co., Inc., or equal.

C. MORTAR AND GROUT MATERIALS

1. Portland Cement shall conform to ASTM C150 Type II requiring only sand and water for mixing. Masonry cements may be used for colored mortar when specifically accepted.
2. Lime for masonry mortar shall be hydrated, conforming to ASTM C207, Type S.
3. Sand shall be clean, durable particles, free from detrimental amounts of organic matter. The sand shall conform to the limits of ASTM C14. Sand for grout shall conform to ASTM C144 or C33 as required.
4. Water shall be potable, free from detrimental amounts of oils, acids, alkalis, or organic mater, and shall be clean and fresh.

5. Premix Mortar shall conform to ASTM C270, Type S. Mortar proportions shall conform to ASTM C270, Type S, or as otherwise accepted by the County. Ingredients shall be accurately measured by volume in boxes especially constructed for the purpose by the Contractor. Measurement by shovel will not be allowed.
6. Masonry cements used for integral colored CMU's shall be specifically approved for colored mortar. Colored mortar mixers shall be factory premixed with color pigments and Portland cement, requiring only sand and water for mixing. Colored mortar for the project shall be from the same factory lot and batch numbers. Color of the mortar mix shall be selected by the County from the mortar manufacturer's standard color samples.
7. Water repellent admixture added to mortar shall match water repellent used in manufacture of split-face CMU.
8. Strength of mortars shall exceed 1,800-pounds per square inch, when tested with 2-inch cubes at the end of a 28-day aging period.
9. Grout for setting bearing plates, machinery, or any other non-masonry use shall be as specified in Section 03600 "Grouting."
10. Grout
 - a. Portland cement shall conform to ASTM C150, Type I.
 - b. Aggregates shall conform to ASTM C144.
 - c. Grout for constructing CMU lintel blocks and for grouting cores to receive embedded anchors or reinforcing shall conform to ASTM C476, fine or coarse grout. Strength shall be 2,500-psi minimum at 28-days. Grout will have a slump of 10-inches, plus or minus 1-inch, at time of placement.
 - d. Concrete grout for filling structural CMU cells shall use 3/8-inch pea rock mix with a minimum compressive strength of 3,000-psi.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Provide formwork and shores as required for temporary support of reinforced masonry elements. Design, erection, support, bracing, and maintenance of formwork are the Contractor's responsibility.
- B. Construct formwork to conform to shape, line, and dimensions shown and sufficiently tight to prevent leakage of mortar grout or concrete.
- C. Do not remove forms and shoring until reinforced masonry member has hardened sufficiently to carry its own weight and all other reasonable temporary loads that may be placed on it during construction. Do not remove forms and shoring supporting the weight of concrete in beams, slabs, and other members until concrete has attained its specified 28-day compressive strength.

3.02 MORTAR

- A. Mortar shall be machine mixed in an approved type of mixer in which the quantity of water can be accurately and uniformly controlled. The mixing time shall not be less than 5-minutes, approximately 2-minutes of which shall be for mixing the dry materials and not less than 3-minutes for continuing the mixing after the water has been added. Where hydrated lime is used for mortar requiring lime content, the Contractor will have the option of using the dry-mix method or first converting the hydrated lime into putty.
- B. Where the dry-mix method is employed, the materials for each batch shall be well turned over together until the even color of the mixed, dry materials indicates that the cementaceous material has been distributed throughout the mass, after which the water shall be gradually added until a thoroughly mixed mortar of the required plasticity is obtained.
- C. Mortar that has begun to set shall not be used.

3.03 MASONRY INSTALLATION

- A. Masonry shall not be laid at temperatures below 40°F, without the approval of the County, and all work shall be done in such a manner as to insure the proper and normal hardening of all mortar. All masonry work shall be so protected and heated that the temperature at the surface will not fall below 50°F for a period of 72-hours after placing. Any completed work found to be affected by cold weather shall be taken down and rebuilt by the Contractor at his expense.
- B. All CMU shall be laid in a full bed of mortar, applied to shells only. Butter the vertical joint of unit already set in the wall and all contact faces of the unit to be set. Each unit shall be placed and shoved against the unit previously laid so as to produce a well compacted vertical mortar joint for the full shell thickness. Units shall be set with all cells in a vertical position. The moisture content of the units when laid shall not exceed 35% (percent) of the total absorption as determined by laboratory test. Split-face CMU's shall be laid with the horizontal stringline control to the inside face of block in a full bed of mortar on all 4 sides.
- C. Masonry units shall be laid in a running bond unless otherwise shown.
- D. Sizes shall be as specified and called for on the Drawings and where "Soaps" and "Splits" are used, the space between these members and the backup material shall be slushed full of mortar.
- E. Masonry joints which are exposed to view shall be tooled in accordance with the following:
 - 1. Wait until unit mortar is thumbprint hard before tooling joint.
 - 2. Both vertical and horizontal joint spacing shall be uniform.
 - 3. Joints for CMU shall be 3/8-inch.
 - 4. Joints for structural block shall be 1/4-inch.
 - 5. Joints shall be tooled slightly concave.

6. Joints for standard CMU shall be rubbed with a sponge to provide a flush, neat, rubbed joint.
 7. Exterior joints for split-face CMU shall be rubbed with a sponge, paddle, or Styrofoam tool to cause the joint to blend with the masonry unit's exterior split-face. Interior face joints of split-face CMU shall match standard CMU joints.
- F. Install all frames required to be set in masonry. Set masonry tightly against frames, build in and mortar in all frame anchors and fill frames solid with mortar.
- G. Control joints shall be installed at the intersection of masonry walls with structural concrete members and elsewhere as detailed on the Drawings. Joints shall be raked out to a depth of 3/4-inch for the full height or full width of the wall suitable for caulking. The maximum length, horizontally, between vertical control joints shall be 40-feet, but joints shall be located only as directed or shown. Joints shall be equal in width to the standard mortar joint.
- H. All masonry slots, chases, or openings required for the proper installation of the work of other sections shall be constructed as indicated on the Drawings or in accordance with information furnished before the work is started at the points affected. No chase shall be cut into any wall constructed of hollow units after it is built, except as directed by the County.
- I. Field cut split-face CMU with power tools to provide straight true edge and avoid damage to split-face. Do not install chipped or broken units.
- J. Exercise care that wet mortar is not splashed onto split-face during installation. Excess or splashed mortar shall be cleaned from face with a burlap wipe.
- K. During grouting, placement of foamed-in-place insulation, and application of sealants, ensures that materials are not smeared onto split-faces of CMU. Remove smeared materials as recommended by manufacturer.
- L. Surfaces shall be brushed as work progresses and maintained as clean as practical. Unfinished work shall be raked back where possible, and toothed only where absolutely necessary. Before leaving fresh or unfinished work, walls shall be fully covered and protected against rain and wind, and before continuing work, previously laid surfaces shall be swept clean. The tops of walls or other unfinished work shall be protected against all damage by frost or the elements by means of waterproof paper, tarpaulins, boards, or other means reviewed by the County.
- M. The Contractor shall build in all miscellaneous items to be set in masonry for which placement is not specifically provided under separate Divisions, including reglets, lintels, ties, electrical panel boxes, sleeves, vents, grilles, anchors, grounds and exterior electrical conduits, and fixtures, and shall cooperate with other trades whose work is to be coordinated with the work under this Section.

- N. All anchorage, attachment, and bonding devices shall be set so as to prevent slippage and shall be completely covered with mortar or grout.
- O. All ties and reinforcing for masonry shall be furnished and installed by the Contractor.
- P. Loose lintels shall be set in a full bed of mortar and supported by solid or mortar filled hollow concrete blocks as detailed on the Drawings.
- Q. Bed and grout all items coming in contact with masonry where grouting is required, including door bucks and frames set in masonry. The Contractor shall install all anchor bolts, base plates, and seats in masonry walls, and build in all items required for the completion of the building as they apply to masonry.

3.04 REINFORCED CONCRETE UNIT MASONRY INSTALLATION

A. General

- 1. Do not wet CMU's.
- 2. Place CMU with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths as shown, or if not shown, provide 3/8-inch joints.
- 3. Where solid CMU units are shown, lay units with full mortar head and bed joints.

B. Walls

- 1. Pattern Bond: Lay CMU wall units as specified in Section 04050 "Masonry." Bond and interlock each course at corners and intersections and use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams, and other special conditions.
- 2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
- 3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.
- 4. Option: Where all vertical cores are not shown to be grouted, Contractor may elect to fill all vertical cores with grout, in which case, requirements for mortar bedding of cross-webs and closing of core spaces below bond beams will not apply.

C. Columns, Piers, and Pilasters:

- 1. Use CMU of the size, shape, and number of vertical core spaces shown. If not shown, provide units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.

2. Provide pattern bond as shown, or if not shown, provide alternate head joints in vertical alignment.
3. Where bonded pilaster construction is shown, construct wall and pilaster units together to the maximum pour height specified.

D. Grouting

1. Use fine grout for filling spaces less than 4-inches in both horizontal directions.
2. Use course grout for filling 4-inch spaces or larger in both horizontal directions.
3. Grouting Technique: At the Contractor's option, use either low-lift or high-lift grouting techniques subject to the requirements which follow.

E. Low-Lift Grouting:

1. Provide a minimum clear dimension of 2-inches and clear area of 8-square inches in vertical cores to be grouted.
2. Place vertical reinforcement prior to laying of CMU. Extend vertical reinforcement above elevation of maximum pour height as required to allow for splicing and support it in position at vertical intervals exceeding neither 192-bar diameters nor 10-feet. Lay CMU to maximum pour height. Limit pour height to 5-feet. If bond beam occurs below the 5-foot height stop, pour at course below bond beam.
3. Preparation of Grout Spaces: Prior to grouting, inspect and clean out the grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry, and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond.
4. Pour grout using container with spout or by chute. Rod or vibrate during placing. Place grout continuously. Do not interrupt pouring of grout for more than 1-hour. Terminate grout pours 1-1/2- inches below top course of pour.
5. Bond Beams: Terminate grout in vertical cells 1-1/2-inches below bond beam course. Place horizontal reinforcement in bond beams with corners and intersections lapped as shown. Place grout in bond beam course before filling vertical cores above bond beam.

F. High-Lift Grouting

1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 3-inches and 10-square inches, respectively.
2. Provide cleanout holes in first course at all vertical cells which are to be filled with grout. Use units with 1 shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in 1 face shell.
3. Construct masonry to full height of maximum grout pour specified, prior to placing grout.
4. Limit grout lifts to a maximum height of 5-feet and grout pour to a maximum height of 24-feet, for single wythe hollow concrete masonry walls, unless otherwise indicated.
5. Place vertical reinforcement before grouting. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals exceeding neither 192 bar diameters nor 10-feet.

6. Where reinforcement is prefabricated into cage units before placing, fabricate the units with vertical reinforcement bars and lateral ties of the size and spacing shown.
7. Place horizontal beam reinforcement as the masonry units are laid.
8. Embed lateral tie reinforcement in mortar joints where shown as masonry units are laid.
9. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than No. 2 bars or 8-gauge wire ties spaced 16-inches on center for members with 20-inches or less side dimensions, and 8-inches on center for members with side dimensions exceeding 20-inches.
10. Preparation of Grout Spaces: Prior to grouting, inspect and clean out the grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
11. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
12. Place grout by pumping into grout spaces unless alternate methods are acceptable to the County.
13. Limit grout pours to sections which can be completed in 1 working day with not more than 1-hour interruption of pouring operation. Place grout in lifts which do not exceed 5-feet. Allow neither less than 30-minutes nor more than 1-hour between lifts of a given pour. Rod or vibrate each grout lift during pouring operation.
14. Place grout in lintels or beams over openings in 1 continuous pour.
15. Where bond beam occurs more than 1 course below top of pour, fill bond beam course to within 1-inch of vertically reinforced cavities during construction of masonry.
16. When more than 1 pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2-inches of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if additional pours are required.

3.05 REINFORCED MASONRY

- A. Provide vertical reinforcing in filled cores of masonry units of size, spacing, and locations as indicated on the Drawings and specified herein.
- B. All cores containing reinforcing shall be filled, full height, with concrete conforming to these Specifications, except that maximum slump may be 6-inches and course aggregate shall consist of a 3/8-inch maximum size and conform to a #89 gradation (ASTM C33). Provide clean-out openings at the bottom of each cell for removing mortar droppings. Do not block openings until they have been reviewed by the County.

- C. Cores shall be filled in lifts not to exceed 4-feet. Vertical reinforcing shall be continuous through the full height of the wall. This may be accomplished by lapping bars with a full class "C" splice.
- D. Grout for filled cells shall be tested.

3.06 PLACING REINFORCEMENT

- A. Clean reinforcement of loose rust, mill scale, earth, or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on Drawings or final Shop Drawings. Bars with reduced cross-section due to excessive rusting or other causes shall not be used.
- B. Place reinforcement accurately at the spacing shown. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1-inch, whichever is greater.
- C. For columns, piers, and pilasters, provide a clear distance between vertical bars as shown, but not less than 1-1/2-times the nominal bar diameter or 1-1/2-inches, whichever is greater. Provide lateral ties as shown.
- D. Splice reinforcement bars only as shown. Do not splice at other points unless approved by the County. Provide lapped splices unless otherwise shown. In splicing vertical bars or attaching to dowels, tie splices with wire.
- E. Provide not less than the minimum lap shown or if not shown, as required by governing code.
- F. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 5/8-inch on exterior face of walls and 1/2-inch at other locations.
- G. Anchor reinforced masonry work to supporting structure as indicated.

3.07 PROTECTION

- A. During erection: Cover top of walls with waterproof sheeting at end of day. Cover partially completed walls when work is not in progress. Extend 24-inches minimum down both sides and hold securely in place.
- B. Protect face of walls, sills, and other projections from roof run-off, water, mud, grout, and mortar.
- C. Spread sand or straw at base of walls to minimize dirt and clay splashed.
- D. Without damaging completed work, provide protective boards at exposed external corners, which may be damaged by construction activities.

- E. Clean installed block at the end of each work day.

3.08 CLEANING

- A. All holes in exposed masonry shall be pointed, and defective joints shall be cut out and re-pointed with mortar of same color as that of the original and adjoining work.
- B. Exposed masonry shall be protected against staining by wall coverings, and excess mortar shall be wiped off the surface as the work progresses.
- C. All masonry shall be cleaned with approved detergent solution in accordance with manufacturer's printed directions. No acid or metal scrapers shall be used on masonry.
- D. Before applying any cleaning agent to the entire wall, it shall be applied to a sample wall area of approximately 20-square feet in a location reviewed by the County. No further cleaning work may proceed until the sample area has been reviewed by the County, after which time the same cleaning materials and method shall be used on the remaining wall area.
- E. After cleaning, treat exposed split-face CMU surfaces and mortar joint sealer applied in accordance with manufacturer's instructions. Verify surfaces are clean and thoroughly dry prior to application.

END OF SECTION

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 un-altered, 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 & Razor 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. Surfacers 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. Surfacer 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. Surfacer/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 manufacturer's 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 fiberglassed 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 09910
PREFABRICATED FIBERGLASS LINERS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work included under this Section consists of furnishing all labor, equipment and materials necessary for the installation of prefabricated fiberglass wetwell and manhole liners and appurtenances as described in the specifications herein.

1.02 SHOP DRAWINGS AND SUBMITTALS

- A. Submit Shop Drawings, manufacturer's literature and other descriptive material in accordance with Section 01300 "Submittals."

1.03 QUALITY ASSURANCE

- A. Contractor shall follow all applicable OSHA Standards concerning confined space entry.
- B. Warranty: Prior to its installation, the manufacturer shall provide a warranty for the fiberglass wetwell liners to be free from defects and constructed as specified herein. During and after installation, the Manufacturer shall provide a 20-year warranty on the completed installation to cover the complete cost including costs for materials, equipment, and labor. The warranty shall cover any and all damage to the liners resulting from manufacturing or installation issues such as cracking, deterioration, or leaking due to settlement or chemical attack and as specified in Section 01740 "Warranties and Bonds" herein.

PART 2 - PRODUCTS

2.01 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. All materials furnished for this Work shall be in accordance with the "List of Materials and Approved Manufacturers" as appended to these Specifications.

- 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. The interior and exterior surfaces shall be free of crazing, de-laminations, 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 1/4-inch diameter and less than 1/16-inch deep. 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	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 (psi)	18,000	12,000

- E. Soundness: Following installation, the Contractor shall determine soundness by applying air or water pressure (3-5-psi) to the wetwell 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 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-3253 8.6.
- F. 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.

2.02 NON-SHRINK GROUT

- A. 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 un-altered, as manufactured by Sewpercoat, Strong-Seal, or an approved equal.

2.03 BENCH

- A. 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.

2.04 PIPE PENETRATIONS

- A. 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.

2.05 MANWAY NECK OR LIP

- A. 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.

2.06 MISCELLANEOUS MATERIALS

- A. 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.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fiberglass Liner
 1. 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.

2. Exterior liner diameter shall be approximately 4-inches smaller than the inside diameter of the barrel section of the structure.
3. 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.
4. 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.
5. Measure and cut wetwell liner to exact length and invert configuration. Measure and cut all incoming and outgoing line openings.
6. Lower wetwell liner into wetwell and level.
7. Extend all incoming and outgoing lines inside the liner with PVC or other approved pipe.
8. Construct new benches/fillets and tie-in and seal bottom of liner with a quick setting non-shrink grout as specified herein.
9. Tie-in and seal all lines extending into the wetwell liner with non-shrink grout.
10. Pour or pump 3,000-psi pump mix into the annular space between the liner and existing wetwell.
11. Use concrete grade rings on top of the liner cone section to bring ring and cover to finish grade.
12. A non-shrinking grout as specified herein shall be applied to areas that cannot be fiber-glassed due to water.

3.02 SHIPPING

- A. Do not drop or impact the fiberglass wet well liner. Use of chains or cables in direct contact with the wet well is prohibited.

3.03 MAINTENANCE OF SERVICE

- A. The Contractor shall sequence the Work so that wastewater service is maintained to existing customers at all times.

3.04 FIELD QUALITY CONTROL

- A. Workmanship: It is imperative that the wetwell liner and appurtenances be built watertight and that the Contractor adhere rigidly to the specifications for materials and workmanship. Upon completion, the wetwell liner will be tested and if any damage on the liner is observed, the fiberglass liner installation will be rejected.
- B. Cleaning
 1. 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.

2. Upon the County's final inspection of the fiberglass liner installation, if any foreign matter is still present in the system, flush and clean the section and portions of the wetwell as required.
3. Testing: Upon installation, cleaning, and visual inspection, the Contractor shall, in the presence of the County, test the entire lined surface in accordance with subsection 2.01, E of this specification section. Any repairs required shall be repaired in accordance with the manufacturer's recommendations at the Contractor's expense. The cost for the performance of this test shall be borne entirely by the Contractor.

END OF SECTION

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SECTION 13430
PUMP STATION CONTROL PANELS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Intrinsically safe isolator relays.
 2. Terminal blocks.

1.02 SUBMITTALS

- A. Shop Drawings covering the items included under this Section shall be submitted in accordance with Section 01300, "Submittals."

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements
1. Codes, Ordinances, and Industrial Standards: Design, testing, assembly, and methods of installation for materials, electrical equipment, and accessories proposed under this Section shall conform to National Electric Code and to applicable State and local requirements.
 2. UL listing and labeling of custom-built panels (UL 508) shall be adhered to under this Contract.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with specified requirements, approved manufacturers are listed in Appendix D "Orange County Utilities, Standards and Construction Specifications Manual", dated February 11, 2011.

2.02 CONTROL PANEL

- A. Panel Construction
1. The Contractor shall furnish and install all the necessary panels, meter cabinets, disconnects, conductors, conduits, and other associated electrical components for a complete electrical system. All work shall conform to the latest national and local codes and be in strict conformance with Orange County standards as previously identified. All material and equipment shall be Underwriters Laboratories (UL) listed. All coordination for service and metering shall be accomplished by the Contractor at no additional cost to the County. The Work shall include complete testing of all equipment, components and wiring to demonstrate proper functioning of the system.

2. The manufacturer of the control panel shall be UL certified and provide data to indicate that the manufacturer has a minimum of 3-years experience in the building of pump control panels.
3. The duplex pump control panel shall be housed in a NEMA 12/3R, Type 316, 14-gauge stainless steel enclosure, with drip shield and door gasket. The control panel door shall be operated by a 3-point latch. An additional remote access terminal strip with thirty additional terminal blocks shall be added for SCADA. Enclosure shall have provisions for padlocking the door and a dead front inner door unit for mounting controls. All exterior hardware and hinges shall be stainless steel. All LCD screens shall have an aluminum sunshield painted white with hinged flap covering the screen surrounding the manufacturer's enclosure.
4. There shall be permanently affixed to the interior side of the enclosure door both a nameplate and a 10-inch by 12-inch pocket for log sheet storage. The nameplate shall contain the following information:
 - a. voltage
 - b. phase
 - c. rated horsepower
 - d. rpm
 - e. date manufactured
 - f. pump and control panel manufacturer's name
 - g. pump data
 - h. impeller data
 - i. operating point including design flow and head
 - j. kilowatt input
 - k. amperes at the operating point and at least 2 other points on the pump curve
 - l. pump serial numbers.
5. The control panel enclosure shall be UL 50 type NEMA 3R listed. Overhead T-8 fluorescent lighting shall be controlled by a single pole switch installed inside of the control panel. Light shall be mounted on the inside of the door.
6. The control panel shall consist of a main circuit breaker and generator breaker with mechanical interlock, an emergency power receptacle, a circuit breaker and magnetic starter for each pump motor, and 20-ampere, 120 volt circuit breakers as required. The main circuit breaker and generator circuit breaker shall be equal in rating. Each panel shall contain an additional 20-ampere breaker for SCADA purposes. All circuit breakers shall be operable through the dead front inner door. Additional multi-lug assemblies shall be provided to prevent more than 1-wire per lug. All circuit breakers shall be molded case. The control panel shall respond to liquid level float switches and other approved methods specified by Appendix D "List of Approved Products", to automatically start and stop pumps as well as sound an alarm upon high or low wetwell levels. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the "lead" and "lag" pumps after each pumping cycle. A float type liquid level control system shall continuously monitor wetwell liquid level and control operation of the low-level cutoff for the pumps and shall operate off a 24-VAC circuit.

7. The control panel shall operate a minimum of 2 electrical submersible pumps at the power characteristics specified. The control function shall provide for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump shall automatically start to handle this increased flow. As the flow decreases, pumps shall be cut off at the elevation as shown on the Drawings. Pumps shall alternate positions as lead pump at the end of each cycle. A failure of the alternator shall not disable the pumping system. The alternator shall include a safe, convenient method of manual alternation and also have provisions to prevent automatic alternation without disturbing any wiring. Should the "pump off" regulator fail, the system shall keep the station in operation.
8. The control panel shall be compatible with both of the manufacturers' pumps listed in Table 11305-A - Submersible Pumps Schedule.

B. Power Supply and Main Disconnect

1. Power supply to the control panel shall be 240 volt, 3-phase, 4-wire (Delta) or 480 volt, 3-phase, 4-wire (Y). Minimum service shall be 100-amperes. Single-phase power shall not be accepted.
2. A lockable, non-fused disconnect shall be used for service main disconnects at all stations. In all pump stations, a main disconnect shall be installed between the meter and the panel. Provide dual lugs on load side of disconnect for connection of TVSS equipment. Exception: At pump stations with a generator and transfer switch, provide molded case circuit breaker located ahead of transfer switch for service main disconnect.
3. Disconnect shall be rated for the maximum available fault current from the utility serving the pump station with electrical power.
4. On all 480 volt systems, an additional UL approved lockable, non-fused, safety type switch utility service disconnect shall be installed ahead of the meter.
5. Contractor shall be responsible for coordination of the electrical service with the utility providing power for the installation.

C. Motor Circuit Protectors

1. Each pump motor shall be protected by a 3-pole molded case circuit breaker (See Appendix D "List of Approved Products"). The motor circuit breaker shall be operated by a toggle type handle and shall have a quick make, quick break over-center switching mechanism that is mechanically trip free from the handle so that the contacts cannot be held closed against a short circuit and abnormal currents which cause the motor circuit breaker to trip. Tripping shall be clearly indicated by the handle automatically assuming a position midway between the normal "on" and "off" positions. All latch surfaces shall be ground and polished. All poles shall be so constructed that they open, close, and trip simultaneously. Motor circuit breaker must be completely enclosed in a high strength glass polyester molded case. Ampere ratings shall be clearly visible. Contacts shall be of non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes. A manual push to trip button shall be provided for manual exercising of the trip mechanism.

D. Motor Starter and Selector Switches

1. The panel shall contain a motor starter for each motor. The motor starter shall be across-the-line non-reversing magnetic starter with individual mechanical overload protection on each power leg with reset installed through the dead front inner door unit. Provide solid-state soft start overloads with user selectable bypass contactor for motors greater than 50-horsepower. Local power company regulations shall govern.
2. Selector switches shall be installed on the face of the inner dead front door unit. Selector switch shall be a heavy-duty oil tight "Hand Off Auto" 3-position switch to control the operation mode of each pump motor starter.
3. Motor Disconnect: Where pump motor disconnect and starter is not mounted within site of pump wetwell, (where electrical equipment is mounted within a building or other enclosure) provide additional NEMA 4X stainless steel non-fused disconnect for each pump within site of pump location.

E. Pump Alternator: A solid-state alternator shall be provided to change the pump starting sequence on each pumping cycle. A 3-position alternator test switch shall be provided to control the alternation operation. Switch positions to include the "auto" to provide normal automatic sequence, "off" position to disable alternator, and "test" position with a spring return to allow the alternating of the pump sequence to check alternator operation.

F. Lights and Alarms

1. Indicator Lights: There shall be installed on the face of the dead front inner door, heavy-duty oil tight indicator lights as shown on the STANDARD DRAWINGS.
2. High Level Alarm: A vapor-proof red light shall be mounted on top of the panel and horn shall be mounted on the side of the panel for high level alarm. Also, there shall be an alarm silence pushbutton on the dead front inner door and a silence relay which will silence the horn and automatically reset when these signals are restored to normal. The pushbutton shall be heavy-duty oil tight. The red globe shall be the screw on type.

G. Emergency Power Receptacle: This item shall be required on all stations up to and including 200-ampere main service as approved in Appendix D "List of Approved Products."

H. Additional Control Panel Requirements

1. Wiring
 - a. All power wires shall be THW or THWN 75°C insulated stranded copper conductors and shall be appropriately sized for the given load application. All control circuit wire shall be type THW/THWN stranded. All wiring within the enclosure shall be neatly routed by the use of slotted type wiring duct with snap on type covers.
 - b. Interior wiring shall be neatly bundled with nylon ties and include sufficient loop across the hinges to prevent wire damage, with each end of conductor marked (ID), color: red, 24 volt; white, neutral; black, 120 volt.

2. Terminal Points: Terminal points of all terminal strips shall be permanently identified. All terminal numbers and identifying nomenclature shall correspond to and be shown on electrical diagrams. All wiring shall be permanently identified with heat shrink preprinted labels and be shown on electrical schematic diagrams.
3. Engraved and/or etched Nameplates: All equipment enclosures, circuit breakers, control switches, indicator pilot lights and other control devices shall be identified with permanently affixed legend plates and lamicoid type engraved nameplates where applicable. Nameplates may also be permanently etched into dead front cover of control panel.
4. Surge Protective Device (SPD) A surge protective device shall be included and wired to protect motors and control equipment from lightning induced line surges. All surge protectors shall be UL approved and installed per respective power company requirements and manufacturer's specifications. TVSS shall be connected to a dedicated circuit breaker located within the pump control panel. and be mounted in a separate NEMA 4X enclosure. SPD circuit breaker shall be sized per manufactures recommendation. On larger 480 volt stations with MCC construction, a SPD shall be installed on the MCC or Main Control Panel as applicable. If a transformer and 120/240 volt panel is installed, a second SPD shall be included for the low voltage (120/240 volt) panel.
 - a. The TVSS unit shall be UL listed and labeled as per UL 1449 Current edition.
 - b. The unit shall meet "Testing Requirements" of IEEE 62.41 and 62.45.
5. Elapsed Time Meters: Elapsed time meters shall be 115 volt not reset type and shall totalize pump running time in hours and tenths of hours to 99999.9 hours.
6. Convenience Receptacle: On the face of the dead front inner door unit, there shall be installed a 20-ampere 120 volt, duplex convenience receptacle. It shall be provided with its own single pole, 20-ampere circuit breaker for protection. Ground fault interrupt type shall be required.
7. SCADA Circuit Breaker: A 20A-1P, 120-VAC circuit shall be provided for connection to SCADA equipment provided for the pump station.
8. Control Terminal Blocks: Control terminal blocks shall be of the clamp screw type, rated for 600 volts. Amperage rating shall accommodate the control circuit amperage. An additional 30-space terminal strip shall be installed in the cabinet for future use, with RTU equipment.
9. Control Power Transformers
 - a. On 480 volt control panels, there shall be a control 480/120 volt power transformer with a minimum size of 2.52 KVA to provide 120-VAC power for: coils for starters, 20-ampere duplex receptacle, indicator pilot lights, alarm horn, alarm light, pump alternator, elapsed time meters, SCADA control panel, etc. The secondary side shall have 1 leg fused and the other grounded.
 - b. A 120/24-VAC 75 VA control power transformer shall provide power for float switches.
10. Control Relay: The level control relays shall operate from 24-VAC. They shall be enclosed, plug in 8-pin type with octal style screw terminal sockets.
11. Electrical Schematic: There shall be permanently affixed to the interior side of the exterior enclosure door an electrical schematic diagram and a copy supplied to County personnel at start up. The schematic shall be laminated and include the rated amperage and voltage for all components.

12. Phase Monitor: For all 240-volt stations an 8-pin plug in type phase monitor shall be provided for protection of electrical components due to phase loss. Adequate dummy pin protection shall be provided to prevent accidental interchanging of the 8-pin phase monitor with the 8-pin alternator. All 480-volt stations shall have surface mount type phase monitors. An approved breaker shall provide phase monitor protection. Fuses shall not be used for phase monitor protection.
13. Panel Support: Main support posts shall be minimum 3-inch, schedule 40, Type 316 stainless steel with Type 316 stainless steel cap. All other control panel support brackets and hardware shall be Type 316 stainless steel. Hardware shall include U-channel strut systems, brackets, nuts, bolts, washers, toggle bolts, clamps, straps, etc.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 13431
PUMP STATION SCADA PANELS

PART 1 - GENERAL

1.01 SUMMARY

- A. This section describes the general requirements for duplex pump station SCADA panels and required appurtenances.
- B. Related sections:
 - 1. Section 17166 – Field Testing.

1.02 SUBMITTALS

- A. Shop Drawings covering the items included under this Section shall be submitted in accordance with Section 01300, "Submittals."
- B. Submit a list of each component of the SCADA panel and antenna assembly from the SCADA panel supplier for approval. Submit manufacturer's official and published product data, specifications, and installation recommendations for each item. Product data must include terminal wiring details, specific features such as ranges and options, and calibration data.

1.03 QUALITY ASSURANCE

- A. Design, testing, assembly, and methods of installation for materials, electrical equipment, and accessories proposed under this Section shall conform to National Electric Code and to applicable State and local requirements.
- B. Listing and labeling of custom-built panels shall comply with Underwriters Laboratory, Inc. (UL) Standards (UL 508).
- C. All electrical materials and equipment must be new and must bear the UL label, or equivalent where standards have been established and label service regularly applies.
- D. Each panel assembly shall be tested in conjunction with factory acceptance test as required by Orange County Utilities. Contractor shall provide documentation from SCADA panel supplier that the panel assembly has met factory acceptance.
- E. Appendix H-7 through H-9 should be submitted to the approved pump station control panel supplier prior to request for panel construction.
- F. Appendix H-7 through H-9 shall be forwarded to Orange County Utilities upon factory acceptance testing.

1.04 MAINTENANCE

- A. Provide the following spare parts for each pump station:

1. Fuse kit package. Including One (1) each of; 2A, 3A, 5A, and 6A.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The SCADA Panel and Antenna shall be supplied by a County approved pump station control panel supplier. Approved pump station control panel suppliers are listed in Appendix D.

2.02 SCADA PANELS AND APPURTENANCES

A. The assembled SCADA panel shall be comprised of the most current County approved components.

B. The SCADA panel shall include, but not be limited to, the following components:

- | | |
|---|--------------------------------|
| 1. Terminal blocks | 2. Radio |
| 3. Circuit breakers | 4. PLC |
| 5. Fuse holders | 6. Fuses |
| 7. Isolated loop circuit protector | 8. Communications module (TIM) |
| 9. Power supply | 10. Enclosure |
| 11. Terminal block labels and accessories | 12. DC UPS |

C. The antenna assembly shall include, but not be limited to, the following components:

1. Antenna connectors
2. Antenna
3. Antenna surge suppression

D. Panel Construction

1. The Contractor shall furnish and install all the necessary hardware, conductors, conduits, and all other associated equipment as specified and approved by the County for a complete system.
2. All work shall conform to the latest national and local codes and be in strict conformance with Orange County drawing standards specifically developed for duplex and triplex pump station SCADA panel.
3. All material and equipment shall be Underwriters Laboratories (UL) listed. The Work shall include complete testing of all equipment, components and wiring to demonstrate proper functioning of the system, as required by Orange County Utilities.
4. The manufacturer of the control panel shall be a County approved panel fabricator as listed in Appendix D. The manufacturer shall be UL certified and provide data to indicate that the manufacturer has a minimum of three (3) years experience in the building of pump control panels and antennas.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 13431

SECTION 15064
POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

GENERAL

DESCRIPTION

Scope of Work: Furnish all labor, materials, equipment and incidentals required and install and test all polyvinyl chloride (PVC) piping, fittings and appurtenances as shown on the Drawings and specified herein.

General Design: The equipment and materials specified herein are intended to be standard types of PVC pipe and ductile iron fittings for use in transporting wastewater, reclaimed water, and water.

QUALITY ASSURANCE

Qualifications: All of the PVC pipe and ductile 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, installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

Standards:

AWWA C900/C905

ASTM D1784 / D1785 / D2241 / D2466 / D2564 / D2729 / D2774 / D3034 / D3139 / D3212

NSF 14

UNI-B-1 through 5

Factory Tests: The manufacturer shall perform the factory tests described in Section 3 - AWWA C900/C905.

Quality Control:

The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards.

In addition to the manufacturer's quality control procedures, the County may select an independent testing laboratory to inspect the material at the production facility for compliance with these specifications. The County will pay for the cost of facility inspection requested by the County.

SHOP DRAWINGS AND SUBMITTALS

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

Materials and Shop Drawings

Manufacturer's Certification

Submit sworn certification of factory tests and their results.

PRODUCT DELIVERY, STORAGE AND HANDLING

Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer's recommendations. PVC pipe shall be covered with black plastic with a minimum thickness of 15-mil. Joint gaskets shall be stored in a clean, dark and dry location until use.

Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe or 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 County or it shall 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 to prevent 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.

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.

PRODUCTS

GENERAL

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

MATERIALS

Polyvinyl Chloride (PVC) Pipe

Standards: AWWA C900/C905 and ASTM D1784/D3034/F679 (Gravity Sewer)

Compounds: Class 12454-A or Class 12454-B

PVC Gravity Pipe and Fittings: PVC gravity pipe (6-inch to 15-inch), shall conform to ASTM D3034, maximum SDR 35. PVC gravity pipe (18-inch to 36-inch), shall conform to ASTM F679 and uniform minimum "pipe stiffness" at 5% (percent) deflection shall be 46-psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI Bell Plastic Pipe Association standard is UNI B.

PVC Pressure Pipe and Fittings: All PVC pipe of nominal diameter 4 to 12-inches shall be manufactured in accordance with AWWA Standard C900 and greater than 12-inches shall be manufactured in accordance with AWWA Standard C905. The PVC pipe shall have a minimum working pressure rating of 100-psi and shall have a maximum dimension ratio of 18. Pipe shall be the same outside diameter as ductile iron pipe.

Dimension Ratio/Thickness: (unless otherwise shown on the Drawings)

Raw Wastewater:

(1) Pressure Systems: DR 18

(2) Gravity Systems: DR 35 (ASTM D3034) or PS 46 (ASTM F679)

Treated Wastewater: DR 18

Reclaimed Water: DR 18

Raw Water: DR 18

Potable Water: DR 18

Irrigation Piping: Schedule 40 or SDR 21

Joints:

Push-on integral bell elastomeric gasket joints:

(3) Standards: ASTM D3212/D3139/F477 and UNI-B-1

(4) Gaskets:

Potable and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) rieber type.

Wastewater Service: Styrene Butadiene Rubber (SBR) rieber type for C900 / C905 pipe. Styrene Butadiene Rubber (SBR) ring type for gravity systems.

(5) Pipe Markings: Pipes shall have a manufacturer's home-mark on the spigot.

On field cut pipe, the Contractor shall provide home-mark on the spigot in accordance with manufacturer's recommendations.

Solvent weld (nominal diameter less than 4-inches):

(6) Standards: ASTM D2466/D2564

(7) Type: Slip Fitting Socket (tapered)

(8) Exclusions: Plastic saddle and flange joints will not be used.

Restrained Joints:

- (9) Restrained joint devices shall be made specifically for PVC pipe and meet or exceed the requirements in ASTM F-1674.
- (10) Manufacturers: Uni-flange mechanical joint restraints and bell restraints (for all sizes); Meg-a-lug system as manufactured by EBBA Iron (sizes 12-inches or less), or acceptable equal.
- (11) Design pressure rating equal to or above test pressure as specified herein.

Pipe Length:

- (12) Pressure systems: 20-feet maximum nominal length
- (13) Gravity systems: 13-feet minimum nominal length

Fittings - Pressure Systems (nominal diameter 4-inches and greater):

Materials: Ductile iron

Joints: Mechanical Joint, Minimum 350-psi pressure rating

Gaskets:

Water and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) ring type

Wastewater Service: Neoprene rubber ring type

Exclusions: Standard double bell couplings will not be acceptable where the pipe will slip completely through the coupling.

All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron.

All fittings shall have a date code cast (not printed or labeled), with identification of the date, factory and unit at which it was cast and machined. Fittings shall have distinctly cast on them the pressure rating, nominal diameter of openings, manufacturer's name, the country where cast, and deflection angle. Ductile iron fittings shall have the letters "DI" or "Ductile" cast on them.

All potable water main fittings shall have NSF 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.

All ductile iron fittings shall have exterior coatings, including markings and colors, and interior linings in conformance with Section 15062 "Ductile Iron Pipe and Fittings."

Fittings - Pressure Systems (nominal diameter less than 4-inches)

Material: Polyvinyl Chloride (PVC)

Joints: Slip fitting tapered socket with solvent weld

Solvent: Sure Guard 12 or acceptable equal

Exclusions: Plastic saddle and flange joint fittings shall not be used

LOCATION MARKERS, LOCATION WIRE AND IDENTIFICATION MARKINGS

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

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 the 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.

Locator System: Marker locator set shall be the 3M Dynatel 1420 or 3M Dynatel 1420E Electronic Marker System Marker Locator, 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:

Unit(s) shall be tuned to the proper frequency for each type (service) of piping.

Field strength meter that provides visual indication of the return signal

Function switch for selection of operation mode

Sensitivity control to adjust the receiver gain

Audio speaker for signal response

Battery access panel containing condensed operating instructions

Auxiliary headset and headset jack

Permanently attached shoulder straps

Rugged shockproof and weatherproof storage/carrying case

Manufacturer: System shall be Scotch Mark Locator System, or acceptable equal.

Location Detection Wire

Materials: Continuous, insulated 10-gauge copper wire (color to match pipe identification).

Installation: Directly above (1-inch maximum) centerline of pipe terminating at top of each valve box collar and be capable of extending 18-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.

Identification Markings:

Pipe furnished in solid color or white with color lettering as indicated below.

Lettering along top 90° (degrees) of pipe, minimum 3/4-inch in height with appropriate wording appearing 1 or more times every 21-inches along the entire length of the pipeline.

- (14) Raw Wastewater: Safety Green
- (15) Reclaimed Water: Purple (Pantone 522C)
- (16) Potable Water: Safety Blue

EXECUTION

INSTALLATION

Standards: AWWA C900/C905/UNI-B 3 and 4

Underground Polyvinyl Chloride (PVC) Pipe and Fittings

Bedding: Firm, dry and even bearing of suitable material. Blocking under the pipe will not be permitted.

Placement/Alignment:

Installation shall be in accordance with lines and grades shown on the Drawings. For pressure systems, deflection of joints shall not exceed 75% of that recommended by the manufacturer.

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 on pipe 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.

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.

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.

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 color stripe and pipe text shall be viewed from the top of pipe when installed. When installing PVC pipe, no additional joints will be installed until the preceding pipe joint has been completed and the pipe carefully embedded and secured in place.

Locating Wire: Locating wire, for electronically locating pipe after it is buried, or installed by trenchless technology shall be attached along the length of and installed with the pipe. This is applicable to all sizes and types of pressure mains. At a minimum, the tracing wire is to be attached to the pipe with nylon wire ties. The wire itself shall be 10-gauge single strand solid core copper wire with non-metallic insulation. The insulation shall be color coded for the type of pipe being installed. Continuous continuity must be maintained in the wire along the entire length of the pipe run. Permanent splices must be made in the length of the wire using wire connectors approved for underground applications as listed in the uniform electric code handbook. The coiled wire shall extend to a minimum of 12-inches above the surface and be connected to a test station box at valve locations.

PVC Pressure Pipe Installation and Training: PVC pipe shall be installed in accordance with standards set forth in the UNI-BELL "Handbook of PVC Pipe", AWWA C605, and AWWA Manual M-23. The pipe shall be laid by inserting the spigot end into the bell flush with the insertion line or as recommended by the manufacturer. At no time shall the bell spigot end be allowed to go past the "insertion line" or "homing mark" for pressure pipe applications and homing mark shall be visible.

Field Cutting: PVC pipe can be cut with a handsaw or power driven abrasive disc making a square cut. The end shall be beveled with a beveling tool, wood rasp or power sander to the same angle as provided on the factory-finished pipe. The insertion line on the spigot shall be remarked to the same dimensions as the factory-marked spigot.

All Contractor pipe crews utilizing PVC pressure pipe shall be trained on an annual basis by Uni-Bell in coordination with the County and attended by the manufacturer's representative of the respective approved Manufacturers in Appendix D "List of Approved Products." The Uni-Bell PVC training session will consist of proper handling, storage, installation, and compaction as well as County requirements regarding PVC pipe and deflection. Every person handling, installing or backfilling PVC pipe shall not be permitted to install County owned and / or maintained pipe without training.

Approved manufacturers representatives (Appendix D "List of Approved Products"), not present at the hosted Uni-Bell training session or individuals of pipe crews not in attendance shall be trained on every project site. On-site project training shall be for each manufacturer of pipe utilized on-site, per crew and per project. Specifically each crewmember shall be trained on every project by every pipe manufactures representative regardless of previous on-site training. Every person handling, installing or backfilling PVC pipe shall not be permitted to install County owned and / or maintained pipe without training.

PVC Gravity Pipe Installation: Gravity sewer pipe shall be installed to the homing mark, no tolerance. Any noticeable separation shall be removed and reinstalled. The homing mark may be disregarded to meet the maximum of 1-inch separation between bell and spigot requirement. Joints:

Joint Placement:

- (17) Push on joints: Pipe shall be laid with the bell ends 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.
- (18) 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.

Thrust Restraint

Thrust restraint shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein.

Length of restrained joints shall be in accordance with the lengths listed in the table as shown on the Drawings.

Installation of Pipes on Curves:

No joint deflection or pipe bending is allowed in PVC pipe. The maximum allowable tolerance in the joint due to variances in installation is 0.75° (degrees) (3-inches per joint per 20-foot stick of pipe). No bending tolerance in the pipe barrel shall be acceptable. Alignment change shall be made only with sleeves and fittings.

CLEANING AND FIELD TESTING

At the conclusion of the Work, the Contractor shall provide all associated cleaning and field testing as specified in associated sections of these specifications.

END OF SECTION

SECTION 16010
ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The Work covered under this Division of the Specifications is intended to include the furnishing of all materials, equipment and labor necessary for or reasonably incidental to, the installation of a complete and fully operative electrical system as indicated on the Drawings and specified in this Section.
 - 1. The Work shall consist generally of, but is not limited to, the following major items:
 - a. Circuit Protective Devices
 - b. Conduit and Wiring
 - c. Equipment Connections
 - d. Temporary power
- B. Work Not Included: The following work is not included in this Section:
 - 1. Furnishing of pump control panels.
- C. Fees and Permits
 - 1. Obtain all permits required for the Work and include the cost of same in bid.
 - 2. The Contractor shall also include in the bid, the cost for the power company service.
- D. Certificate of Inspection

The Contractor shall pay for a final inspection made of the complete electrical installation and shall deliver a certificate of approval of the complete Work to the County before receiving final payment.

E. Service

Voltage and Phase as indicated on the Drawings. Secondary metered electrical power underground or overhead as indicated on the Drawings. Serving electrical utility company is as noted 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."
- B. Submit to the County as provided in the General Conditions, Shop Drawings, manufacturer's literature and technical data on the proposed electrical systems before commencing work.

C. Shop Drawings

1. Submit copies of manufacturer's drawing of surge protection devices, circuit protective devices, panel boards, conduit, wire, wiring devices, and any other special electrical equipment to be installed, and shall receive the County's acceptance before ordering the same for installation.
2. All Shop Drawings shall be submitted in a 3-ring binder with each specification section indicated with tabs.
3. If Shop Drawings are submitted intermittently and not in 3-ring binders, they will not be reviewed and they will be returned to the Contractor for proper submittal.
4. Acceptable Equivalent
 - a. Any manufacturer and/or catalog number listed on the Drawings or in the Project Manual shall be construed to mean "or acceptable equivalent" as listed in Appendix D "List of Approved Products."
 - b. Any substitutions to be considered as "Acceptable Equivalent" shall be submitted with both the cut of the proposed substitution and a cut of the specified equipment to the County in writing, and returned to the Contractor at least 10-days prior to bid opening.
 - c. No substitutions shall be submitted or will be allowed after the contract has been awarded.

1.03 QUALITY ASSURANCE

A. Qualifications of manufacturers, materials and equipment

1. Material and equipment, except as herein otherwise noted, shall be new and conform to standards specified herein defined to include conduits, cable, wiring materials and devices and panel boards.
2. Materials and equipment shall be of an approved design.
 - a. Similar materials shall be of one manufacturer wherever possible.
3. Equipment offered under these Specifications shall be limited to products regularly produced and recommended for service ratings in accordance with manufacturer's catalogs, engineering data, or other comprehensive literature made available to the public and in effect at the time of opening of bids.
4. Install equipment in strict accordance with manufacturer's instruction for type, capacity and suitability of each piece of equipment used.
 - a. Obtain these instructions, which shall be considered a part of these Specifications.

B. Qualifications of supervisor, workmanship and installers

1. The Contractor shall have a Master Electrician constantly supervising the Work covered by these Specifications, and so far as possible shall keep the same foreman on the job from start to finish.
 - a. The workmanship of the entire job shall be excellent and only experienced and competent workers shall be employed for the Work.

1.04 CODES AND REGULATIONS

- A. Work shall be installed in accordance with the regulations and requirements of the National Electrical Code NFPA No. 70; Life Safety Code NFPA No. 101, Standard Building Code as well as all rules, state and local codes, regulations and requirements of the telephone and power companies.
- B. Where conduits and/or cables penetrate wetwell walls, the penetrations shall be sealed in accordance with NFPA 70, Article 500.
 - 1. The above shall be ascertained and fully coordinated before the installation of any material, equipment, and the like, and any discrepancy shall be immediately brought to the attention of the County in writing, and the Contractor shall receive a disposition of same before proceeding with the Work.
 - 2. Furnish, without additional charge, any additional materials and labor that may be required for compliance with these codes, law, rules, regulations or requirements even though the work is not mentioned in these Specifications or shown on the Drawings.
- C. Material and equipment shall bear the label of approval of the National Board of Fire Underwriters Laboratory.

1.05 INSPECTIONS

- A. All work and materials covered by these Specifications and shown on the Drawings shall be subject to inspection at any and all times by the County.
- B. If the County finds that any material does not conform with these Specifications, the Contractor shall within 3-days after being notified by the County; remove the material from the premises, and if said material has been installed, the entire expense of removing and replacing same, including any cutting and patching that may be necessary, shall be borne by the Contractor.
- C. Tests

The County reserves the right to inspect and test any portion of the equipment during the progress of this Work.

- 1. The Contractor shall test the entire system in the presence of the County when the Work is completed to insure that all portions are free from short circuits and grounds.
- 2. All equipment, material and labor necessary to conduct the above tests shall be furnished at the Electrical Contractor's expense.

1.06 PRODUCT HANDLING

- A. Protection of Equipment, Material and Work: The Contractor shall effectively protect and pay for protection of the work, materials or equipment, as is liable to injury during the construction period.
 - 1. Openings into any part of the conduit system as well as associated fixtures, equipment, and the like, both before and after being set in place, shall be securely covered or otherwise protected to prevent obstruction of the conduit, or injury due to carelessness or maliciously dropped tools or materials, grit, dirt, or any foreign matter.
 - a. The Contractor will be held responsible for all damage done until the Work is fully and finally accepted.
 - 2. Cover conduit ends with capped bushings.
- B. Repair of damage: In the event of damage, repair shall be made immediately, to the County's satisfaction and at no additional cost to the County.
- C. Special Handling: Special care, storage and handling of new and existing lighting fixtures shall be taken to minimize breakage of lenses and lamps shipped with fixtures.
 - 1. Immediately replace any breakage with the exact lens or lamp.

1.07 JOB CONDITIONS

- A. Accuracy of Data: The data given herein and on the Drawings are as exact as could be secured.
 - 1. The Specifications and Drawings are for the assistance and guidance of the Contractor.
 - 2. Exact locations, distances, levels, and the like, will be governed by the building field conditions and the Contractor shall use the data contained herein with this understanding.
- B. Drawings
 - 1. The electrical drawings are diagrammatic, but shall be followed as closely as actual construction and work of other Contractors will permit.
 - 2. Deviations from diagrammatic electrical drawings required by either building construction or the work of other Contractors shall be made by the Contractor at his/her expense.
 - 3. It is not the intention of the Drawings or specifications to indicate each piece of conduit and fittings required for the satisfactory operation of the installation and whereby one is indicated, but not specified, or specified but not indicated on the Drawings, it shall be considered to be both specified and indicated.
- C. Measurements
 - 1. Review the Contract Drawings and Specifications and visit the job site to ascertain all conditions, including conduit runs, interfacing, interferences, conflicts, discrepancies, etc., and shall report the same to the County for clarification 10-days prior to submittal of the bid.

2. Failure to comply with this condition shall constitute an acceptance of the conditions and any necessary changes will be at Contractor's expense.
3. The Contractor shall make all measurements necessary for his/her work and shall assume responsibility for their accuracy.
4. Install necessary pull boxes, manholes and junction boxes as may be required to accomplish the distribution system indicated on the riser diagram.

D. Structural difficulties: Should any structural difficulties prevent the setting of cabinets, running conductors, and the like, at points indicated on the Drawings, the necessary deviation will be as determined by the County shall be made without additional cost.

E. Cooperation with Other Contractors

1. The Contractor shall arrange all parts of his/her work in proper relation to the work of other Contractors.
2. Where interferences occur, the Contractor shall, before installing the work involved, consult with the County as to exact location and level of his/her work.
3. The County's decision will be final.
4. The Contractor shall be responsible for arrangement of his/her work and equipment and maintenance of proper headroom under this Work.
5. Should work installed under this Section require any modifications to avoid interference with the other work, such changes shall be made without additional cost.
6. The County's decision as to determination or allocation or responsibility where conditions require changing of work, shall be final.
7. If any work of the Contractor is dependent for its proper execution on contiguous work, examine such work and report in writing any defect thereon or conditions rendering it unsuitable.
8. The beginning of work, without making such report, shall constitute an acceptance of such work, and any defects in his/her own work consequently shall be his/her responsibility.

1.08 TEMPORARY SERVICE

- A. Temporary power: Provide, maintain and remove after construction is completed, a temporary, receptacle and power system in accordance with the progress schedule.
 1. Receptacles: Ground fault interrupter type.
 2. Three Phase Power for Testing Motors: Provided at all necessary points.
- B. Temporary telephone service: Each respective trade shall be responsible for providing and maintaining their telephone services.

1.09 CLEANING

- A. Keep the premises free of debris and unusable materials resulting from the Work, and immediately upon completion of the Work remove such debris and material from the site and leave floors broom clean in areas affected by the Work.

1.10 GUARANTEE

- A. Leave the electrical installation in proper working order and without charge, replace any work or materials which develop defects within 1-year from date of final inspection and acceptance by the County.

1.11 DEFINITIONS

- A. In this Division "provide" is used as a term contraction meaning "to furnish, install and connect up completely in the specified or in an approved manner for the item and/or material described."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 16110

RACEWAYS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.

1.02 DESCRIPTION OF WORK

- A. Extent of raceway work is indicated by drawings and schedules.
- B. Types of raceway specified in this Section include the following:
 - 1. Liquid tight flexible metal conduit
 - 2. Rigid non-metallic conduit (PVC)
 - 3. Rigid aluminum conduit
- C. Electrical non-metallic tubing (ENT) is not acceptable.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience that will allow for quality and successful manufacture of raceway systems of types and sizes required for this Project.
- B. Installer's Qualifications: Firms shall have sufficient experience to allow for quality and successful installation of electrical raceway work required for this Project.

1.04 CODES AND STANDARDS

- A. NEMA Compliance: Comply with applicable requirements of NEMA Standards Publications pertaining to raceways.
- B. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL listed and labeled.
- C. NEC Compliance: Comply with applicable requirements of NFPA-70 pertaining to construction and installation of raceway systems.
- D. Comply with NECA "Standard of Installation."
- E. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

1.05 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. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions for each type of raceway system required. Include data substantiating that materials comply with requirements.
- C. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

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 NON-METALLIC CONDUIT

- A. General: Provide non-metallic conduit and fittings of types, sizes, and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, which comply with provisions of NFPA-70 for raceway.

B. Electrical Plastic Conduit

1. Extra Heavy Wall Conduit: Schedule 80, UL rated, construct of polyvinyl chloride compound C 200 PVC, and UL listed in accordance with NFPA-70 Article 347 for direct burial, or above ground use. Conduits shall be UL listed and marked for use with conductors having 90°C insulation. Use conduits, couplings, bushings, elbows, nipples, and other fittings meeting the requirements of NEMA TC 2 and TC 3, Federal Specification W C 1094, UL, NEC, and ASTM specified tests for the intended use. Use only conduit with a factory formed bell on 1 end. Conduit that requires the use of couplings for straight runs will not be acceptable. Minimum size 3/4-inch exposed, 1-inch embedded or buried.

C. Conduit and Tubing Accessories: Provide conduit and accessories of types, sizes, and materials, complying with manufacturers published product information, which mate and match conduit.

D. Conduit Bodies: Provide extra heavy PVC conduit bodies of types, shapes and sizes as required to fulfill job requirements and NFPA-70 requirements. Construct conduit bodies with threaded conduit entrance ends, removable covers, either cast or of galvanized steel and corrosion resistant screws.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering conduit bodies which may be incorporated in the Work include, but are not limited to the following:

1. Appleton Electric; Div. of Emerson Electric Co.
2. Arrow Hart Div.; Crouse Hinds Co.
3. Bell Electric Div.; Square D Co.
4. Killark Electric Mfg. Co.
5. O Z/Gedney Div.; General Signal Co.
6. Spring City Electrical Mfg. Co.

2.03 RIGID ALUMINUM CONDUIT

A. Meet requirements of ANSI C80.1 and UL6.

B. Material: Type 6063, copper free aluminum alloy.

C. Available Manufacturers

1. Appleton Electric, Div. Of Emerson Electric Co.
2. Arrow Hart Div; Crouse Hinds Co.
3. Bell Electric Div.; Square D Co.
4. O-Z/Gedney Div.; General Signal Co.

D. Minimum size shall be 3/4-inch unless noted otherwise or permitted by the following: 1/2-inch may be used for connections to individual instruments, outlets, wiring devices and indoor lighting fixtures.

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Liquid-tight Flexible Steel Conduit (LFS): UL listed liquid tight consisting of an extruded thermoplastic cover over a galvanized steel core. Minimum size 3/4-inch unless for equipment with 1/2-inch knockout.
- B. Fittings and Conduit Bodies: NEMA FB-1; galvanized steel compression type with O-ring.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install raceways as indicated; in accordance with manufacturer's written installation instructions, and in compliance with NFPA-70, and NECA's "Standards of Installation."
- B. Coordinate with other work including wires/cables, boxes and panel work, as necessary to interface installation of electrical raceways and components with other work.
- C. Install conduits concealed below grade or in slabs. Where conduits turn up and/or cannot be concealed, route conduits exposed.
- D. Mechanically fasten together conduits, enclosures and raceways for conductors to form continuous system. Connect to electrical boxes, fittings and cabinets to provide firm mechanical assembly.
- E. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
- F. Cap conduits or plug flush conduits during construction to prevent entrance of dirt, trash, and water. Cap or plug empty conduits designated as "future", "spare", or "empty" and include a pulling line accessible at both ends. Use anti-seize compound on cap and plug threads prior to installation.
- G. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- H. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offset parallel.
- I. Use raceway fittings compatible with raceway and suitable for use and location. Fitting sizes shall be such that the enclosed conductors do not exceed the permissible percentage of fitting area/volume.

- J. Install miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs that have been specifically designed and manufactured for their particular application. Install expansion fittings in raceways every 200-foot linear run or wherever structural expansion joints are crossed.
- K. Use roughing in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.
- L. Provide nylon pull cord in all empty conduits. Test conduits required to be installed, but left empty; test with ball mandrel. Clear any conduit, which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.

3.02 CONDUIT INSTALLATION

- A. Use Schedule 80 PVC throughout above grade and for turn ups including elbows and bends and where required.
- B. Use rigid aluminum above grade between control panel and conduit seals.
- C. Cut conduits straight and properly ream.
- D. Field bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.
 - 1. Size conduits to meet NFPA-70, except no conduit smaller than 3/4-inches shall be embedded in concrete or installed below grade.
 - 2. Fasten conduit terminations in sheet metal enclosures by threaded hubs, and terminate with insulating bushings.
 - 3. Complete installation of electrical raceways before starting installation of cables/wires within raceway.

3.03 CONCEALED CONDUITS

- A. Install coupling full depth to ensure watertight integrity.
- B. Install underground conduits minimum of 24-inches below finished grade.

3.04 CONDUITS IN CONCRETE SLAB

- A. Place conduits between bottom reinforcing steel and top reinforcing steel.
- B. Place conduits either parallel, or at 90° (degrees) to main reinforcing steel.
- C. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.
- D. Conduits crossing in slab must be reviewed for proper cover by the County.

E. Embedded conduit diameter is not to exceed 1/3 (one-third) of slab thickness.

F. Install conduits as not to damage or run through structural members.

3.05 NON METALLIC CONDUITS

A. Make solvent cemented joints in accordance with recommendations of manufacturer.

B. Install PVC conduits in accordance with NFPA-70 and in compliance with local practices.

3.06 CONDUIT FITTINGS

A. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.

B. Install insulated type bushings for terminating conduits. Bushings shall have cast flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing. Bushings shall be "O.Z" type or "B" or equal.

C. Bushings shall have screw type grounding terminal.

D. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, and plugs to be specifically designed for their particular application.

END OF SECTION

SECTION 16120
WIRES AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this Section.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete and operable installation of all electrical conductors, wire and cables and associated splices, connectors, and termination for wiring systems rated 600 volts or less. All electrical conductors shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings.

1.02 DESCRIPTION OF WORK

- A. Extent of electrical wires and cable work is indicated by drawings and schedules.
- B. Types of electrical wire, cable, and connectors specified in this Section include the following:
 - 1. Copper conductors
 - 2. 2 and/or 4 bolt connectors
 - 3. Wire nut connectors
- C. Applications of electrical wire, cable, and connectors required for project are as follows:
 - 1. For power distribution circuits
 - 2. For control and equipment circuits
 - 3. For motor branch circuits

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience that will allow for quality and successful manufacture of electrical wire and cable products of types, sizes and ratings required for items required for this Project.
- B. Installer's Qualifications: In addition to the requirements specified in Division 16 an independent testing firm shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907 quality and successful installation of wire and cable products for this Project.
- C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to construction, installation and color-coding of electrical wires and cables.

- D. UL Compliance: Comply with applicable requirements of UL Std. 83, "Thermoplastic Insulated Wires and Cables" and Std. 486A, "Wire Connectors and Soldering for Use With Copper Conductors".
- E. UL Compliance: Provide wiring/cabling and connector products, which are UL, listed and labeled.
- F. NEMA/ICEA Compliance: Comply with NEMA/ICEA Std. Pub/No's WC5, Thermoplastic Insulated Wires and Cable for the "Transmission and Distribution of Electrical Energy", and WC30, "Color Coding of Wires and Cables", pertaining to electrical power type wires and cables.
- G. IEEE Compliance: Comply with applicable requirements of IEEE Standards 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Standard. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring.
- H. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8, and D-573. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F.)
- I. FOIST Compliance: Comply with Federal Specifications J C 30, "Electrical Cable and Wire (Power, Fixed, Installation)", and W-S-610, "Splice Conductor."
- J. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code", Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NTRL) as defined in OSHA Regulation 1910.7.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Product Data: Submit manufacturer's data on electrical wires, cables, and conductors.
- C. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.

- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA specified type wire and cable reels.
- B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- C. Handle wire and cable carefully to avoid abrasing, puncturing, and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

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 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to the following:
 - 1. Wire and Cable
 - a. Alpha Wire Corporation
 - b. Apex Wire and Cable Corp.
 - c. American Insulated Wire Corp.
 - d. American Wire and Cable Co.
 - e. Anaconda-Ericson Inc., Wire and Cable Div.
 - f. Beldon Div.; Cooper Industries
 - g. Brand-Rex Div.; Pyle National Co.
 - h. Cablec
 - i. Cerro Wire and Cable Corp.
 - j. Cleveland Insulated Wire Co.
 - k. Dekoron
 - l. Konite
 - m. Penn

- n. Pirelli
 - o. Phelps Dodge Cable and Wire Co.
 - p. Rome Cable Corp.
 - q. Southwire Corp.
 - r. Triangle PWC, Inc.
2. Connectors
- a. AMP, Inc.
 - b. Anderson
 - c. Appleton Electric Co.; Emerson Electric Co.
 - d. Burndy Corporation
 - e. Brand-Rex Div.; Pyle National Co.
 - f. Electrical Products Div.; Midland Ross Corp.
 - g. General Electric Co.
 - h. Ideal Industries, Inc.
 - i. 3M Company
 - j. Monograms Co.
 - k. O-Z/Gedney Co.
 - l. Pyrotenax
 - m. Southport Industries Inc.
 - n. Square D Company
 - o. Thomas and Betts Corp.

2.03 WIRES, CABLES, AND CONNECTORS

- A. General: Provide electrical wires, cables, and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, for a complete installation, and for application indicated. Except as otherwise indicated, provide copper conductors with conductivity of not less than 98% at 20°C (68°F.)
- B. Building Materials: Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper wire selection as determined by installer to comply with project's installation requirements, NFPA-70 and NEMA standards. Select from the following UL types, those wires with construction features, which fulfill project requirements.
1. Type THW/THHN/ THWN, dual rated: For dry or wet locations; maximum operating temperature 75°C (167°F.) Insulation, flame retardant, moisture and heat resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper. NEMA WC-5 thermoplastic insulated building wire. 98% conductivity copper, 600V PVC insulated with nylon jacket, 75/90 wiring type. Minimum size #12 AWG. For control circuits minimum size #14 AWG.
 2. Type XHHW: For dry and wet locations; maximum operating temperature 90°C (194°F.) Insulation, flame retardant, cross-linked synthetic polymer; conductor, annealed copper.

3. Type 1 (600 Volt Multi-Conductor Control Conductor Cable, Type TC)
 - a. General: Multi conductor control circuit interconnection cable with ground. Suitable for installation in open air, in cable trays, conduit or other approved raceways. Minimum cable temperature rating 90°C dry locations, 75°C wet locations. Passes vertical tray flame test.
 - b. Individual Conductors: No. 14 AWG, 7-strand copper.
 - c. Insulation and Jackets: Provide conductors having 15-mil PVC insulation with 4-mil nylon jacket, and UL listed as Type THHN/THWN.

2.04 CABLES FOR VARIABLE FREQUENCY MOTORS

- A. General: All AC motors rated 600 volt (maximum) which are powered from AC Variable Frequency Drives (VFDs), so as to permit variable speed operation, shall be wired with shielded multiconductor Variable Frequency Drive Cable, specifically manufactured for that application in exposed applications. When in conduit, 600V THHN/THWN copper wire is acceptable
- B. Conform to NEC Article 336.
- C. Ratings
 1. 1,000 Volt UL flexible motor supply cable
 2. XLPE insulated, XHHW-2 90°C Wet/Dry
- D. Suitable for Class 1, Div. 2 hazardous locations.
- E. Suitable for direct burial, cable tray installation and conduit installation.
- F. Full-sized ground wire or equivalent.
- G. Overall shield with full-sized drain wire or equivalent.
- H. Belden Part No. 295XX, or approved equal.

2.05 TYPE 2 (600 VOLT NO. 16 AWG TWISTED, SHIELDED PAIR INSTRUMENTATION CABLE, TYPE TC)

- A. General: Single pair instrumentation cable designed for noise rejection for process control, computer, or data log applications. Suitable for installation in cable trays, conduit, or other approved raceways. Minimum cable temperature rating shall be 90°C dry locations, 75°C wet locations.
- B. Individual Conductors: Bare soft annealed copper, Class B, 7-strand concentric per ASTM B 8; 20 AWG, 7-strand tinned copper drain wire.
- C. Insulation and Jacket: Each conductor 15-mil nominal PVC and 4-mil nylon insulation. Pair conductors pigmented black and red. Jacket flame-retardant and sunlight and oil resistant PVC with 45-mil nominal thickness. Shield 1.35-mil aluminum/mylar overlapped to provide 100% coverage.

D. Dimension: 0.31-inch nominal OD.

2.06 TYPE 3 (600 VOLT NO. 16 AWG, MULTIPLE TWISTED SHIELDED PAIRS WITH A COMMON OVERALL SHIELD INSTRUMENTATION CABLE, TYPE TC)

A. General: Twisted, shielded pairs of instrument cables, grouped in a single cable, designed for use as instrumentation, process control, and computer cable. Suitable for installation in cable tray, conduit or other approved raceways. Minimum cable temperature rating shall be 90°C dry locations, 75°C wet locations.

B. Conductors: Bare soft annealed copper Class B, 7-strand, concentric per ASTM B 8. Tinned copper drain wires. Pair drain wire size AWG 20, group drain wire size AWG 18.

C. Insulation and Jacket: Each conductor 15-mil PVC and 4-mil nylon insulation. Pair conductors pigmented black and red with red conductor numerically printed for group identification. Outer jacket flame retardant and sunlight and oil resistant PVC with nominal thickness as shown in table. Individual pair shield 1.35-mil aluminum/mylar. Group shield 2.35-mil aluminum/mylar, overlapped for 100% coverage.

D. Dimensions as noted in table below:

No. of Pairs	Max. Outside Dimension (inches)	Nominal Jacket Thickness(mils)
4	0.50	45
8	0.77	60
12	0.82	60
24	1.16	60

2.07 TYPE 4 (600 VOLT NO. 16 AWG, SINGLE TWISTED, SHIELDED TRIAD INSTRUMENTATION CABLE)

A. General: Twisted, shielded triad instrument cables, designed for use as instrumentation, process control, and computer cable. Suitable for installation in cable tray, conduit or other approved raceways. Minimum cable temperature rating shall be 90°C dry locations, 75°C wet locations.

B. Conductors: Bare soft annealed copper Class B, 7-strand, concentric per ASTM B 8. Tinned copper drain wires. Triad drain wire size AWG 18.

C. Insulation and Jacket: Each conductor 15-mil PVC and 4-mil nylon insulation. Triad conductors pigmented black, white and red. Outer jacket flame retardant and sunlight and oil resistant PVC with nominal thickness. Individual triad shield 1.35-mil aluminum/mylar.

2.08 EQUIPMENT GROUNDING CONDUCTORS

- A. Provide stranded copper conductors, as indicated or as required by NEC, for equipment grounding.
- B. Provide conductors bare.

2.09 CONNECTORS

- A. General: Provide UL type factory-fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements, NFPA-70 and NEMA standards. Select from the following those types, classes, kinds and styles of connectors to fulfill project requirements:
 - 1. Type: Pressure
 - 2. Type: Crimp
 - 3. Type: Threaded
 - 4. Class: Insulated
 - 5. Kind: Copper (for CU to CU connection)
 - 6. Style: Butt connection
 - 7. Style: Elbow connection
 - 8. Style: Combined "T" and straight connection
 - 9. Style: "T" connection
 - 10. Style: 2 or 4 bolt parallel connection. Use of split bolt connectors is prohibited
 - 11. Style: Tap connection
 - 12. Style: Pigtail connection
 - 13. Style: Wire nut connection

PART 3 - EXECUTION

3.01 INSTALLATION OF WIRES AND CABLES

- A. General: Install electrical cables, wire and wiring connectors as indicated, in compliance with applicable requirements of NFPA-70, NEMA, UL, and NECA's "Standard of Installation" and in accordance with recognized industry practices.
- B. Coordinate wire/cable installation work including electrical raceway and equipment installation work, as necessary to properly interface installation of wires/cables with other work.
- C. Install UL type wiring in conduit, for feeders and branch circuits.
- D. Pull conductors simultaneously where more than 1 is being installed in same raceway.
- E. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulator.

- F. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips, which will not damage cables or raceways.
- G. Keep conductor splices to a minimum.
- H. Install splices and tapes, which possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- I. Use splice and tap connectors, which are compatible with conductor material.
- J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A and B.
- K. Use only stranded conductors. Exception: Solid conductors size #12 and #10 AWG may be used for receptacle branch circuit wiring and lighting.
- L. Use #10 AWG conductor for 20-ampere, 120-volt branch circuit home runs longer than 75-feet, and for 20-ampere, 277-volt branch circuit home runs longer than 200-feet.
- M. Neatly train and lace wiring inside boxes, equipment, and panel boards. Support to prevent conductor movement under fault conditions.
- N. All underground wiring shall be suitable for wet locations per NEC.
- O. Discrete control 120-VAC and 4-20mA signals must not be run in same conduit. Discrete control 120-VAC and 4-20mA signal wiring in control panels and cabinets shall be separated from each other and when required, should cross perpendicular with each other to reduce signal noise.
- P. Avoid unnecessary splices. Splice only in accessible junction or outlet boxes.
- Q. Make all connections with solderless lugs.
- R. Use mechanical connectors for low voltage splices, taps, fixture and motor connections.
- S. Use insulated spade type crimp on connectors for strap screw device terminals.
- T. Where possible use connectors with integral, insulating covers. Otherwise tape uninsulated conductors and connectors to 150% of the insulation value of conductor.
- U. Thoroughly clean wires before installing lugs and connectors.
- V. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

3.02 FIELD QUALITY CONTROL

- A. Prior to energization of circuitry, check installed wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled.
- B. Prior to energization, test wires and cables for electrical continuity and for short circuits.
- C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION

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SECTION 16135
ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete and operable installation of boxes, bushings and locknuts. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings.

1.02 DESCRIPTION OF WORK

- A. Extent of electrical box and associated fitting work is indicated by drawings and schedules.
- B. Types of electrical boxes and fittings specified in this Section include the following:
 - 1. Outlet boxes
 - 2. Junction boxes
 - 3. Pull boxes
 - 4. Bushings
 - 5. Locknuts

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience that will allow for quality and successful manufacture of electrical boxes and fittings of types, sizes and capacities required for manufacture of electrical boxes and fittings required for use in this Project.
- B. Installer's Qualifications: Firms shall have sufficient experience that will allow for quality and successful installation of electrical boxes and fittings required for this Project.
- C. NFPA-70 Compliance: Comply with NFPA-70 as applicable to construction and installation of electrical wiring boxes and fittings.
- D. UL Compliance: Comply with applicable requirements of UL 50, UL 514 Series, and UL 886 pertaining to electrical boxes and fittings which are UL listed and labeled.

- E. NEMA Compliance: Comply with applicable requirements of NEMA Standard Publication Numbers OS1, OS2, and Pub.250 pertaining to outlets and device boxes, covers and box supports.
- F. Comply with NECA "Standard of Installation."
- G. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled." As defined in the "National Electrical Code", Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Product Data: Submit manufacturer's data on electrical boxes and fittings.
- C. A copy of this specification section with addendum updates included, and all referenced and applicable sections with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

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 FABRICATED MATERIALS

- A. Outlet Boxes: Provide corrosion resistant cast metal rain tight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast metal face plates with spring-hinged watertight caps suitably configured for each application, including face plate gaskets and corrosion resistant plugs and fasteners.
 - 1. Manufacturers: Subject to compliance with requirements, provide rain tight outlet boxes of 1 of the following:
 - a. Appleton Electric; Emerson Electric Co.
 - b. Arrow Hart Div.; Crouse-Hinds Co.
 - c. Bell Electric; Square D Co.
 - d. Harvey Hubbell, Inc.
 - e. OZ/Gedney; General Signal Co.
 - f. Pass and Seymour, Inc.
- B. Junction and Pull Boxes: Provide NEMA 4X Stainless Steel junction and pull boxes, with screw-on covers; of types, shapes, and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
 - 1. Manufacturers: Subject to compliance with requirements, provide junction and pull boxes of 1 of the following:
 - a. Adalet-PLM Div.; Scott Fetzer Co.
 - b. Appleton Electric; Emerson Electric Co.
 - c. Arrow Hart Div.; Crouse Hinds-Co.
 - d. Bell Electric; Square D Company
 - e. OZ/Gedney Co.; General Signal Co.
 - f. Spring City Electrical Mfg. Co.
- C. Bushings, Knockout Closures and Locknuts: Provide corrosion resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.
 - 1. Manufacturers: Subject to compliance with requirements, provide bushings, knockout closures, locknuts and connectors of 1 of the following:
 - a. Adalet-PLM Div.; Scott Fetzer Co.
 - b. AMP, Inc.
 - c. Arrow Hart Div.; Crouse-Hinds Co.
 - d. Appleton Electric Co.; Emerson Electric Co.
 - e. Bell Electric; Square D Co.
 - f. Midland Ross Corp.

- g. Midwest Electric; Cooper Industries, Inc.
- h. OZ/Gedney Co.; General Signal Co.
- i. RACO Div.; Harvey Hubbell, Inc.
- j. Thomas and Betts Co. Inc.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

- A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NFPA-70 and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
- C. Provide weather tight outlets at all locations.
- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Install electrical boxes in those locations, which ensure ready accessibility to enclosed electrical wiring.
- F. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
- G. Provide electrical connections for installed boxes.
- H. Subsequent to installation of boxes, protect boxes from construction debris and damage.

3.02 GROUNDING

- A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

END OF SECTION

SECTION 16142
ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this Section.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete and operable installation of all electrical connections for wiring systems rated 600 volts or less. All electrical connections shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings.

1.02 DESCRIPTION OF WORK

- A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.
- B. Applications of electrical power connections specified in this Section include the following, but not limited:
 - 1. From electrical source to control panel
 - 2. From control panel to motors and control devices
- C. Electrical connections for equipment, not furnished as integral part of equipment, are specified in Division 15 and other Division 16 sections, and are work of this Section.
- D. Refer to Division 15 sections for motor starters and controller furnished integrally with equipment; not work of this Section.
- E. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this Section.
- F. Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this Section.
- G. Refer to Division 15 or Division 13 sections as applicable for control system wiring; not work of this Section.
- H. Refer to sections of other Divisions for specific individual equipment power requirements, not work of this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience and be regularly engaged in manufacture of electrical connectors and terminals, of types and rating required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties, whose products have been in satisfactory use in projects with similar service as this Project.
- B. Installer's Qualifications: Firms shall have sufficient experience to allow for quality and successful installation utilizing electrical connections for equipment for this Project.
- C. NFPA-70 Compliance: Comply with applicable requirements of NFPA-70 as to type of products used and installation of electrical power connections (terminals and splices), for junction boxes, motor starters and disconnect switches.
- D. IEEE Compliance: Comply with Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to connections and terminations.
- E. ANSI Compliance: Comply with applicable requirement of ANSI/NEMA and ANSI/EIA standards pertaining to products and installation of electrical connections for equipment.
- F. UL Compliance: Comply with UL Std.486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL listed and labeled.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Product Data: Submit manufacturer's data on electrical connections for equipment products and materials.
- C. A copy of this specification section with addendum updates included, and all referenced and applicable sections with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

- F. Failure to include a copy of the marked-up specification sections along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

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 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of product):
 1. Adalet PLM Div., Scott and Fetzer Co.
 2. Allen Stevens Conduit Fittings Corp.
 3. AMP Inc.
 4. Appleton Electric Co.
 5. Arrow Hart Div., Crouse Hinds Co.
 6. Burndy Corp.
 7. General Electric Co.
 8. Harvey Hubbell Inc.
 9. Ideal Industries, Inc.
 10. Pyle National Co.
 11. Reliable Electric Co.
 12. Square D Company
 13. Thomas and Betts Corp.

2.03 MATERIALS AND COMPONENTS

- A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to; pressure connectors, terminals (lugs), electrical insulating tape, heat shrinkable insulating tubing, cables ties, solderless wire nuts, and other items and accessories as needed to complete splices and terminations of types indicated.

2.04 CONDUIT, TUBING AND FITTINGS

- A. General: Provide conduit, tubing, and fittings of types, grades, sizes, and weights (wall thickness) indicated for each type service. Where types and grades are not indicated, provide proper selection to fulfill wiring requirements, and comply with NFPA-70 requirements for raceways. Provide products complying with Section 16110 "Raceways" and in accordance with the following listing of conduit, tubing and fittings:
 1. Schedule 80 PVC conduit
 2. Schedule 80 PVC fittings

3. Liquid-tight flexible metal conduit
4. Liquid-tight flexible metal conduit fittings
5. Rigid aluminum conduit
6. Rigid aluminum conduit fittings

2.05 WIRES, CABLES AND CONNECTORS

- A. General: Provide wires, cables, and connectors complying with Section 16120 "Wires and Cables."
- B. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match, including sizes and ratings, of wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F)
- C. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications.
- D. Electrical Connection Accessories: Provide electrical insulating tape, heat shrinkable insulating tubing and boots, wire nuts and cable ties as recommended for use by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect area and conditions under which electrical connections for equipment are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer and/or owner as applicable.

3.02 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NFPA-70, and NECA's "Standard of Installation" to ensure that products fulfill requirements.
- B. Coordinate with other work, including wires/cables, raceways and equipment installation, as necessary to properly interface installment of electrical connections for equipment with other work.
- C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

- D. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity ratings, than electrical insulation rating of those conductors being spliced.
- E. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes, which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.
- F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque-tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, bean type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.
- G. Provide liquid tight flexible conduit for connections of motors and other electrical equipment where subject to movement and vibration.
- H. Fasten identification markers to each electrical power supply wire/cable conductor which indicates their voltage, phase and feeder number in accordance with Section 16195 "Electrical Identification." Affix markers on each terminal conductor, as close as possible to the point of connection.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION

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SECTION 16143
WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.

1.02 DESCRIPTION OF WORK

- A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electrical energy.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete and operable installation of wall switches, receptacles, plugs, device plates and box covers. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings.
- C. Types of electrical wiring devices in this Section include the following:
 - 1. Receptacles
 - 2. Ground fault circuit interrupters
 - 3. Switches

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience in manufacture of electrical wiring devices, of types, sizes, and ratings required that will allow for quality and successful manufacture of wiring devices required for this Project.
- B. Installer's Qualifications: Firms shall have sufficient experience to allow for quality and successful installation of wiring devices required for this Project.
- C. NFPA-70 Compliance: Comply with NFPA-70 as applicable to installation and wiring of electrical wiring devices.
- D. UL Compliance: Comply with applicable requirements of UL 20, 486A, 498, and 943 pertaining to installation of wiring devices. Provide wiring devices which are UL listed and labeled.

- E. IEEE Compliance: Comply with applicable requirements of IEEE Standard 241, "Recommended Practice for Electric Power Systems in Commercial Buildings", pertaining to electrical wiring systems.
- F. NEMA Compliance: Comply with applicable portions of NEMA Standards Publication Number WD 1, "General Purpose Wiring Devices," and WD 5 "Specific Purpose Wiring Devices."
- G. OSHA Compliance: Comply with latest standards of the U.S. Department of Labor, Occupational Safety and Health Administration.
- H. Listing and Labeling: Provide products that are listed and labeled for their applications and installation conditions and for the environments in which installed.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Product Data: Submit manufacturer's data on electrical wiring devices.
- C. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

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 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide wiring devices of one of the following (for each type and rating of wiring device):
 1. Arrow Hart Div., Crouse Hinds Co.
 2. Bryant Electric Co.
 3. Harvey Hubbell Inc.
 4. Leviton Mfg. Co.
 5. Pass and Seymour Inc.
 6. Crouse Hinds.
 7. Appleton.
 8. Or approved equal.
- B. Wiring devices shall be UL approved for the current and voltage specified and shall comply with NEMA WD 1. Devices shall contain provisions for back wiring and side wiring with captive binding screws.

Provide devices colored to conform to manufacturer's or industry standard for special use such as orange for isolated ground receptacles, blue for surge suppression receptacles, and red for emergency power receptacles. Unless shown otherwise on the Drawings or Schedules, normal use devices shall be gray, except those located in finished areas shall be ivory.

2.03 FABRICATED WIRING DEVICES

- A. General: Provide factory fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Standards Publication Number WD 1.

2.04 RECEPTACLES

- A. Comply with NEMA Standard WD 1.
- B. Enclosures: NEMA 1 equivalent, except as otherwise indicated.
- C. Color: Unless noted otherwise by Architect or required by Code.
 1. Surface mounted unfinished areas: Gray.
 2. Flush mounted finished areas: Ivory.

- D. Receptacles, Straight-Blade and Locking Type: Comply with UL Standard 498, heavy-duty specification grade except as otherwise indicated.
- E. Receptacles, Straight-Blade, Special Features: Comply with the basic requirements specified herein for straight-blade receptacles of the class and type indicated, and with the following additional requirements:
 - 1. Ground-Fault Circuit Interrupter (GFCI) Receptacles: UL Standard 943, feed-through type, with integral NEMA 5-20R duplex receptacles arranged to protect connected downstream receptacles on the same circuit. Design units for installation in a 2-1/2-inch deep outlet box without an adapter. Ground-fault trip level shall be 5 milliamperes, and shall be noise-suppressed to the extent that nuisance tripping will be either eliminated or minimized.
 - 2. Line and load terminal screws: Ensure that connection to load terminals will ensure ground fault protection for other receptacles and loads connected to those terminals.
- F. Receptacles, Industrial Heavy-Duty: Conform to NEMA Standard PK 4.
- G. Except as otherwise noted on the Drawings or specified herein, receptacles shall be 125 Volt, 20-Ampere, ANSI C73.12, configuration 5-20R; grounded type; conforming to FS W-C-596/41 for single and FS W-C-596/40 for duplex receptacles and shall accept NEMA 5-15P and 5-20P plugs. Where the manufacturer of cord-connected equipment requires an isolated ground, a receptacle with isolated ground shall be provided.
- H. Ground Fault Interrupter (GFI) Receptacles: Provide duplex specification grade GFI receptacles tripping at 5-milliamperes; rated 20-amperes, 120 volts, NEMA Configuration 5-20R. Use units meeting NEMA WD 1, fitting standard sized outlet boxes having provision for testing, and ivory in color. Use standard model where ground fault protection is needed. Acceptable manufacturers are Square D, General Electric, or equal.
- I. Except as otherwise noted on the Drawings or specified herein, outdoor, process corrosive and chemical areas, receptacles shall be duplex, 20-ampere, NEMA 5-20R, and shall accept NEMA 5-15P and 5-20P plugs. Receptacle and plug shall be corrosion resistant but not marine duty with weatherproof lift covers. For outdoor locations use plastic or Lexan phenolic cover which can maintain the weatherproof integrity while in use.
- J. Receptacles shall be side or back wired with two screws per terminal.
- K. Body shall be thermoplastic compound or impact resistant nylon face supported by mounting yoke having plaster ears.
- L. Three phase receptacles and plugs shall be suitable for 480 volt, 3-phase, 4-wire service, with ampere ratings as specified. Receptacles and plugs shall be designed so that the grounding pole is permanently connected to the housing. The grounding pole shall make contact before the line poles are engaged when the plug is connected to the receptacle housing. The plug sleeve shall also make contact with the receptacle housing before the line and load poles make contact. Receptacles shall be provided complete with cast back box, angle adapter, gaskets, and a gasketed screw-type, weathertight cap with chain fastener.

- M. Install convenience outlets, in suitable steel outlet boxes centered at the height of 18-inches above the finished floor, 6-inches above countertop or at the backsplash level, or as indicated on the Drawings. Coordinate with equipment and architectural Drawings.

2.05 SWITCHES

- A. Snap: General purpose switches NEMA WD-1, shall be quiet AC type, NRTL listed and labeled as complying with UL Standard 20 "General Use Snap Switches," and with Federal Specification W-S 896, specification grade, back and side wired, and shall be provided in accordance with rated capacities as required or as indicated on Drawings or Schedules. Switches shall match receptacles in color. Unless otherwise indicated switches shall be 20-amp, 120/277 volt, toggle handle.
- B. Double Snap: Provide general duty flush double pole AC quiet switches, 20-amperes, 120/277 volts, with mounting yoke insulated from mechanism, equip with plaster ears, switch handles, side wired screw terminals, with break off tab features, which allow wiring with separate or common feed.
- C. Switches shall be 20-ampere with weatherproof/corrosion resistant neoprene plate for corrosive and outdoor areas. Switches shall be mounted in "FS" type copper-free aluminum or PVC mounting boxes.
- D. Switches shall be totally enclosed, specification grade, rated 20-ampere, 277/120 volt AC; conforming to FS W-S-896E, with phenolic body, base and toggles.

2.06 WIRING DEVICE ACCESSORIES

- A. Cover plates: Provide cover plates for single and combination wiring devices, of types, sizes and with ganging and cutouts as indicated. Select plates which mate and match wiring devices to which attached. Construct with metal screws for securing plates to devices. Cover plates shall be cast ferrous or aluminum, weatherproof, gasketed type.

PART 3 - EXECUTION

3.01 INSTALLATION OF WIRING DEVICES

- A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NFPA-70 and NECA's "Standard of Installation" and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.
- C. Install wiring devices only in electrical boxes, which are clean, free from excess building materials, dirt and debris.
- D. Install wiring devices after wiring work is completed.

- E. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B. Use properly scaled torque indicating hand tool.
- F. Unless noted otherwise on the Drawings, receptacles and jacks shall be mounted 18-inches above finished floor or approximately 6-inches above countertops, work surfaces or similar surfaces where applicable. Switches shall be mounted 48-inches above finished floor, unless noted otherwise. For wet or damp unfinished areas receptacles shall be mounted at 24-inches.
- G. Boxes shall be independently supported by galvanized brackets, expansion bolts, toggle bolts, or machine or wood screws as appropriate. Wooden plugs inserted in masonry or concrete shall not be used as a base to secure boxes, nor shall welding or brazing be used for attachment. Where installed outdoors or subject to corrosion, all supporting brackets shall be 316 Stainless Steel.

3.02 GROUNDING

- A. Provide equipment-grounding connections for wiring devices, unless otherwise indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
- B. All wiring devices shall be grounded per Code.
- C. Isolated Ground Receptacles: Connect to isolated grounding conductor routed to designated isolated equipment ground terminal of electrical system.

3.03 TESTING

- A. Prior to energizing circuitry, test wiring for electrical continuity, and for short circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.
- B. Testing: Test wiring devices for proper polarity and ground continuity. Operate each operable device at least 6 (six) times.
- C. Test ground-fault circuit interrupter operation with both local and remote fault simulations according to manufacturer recommendations.
- D. Replace damaged or defective components.

END OF SECTION

SECTION 16170
CIRCUIT AND MOTOR DISCONNECTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.

1.02 DESCRIPTION OF WORK

- A. Extent of circuit and motor disconnect switch work is indicated on drawings and schedules.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete and operable installation of disconnect switches and enclosures. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings. This section includes individually mounted switches used for the following:
 - 1. Equipment disconnects
 - 2. Motor circuit disconnects
- C. Refer to other Division 16 sections for wires/cables, raceways, and electrical boxes and fittings work required in connection with circuit and motor disconnect work; not work of this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience in the manufacture of circuit and motor disconnect switches of types and capacities required, for quality and successful manufacture of circuit and motor disconnects.
- B. Installer's Qualifications: Firms shall have sufficient experience to allow for quality and successful installation of circuit and motor disconnects for use in this Project.
- C. NFPA-70 Compliance: Comply with NFPA-70 requirements pertaining to construction and installation of electrical circuit and motor disconnect devices.
- D. UL Compliance: Comply with requirements of UL 98, "Enclosed and Dead Front Switches." Provide circuit and motor disconnect switches which have been UL listed and labeled.

- E. NEMA Compliance: Comply with applicable requirements of NEMA Standards Publication Number KS 1, "Enclosed Switches" and 250 "Enclosures for Electrical Equipment" (1,000 volts maximum).
- F. Listing and Labeling: provide disconnect switches specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled." As defined in the "National Electrical Code", Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Data: Submit manufacturer's data on circuit and motor disconnect switches.
- C. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

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 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide circuit and motor disconnects of one of the following for each type of switch (refer to Appendix D "List of Approved Products."

2.03 DISCONNECTS

- A. Disconnects shall be rated for the maximum available fault current available at the point of connection. For 600V systems, an additional UL approved lockable, non-fused, safety type switch utility service disconnect shall be installed ahead of meter.
- B. Where pump motor disconnect and starter is not mounted within sight of pump wetwell, where electrical equipment is mounted within a building or other enclosure, provide additional NEMA 4X stainless steel 316 non-fused disconnect for each pump within sight of pump location.
- C. Enclosed, Non-fusible Switch: 600 Volts, heavy-duty, single throw safety switch, with lockable handle. Quantity of poles and ampere rating shall be as required to meet the application. Also, switches for motor applications shall be horsepower rated to meet or exceed the connected motor load. Square D Class 3110, or equal.
- D. Enclosure: As specified or required to meet environmental conditions of installed location:
 - 1. Dry Indoor Locations: NEMA 1
 - 2. Outdoor Locations: NEMA 3R, 316 Stainless Steel
 - 3. Wet, Damp or corrosive Locations: NEMA 4X , 316 Stainless Steel
 - 4. Below Grade Locations: NEMA 4, 316 Stainless Steel
 - 5. NEC Class 1 Hazardous Locations: NEMA 7 with applicable Group (A, B, C, D) rating.
- E. Switches shall have handles lockable with two padlocks and shall have a dual cover interlock.
- F. Disconnect switches used on single phase, 3-wire or 3-phase, 4-wire applications shall have a factory installed neutral assembly.
- G. Disconnect switches shall have a field installed grounding lug.

2.04 FUSES

- A. Enclosed, Fusible Switch: 600 Volts, heavy-duty, and single throw safety switch with lockable handle and with clips to accommodate specified fuses. Fuse size shall be per Contract Drawings and/or to match protected equipment manufacturers recommendation. Quantity of poles and ampere rating shall be as required to meet the application. Also, switches for motor applications shall be horsepower rated to meet or exceed the connected motor load. Square D Class 3110, or equal. Provide fuses for equipment as required and as recommended by switch manufacturer, of classes, types, and ratings needed to fulfill electrical requirements for service indicated.

PART 3 - EXECUTION

3.01 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECT SWITCHES

- A. Install circuit and motor disconnect devices as indicated complying with manufacturer's written instructions, applicable requirements of NFPA-70, NEMA and NECA's "Standard of Installation," and in accordance with recognized industry practices.
- B. Connect disconnect switches and components to wiring system and to ground as indicated and instructed by manufacturer. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- C. Coordinate circuit and motor disconnect device installation work with electrical raceway and cable work, as necessary for proper interface.
- D. Install disconnect devices for use with motor driven appliances, and motors and controllers within sight of controller position unless otherwise indicated.

3.02 GROUNDING

- A. Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground, for electrical disconnect switches per the National Electrical Code (NEC).

3.03 FIELD QUALITY CONTROL

- A. Subsequent to completion of installation of electrical disconnect switches, energize circuitry and demonstrate capability and compliance with requirements. Correct malfunction units at project site where possible, then retest to demonstrate compliance; otherwise remove and replace with new units and retest.

END OF SECTION

SECTION 16180
OVER CURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.

1.02 DESCRIPTION OF WORK

- A. Extent of over-current protective device work is indicated by drawings and schedules.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete installation of all electrical equipment and systems with over-current protection. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings. Types of over-current protective devices in this Section include the following:
 - 1. Circuit Breakers
 - a. Molded Case
- C. Refer to other Division 16 sections for cable/wire and connector work required in conjunction with over-current protective devices; not work of this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience in the manufacture of over-current protective devices, of types, sizes, and ratings required, for quality and successful manufacture of over-current and protective devices for use in this Project.
- B. Installer: Firms shall have sufficient experience to allow for quality and successful installation of over-current and protective devices required for this Project.
- C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to construction and installation of over-current protective devices.
- D. UL Compliance: Comply with applicable requirements of UL 489, "Molded Case Circuit Breakers and Circuit Breaker Enclosures." Provide over-current protective devices which are UL listed and labeled.
- E. NEMA Compliance: Comply with applicable requirements of NEMA Standard Publication Numbers AB 1, AB 2, and SG 3 pertaining to molded case and low voltage power type circuit breakers.

- F. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled." As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Product Data: Submit manufacturer's data on over-current protective devices, including amperes, voltages, and current ratings, interrupting ratings, current limitations, internal inductive and non-inductive loads, time current trip characteristic curves, and mounting requirements.
- C. A copy of this specification section with addendum updates included, and all referenced and applicable sections with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections along with justification(s) for any requested deviations to the specification requirements with the submittal, shall be sufficient cause for rejection of the entire submittal with no further consideration.

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 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type and rating of over-current protective device.)
 - 1. Circuit Breakers: (See Appendix D "List of Approved Products".)

2.03 CIRCUIT BREAKERS

- A. General: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information and as required for a complete installation.
- B. Molded Case Circuit Breakers: Provide factory assembled, molded case circuit breakers of frame size indicated. Provide breakers with permanent thermal and instantaneous magnetic trips in each pole, and with fault current limiting protection, ampere rating as indicated. Construct with over center, trip free, toggle type operating mechanisms with quick make, quick break action and positive handle trip indication. Provide push to trip button on cover for mechanical tripping circuit breakers. All latch surfaces shall be ground and polished. All poles shall be so constructed that they open, close and trip simultaneously. Circuit breakers must be completely enclosed in a high strength polyester molded case. Ampere rating shall be clearly visible. Contacts shall be on non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes. Construct breakers for mounting and operating in any physical position and operating in an ambient temperature of 40°C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated. Mount individual circuit breakers complying with requirements for circuit breakers in this Section in enclosure required for the location, unless otherwise indicated. Provide circuit breakers with handles that can be locked in the OFF position. Interlock enclosure and circuit breaker to prevent opening the cover with the circuit breaker in the ON position. Provide thermal magnetic circuit breaker, unless otherwise shown, for one-pole and two pole breakers, breakers operating at 240V or less, and 3 (three) pole branch circuit breakers operating at 480V.

PART 3 - EXECUTION

3.01 INSTALLATION OF OVER CURRENT PROTECTIVE DEVICES

- A. Install over current protective devices as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NFPA-70 and NEMA standards for installation of over current protective devices.
- B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of over current protective devices with other work.

- C. Fasten circuit breakers without causing mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cabling.
- D. Set field adjustable circuit breakers for trip settings as indicated, subsequent to installation of units.

3.02 ADJUST AND CLEAN:

- A. Inspect circuit breakers operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

3.03 FIELD QUALITY CONTROL

- A. Prior to energizing of over current protective devices, test devices for continuity of circuitry and for short circuits. Correct malfunctions in units, and then demonstrate compliance with requirements.

END OF SECTION

SECTION 16190
SUPPORTING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to work of this Section.

1.02 DESCRIPTION OF WORK

- A. Extent of supports, anchors, sleeves and seals is indicated by drawings and schedules and/or specified in other Division 16 sections.
- B. Types of supports, anchors, sleeves and seals specified in this Section include the following:
 - 1. C clamps
 - 2. Nuts and bolts
 - 3. One-hole conduit straps
 - 4. Round steel rods and associated hardware
 - 5. Support channels

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall sufficient experience in the manufacture of supporting devices, of types, sizes, and ratings required for quality and successful manufacture of supporting devices for use in this Project.
- B. Installers Qualifications: Firms shall sufficient experience to allow for quality and successful installation of supporting devices required for use in this Project.
- C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to construction and installation of electrical supporting devices.
- D. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.
- E. UL Compliance: Provide electrical components which are UL listed and labeled.
- F. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled." As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittal."
- B. Product Data: Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions, for each type of support, anchor, sleeve and seal.
- C. A copy of this specification section with addendum updates included, and all referenced and applicable sections with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

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 MANUFACTURED SUPPORTING DEVICES

- A. General: Provide supporting devices which comply with manufacturer's standard materials, design, and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of supporting device meets indicated requirement, selection is Installer's option.
- B. Supports: Provide supporting devices of types, sizes and materials indicated; and having the following construction features:
 - 1. C Clamps: Stainless Steel: 1/2-inch rod size; approximately 70-pounds per 100-units.
 - 2. I Beam Clamps: Stainless steel, 1-1/4-inch x 3/16-inch stock; 3/8-inch cross bolt; flange width 2-inches; approximately 52-pounds per 100-units.
 - 3. One-Hole Conduit Straps: For supporting 3/4-inch rigid metal conduit; stainless steel; approximately 7-pounds per 100-units.

4. Hexagon Nuts: For 1/2-inch rod size; stainless steel; approximately 4-pounds per 100-units.
 5. Threaded round Steel Rod: Stainless Steel; 1/2-inch dia.; approximately 67-pounds per 100-feet.
 6. Offset Conduit Clamps: For supporting rigid metal conduit; stainless steel.
- C. Anchors: Provide anchors of types, sizes, and materials indicated, with the following construction features:
1. Lead Expansion Anchors: 1/2-inch; approximately 38-pounds per 100-units.
 2. Toggle Bolts: Springhead; stainless steel 3/16-inch by 4-inches; approximately 5-pounds per 100-units.
 3. Manufacturers: Subject to compliance with requirements, provide anchors of one of the following:
 - a. Ideal Industries, Inc.
 - b. Joslyn Mfg. and Supply Co.
 - c. McGraw Edison Co.
 - d. Star Expansion Co.
 - e. U.S. Expansion Bolt Co.
- D. Sleeves and Seals: Provide sleeves and seals of types, sizes and materials indicated, with the following construction features:
1. U Channel Strut Systems: Provide U channel strut system for supporting electrical equipment, 12-gauge stainless steel, of types and sizes indicated; construct with 9/16-inch dia. holes, 8-inch on center on top surface, and with fittings which mate and match with U channel.
 2. Manufacturers: Subject to compliance with requirements, provide channel systems of one of the following:
 - a. Allied Tube and Conduit Corp.
 - b. B Line Systems, Inc.
 - c. Greenfield Mfg. Co., Inc.
 - d. Midland Ross Corp.
 - e. OZ/Gedney Div.; General Signal Corp.
 - f. Power Strut Div.; Van Huffel Tube Corp.
 - g. Unistrut Div.; GTE Products Corp.

PART 3 - EXECUTION

3.01 INSTALLATION OF SUPPORTING DEVICES

- A. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

END OF SECTION

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SECTION 16195
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. Division 16 Basic Electrical Materials and Methods section apply to work specified in this Section.

1.02 DESCRIPTION OF WORK

- A. Extent of electrical identification work is indicated by drawings and schedules.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for identification of electrical materials, equipment, and installations. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings.

Types of electrical identification work specified in this Section include the following:

- 1. Electrical power, control and communication conductors
- 2. Operational instructions and warnings
- 3. Danger signs
- 4. Equipment/system identification signs

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience in the manufacture of electrical identification products of types required, for quality and successful manufacture of electrical identification products for this Project.
- B. NFPA-70 Compliance: Comply with NFPA-70 as applicable to installation of identifying labels and markers for wiring and equipment.
- C. UL Compliance: Comply with applicable requirements of UL Standard 969, "Marking and Labeling Systems" pertaining to electrical identification systems.

- D. NEMA Compliance: Comply with applicable requirements of NEMA Standard Publication Numbers WC 1 and WC 2 pertaining to identification of power and control conductors.
- E. Listing and Labeling: provide disconnect switches specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled." As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Product Data: Submit manufacturer's data on electrical identification materials and products.
- C. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.
- D. A copy of this specification section with addendum updates included, and all referenced and applicable sections with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- E. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- F. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- G. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

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 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide electrical identification products of one of the following (for each type marker):
 1. Alarm Supply Co., Inc.
 2. American Labelmark Co., Labelmaster Subsidiary
 3. Brady, W.H. Co.
 4. Calpico Inc.
 5. Carlton Industries, Inc.
 6. Champion American, Inc.
 7. Cole Flex Corp.
 8. Direct Safety Co.
 9. George Ingraham Corp.
 10. Griffolyn Co.
 11. Ideal Industries, Inc.
 12. LEM Products, Inc.
 13. Markal Co.
 14. National Band and Tag Co.
 15. Panduit Corp.
 16. Seton Name Plate Co.
 17. Standard Signs, Inc.
 18. Tesa Corp.

2.03 ELECTRICAL IDENTIFICATION MATERIALS

- A. General: Except as otherwise indicated provide manufacturer's standard product of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provides single selection for each application.
- B. Color Coded Plastic Tape
 1. General: Provide manufacturer's standard self-adhesive vinyl tape not less than 3-mil thick by 1-1/2-inches wide.
- C. Cable/Conductor Identification Bands
 1. General: Provide manufacturer's standard vinyl cloth self adhesive cable/conductor markers of wrap around type, either pre-numbered plastic coated type, or write on type with clear plastic self adhesive cover flap; numbered to show circuit identification.

D. Baked Enamel Danger Signs

1. General: Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20-gauge steel, of standard red, black, and white graphics; 14-inches by 10-inches size except where 10-inches by 7-inches is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH.

E. Engraved Plastic Laminate Signs

1. General: Provide engraving stock melamine plastic laminate lamicoïd-type engraved nameplates, complying with FS L P 387, in sizes and thickness indicated, engraved with engraver's standard letter style of sizes and wording indicated, black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
2. Thickness: 1/8-inch except as otherwise indicated.
3. Fasteners: Self-tapping stainless steel screws, except contact type permanent adhesive where screws cannot or should not penetrate substrate.

2.04 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in electrical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical system and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements

1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NFPA-70.
2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit Identification

1. General: Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by color-coded method, apply color-coded identification on electrical conduit in manner similar to piping identification. Except as otherwise indicated use white as coded color for conduit.

C. Cable/Conductor Identification

1. General: Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panel boards, shop drawings, contract documents, and similar previously established identification for project's electrical work.
2. Color-Code Conductors: Secondary service, feeder, and branch circuit conductors throughout the secondary electrical system.
3. 208/120 Volt System: As follows:
 - a. Phase A: Black
 - b. Phase B: Red
 - c. Phase C: Blue
 - d. Neutral: White
 - e. Ground: Green
 - f. 480/277 Volt System: As follows:
 - g. Phase A: Brown
 - h. Phase B: Orange
 - i. Phase C: Yellow
 - j. Neutral: Gray
 - k. Ground: Green

D. Operational Identification and Warnings

1. General: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets, and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

E. Danger Signs

1. General: In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.
2. High Voltage: Install danger signs wherever it is possible under any circumstances, for persons to come into contact with electrical power of voltages higher than 110 120 volts.

F. Equipment/Systems Identification

1. General: Install engraved plastic laminate signs on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/ control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2-inch high lettering on 1-1/2-inch high sign (2-inches high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the Contract documents and Shop Drawings. Provide signs for each unit of the following categories of electrical work:
 - a. Electrical cabinets and enclosures
 - b. Access panel/doors to electrical facilities
 - c. Disconnect devices

- G. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate.

END OF SECTION

SECTION 16450 GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.

1.02 DESCRIPTION OF WORK

- A. Extent of grounding work is indicated by drawings and schedules. This Section specifies the system for grounding electrical distribution and utilization equipment cabinets, motor frames, manholes, instrumentation, metal surfaces of process/mechanical equipment that contain energized electrical components, metal structures and buildings, outdoor metal enclosures, fences and gates. This Section also includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete installation of grounding system. All work shall be installed, adjusted and tested in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings. Types of grounding specified in this Section include the following:
 - 1. Solid Grounding
- C. Applications of grounding work in this Section include the following:
 - 1. Underground metal water piping
 - 2. Grounding electrodes
 - 3. Grounding rods
 - 4. Service equipment
 - 5. Enclosures
 - 6. Equipment
 - 7. Fences and gates

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience in the manufacture of electrical connectors, terminals and fittings, of types and ratings required, and ancillary grounding materials, including stranded cables, copper braid and bus, ground rods and plate electrodes, for manufacture of grounding equipment for use in this Project.

- B. Installer: Firms shall have sufficient experience to allow for quality and successful installation of grounding equipment for this Project.
- C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to materials and installation of electrical grounding systems, associated equipment and wiring. Provide grounding products which are UL listed and labeled.
- D. UL Compliance: Comply with applicable requirements of UL Standards Numbers 467 and 869 pertaining to electrical grounding and bonding.
- E. IEEE Compliance: Comply with applicable requirements of IEEE Standard 81, 142 and 241 pertaining to electrical grounding.
- F. NETA Compliance: Comply with the International Electrical Testing Association, Inc. Acceptance Testing Specifications.
- G. Testing Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7, or a full member company of the international Electrical Testing Association (NETA).
 - 1. Testing Agency Field Supervision: Use persons currently certified by NETA or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- H. Comply with NFPA 70.
- I. Comply with UL 467.
- J. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled." As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- K. See also Section 16010 Part 1 for listing of applicable reference standards.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Product Data: Submit manufacturer's data on grounding systems and accessories.
- C. A copy of this specification section with addendum updates included, and all referenced and applicable sections with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.

- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

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 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide grounding products of one of the following:
 1. Apache Grounding; Nashville Wire Products
 2. Chance: A. B. Chance Co.
 3. B-Line Systems, Inc.
 4. Burndy Corp.
 5. Crouse-Hinds Co.
 6. Electrical Components Div.; Grould, Inc.
 7. Galvan Industries, Inc.
 8. General Electric Supply Co.
 9. Hastings Fiber Glass Products, Inc.
 10. Heary Brothers Lightning Protection Co.
 11. Kearney
 12. Ideal Industries, Inc.
 13. Lightning Master Corp.
 14. Lyncole XIT Grounding.
 15. O-Z/Gedney Co.
 16. Raco, Inc.
 17. Thomas and Betts Corp.

2.03 GROUNDING SYSTEMS

A. Materials and Components

1. General: Except as otherwise indicated, provide electrical grounding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes, and plate electrodes, bonding jumper braid, surge arrestors, and additional accessories needed for complete installation. Where more than one type unit meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products complying with NFPA-70, UL, IEEE, and established industry standards for applications indicated.
2. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirement and the greater size, rating, and quantity indications shown shall be adhered.
3. A counterpoise cable grounding system installed a minimum of 30-inches below grade, shall be installed with connections to at least the following equipment:
 - a. Wetwell cover
 - b. Valve vault cover
 - c. Control panels
 - d. Generator
 - e. Electrical system grounding electrode conductor
 - f. Main disconnect switch
 - g. Fence
 - h. Emergency bypass piping and station back flow preventer and water spigot to be bonded
 - i. Exception: Ground connection to fencing is not required for PVC coated chain link fence framing, concrete block wall, or wood fencing.
4. Provide raceways, and electrical boxes and fittings complying with accordance with the following listing:
 - a. PVC conduit
 - b. PVC conduit fittings
 - c. Liquid-tight flexible metal conduit
 - d. Liquid-tight flexible metal conduit fittings
 - e. Rigid aluminum conduit
 - f. Rigid aluminum conduit fittings

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NFPA-70.

C. Ground Rods: Steel with copper welded exterior, 3/4-inch dia. x 10-feet.

D. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

E. Comply with Division 16 Section 16120 "Wires and Cables." Conform the NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

- F. Equipment Grounding Conductors: Insulated copper with green color insulation.
- G. Grounding-Electrode Conductors: Stranded copper cable.
- H. Underground Conductors: Bare and stranded copper.
- I. Bare Copper Conductors: Conform to the following:
 - 1. Solid Conductors: ASTM B3
 - 2. Assembly of Stranded conductors: ASTM B8
- J. Ground cable shall be soft-drawn, bare annealed copper, concentric stranded, as specified.
- K. The minimum sizes shall be as follows, where American Wire Gauge (AWG) cable sizes are not shown or specified:

5 and 15 kV switchgear	2/0 or 4/0 AWG
5 kV motor starters	2/0 or 4/0 AWG
15 kV-5 kV transformers	2/0 or 4/0 AWG
5 kV-480V transformers	2/0 or 4/0 AWG
480V switchgear	2/0 or 4/0 AWG
480V switchboards	2/0 or 4/0 AWG
480V MCC and	2/0 or 4/0 AWG
Cable tray	2/0 or 4/0 AWG
Large motors 250 hp & >	2/0 or 4/0 AWG
Lighting & Power panels	2 AWG
Exposed metal cabinets	2 AWG
Electrical equipment	2 AWG
Buildings and enclosure	2 AWG
Fences and gates	2 AWG
Motors 25 hp to 250 hp	2 AWG
Motors 1 hp to 25 hp	6 AWG
- L. Grounding Bus: Bare, annealed copper bars of rectangular cross section.
- M. Braided Bonding Jumpers: Copper tape, braided Number 3/0 AWG bare copper wire, terminated with copper ferrules.
- N. Bonding straps: Soft copper, 0.05-inch (1-mm) thick and 2-inches (50-mm) wide, except as indicated.
- O. Compression connections shall be irreversible, cast copper, high conductivity as manufactured by Thomas and Betts, or equal.
- P. Bolted connectors shall be Burndy, O. Z. Gedney, or equal heavy-duty type.

- Q. Exothermic welding products shall be Erico's Cadweld Plus system with electronic ignition device and moisture resistant weld metal cup for the required mold, or equal. Connectors shall be provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combination of conductors and connected items.
- R. Provide concrete test well with cover and connect the ground grid extension using a removable connector.
- S. Copper equipment ground bars shall be Erico Eritech EGB Series or equal, sized as required for the installation.

PART 3 - EXECUTION

3.01 APPLICATION AND TESTING

- A. Contractor shall test ground rod to obtain a ground resistance value of less than 5 ohms.
- B. Maximum distance between counterpoise ground rods shall be 100-feet. Provide additional ground rods as required.
- C. Counterpoise shall be installed a minimum of 30-inches below grade.
- D. Tests: Before making connections to the ground electrode, measure the resistance of the electrode to ground using a ground resistance tester specifically designed for ground resistance testing. Perform the test not less than 2-days after the most recent rainfall, and in the afternoon after any ground condensation (dew) has evaporated. If a resistance less than the performance requirements is not obtained, provide a ground rod driven 6-inches below grade spaced 10-feet away from the ground well and connect to ground test well with Number 2/0 tinned stranded copper wire and repeat the test. If the performance requirements are still not obtained, inform the County for resolution. Testing results by a certified testing agency using fall of potential testing as described by NETA (International Electrical Testing Association).
- E. Provide a certified copy of the grounding test report to the County.
- F. Equipment grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
 - 1. Install equipment grounding conductor with circuit conductors for the items below in addition to those required by Code:
 - a. Feeders and branch circuits
 - b. Lighting circuits
 - c. Receptacle circuits
 - d. Single-phase motor or appliance branch circuits
 - e. Three-phase motor or appliance branch circuits
 - f. Flexible raceway runs

2. Metallic Raceways: Raceways, conduits and cable trays, etc. shall be made electrically continuous, and shall be bonded/grounded to earth. Utilize bonding/grounding wires, jumpers, clamps, etc. as necessary to meet requirements of NEC.
 3. Non-metallic Raceways: Install a grounding conductor in non-metallic raceways unless they are designated for telephone or data cables.
 4. Air-Duct Equipment Circuits: Install a grounding conductor to duct mounted electrical devices operating at 120 V and above, including air cleaners and heaters. Bond conductor to each unit and to air duct.
 5. Water Heater, Heat-Tracing, and Anti-frost Heater Circuits: Install a separate grounding conductor to each electric water heater, heat-tracing assembly, and anti-frost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- G. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide a Number 4 AWG minimum insulated grounding conductor from grounding-electrode system to each service location, backboard, terminal cabinet, wiring closet, and central equipment location.
1. Service and Central equipment Locations and wiring Closets: Terminate grounding conductor on a 1/4 by 2 by 12-inch (6 by 50 by 300-mm) grounding.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- H. Separately Derived Systems: Where NEC requires grounding, ground according to NEC.
- I. Metal Poles Supporting Lighting Fixtures: Ground pole to a grounding electrode in addition to separate equipment grounding conductor run with supply branch circuit.
- J. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.
- K. Grounding Electrode System: Where available on the premises, at each building or structure served, a metal underground water pipe, the metal frame of the building or structure, concrete encased electrodes, any ground ring encircling the building or structure and all made electrodes (ground rods, etc.) shall be bonded together to form the grounding electrode system. The main bonding jumper and the grounding electrode conductor shall be installed and sized per NEC except where larger sizes than required by NEC are indicated.
- L. Grounding Rods: A minimum of two (2) ground rods shall be installed where the ground rod serves as the grounding electrode per NEC. Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.
1. Drive until tops are 2-inches (50-mm) below finished floor or final grade, except as otherwise indicated.
 2. Interconnect with grounding-electrode conductors except at test wells and as otherwise indicated. Use exothermic welds or irreversible compression connections. Make these connections without damaging copper coating or exposing steel.
- M. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

- N. Grounding conductors, insulated and color coded green, shall be provided in all low voltage feeder and sub-feeder and branch circuit conduit runs, except low voltage service entrance conduit runs which contain a grounded neutral. These grounding conductors shall be connected to all metallic conduits by means of approved grounding bushings at all conduit terminations at the supply end of all feeders.
- O. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
1. Use electroplated or tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
 2. Make connections with clean, bare metal at points of contact.
 3. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
 4. Make aluminum-to-galvanized steel with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- P. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable. Irreversible compression connections may be acceptable as an alternate method.
- Q. Equipment Grounding-Wire Terminations: For Number 8 AWG and larger, use pressure-type grounding lugs. Number 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- R. Non-contact metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at both entrances and exits with the grounding conductors, except as otherwise indicated.
- S. Connections at Test Wells: Use compression-type connectors on conductors and make bolted and clamped-type connections between conductors and grounding rods.
- T. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
- U. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

END OF SECTION

SECTION 17166
FIELD TESTING

PART 1 - GENERAL

1.01 SUMMARY

- A. This section describes the requirements for field testing at each pump station and the manner in which field testing will take place.

1.02 SUBMITTALS

- A. Submit a Construction Assistance Request "C.A.R." two weeks before a test. See sample form in Appendix H-16.

1.03 GENERAL

- A. Unless otherwise specified in this document, field testing will be conducted by, and is the responsibility of, the Contractor. County engineer and/or technician will actively participate in the test. County engineer and/or technician reserves the right to test any specified function whether or not explicitly stated in the test submittal. County engineer and/or technician have the final authority on whether or not a test is successful.
- B. Meet the following criteria prior to the start of the field test.
 - 1. Complete submittals and resolve disputes.
 - 2. Set a test date that is agreeable to all.
 - 3. All parties agree that the complete system is ready for testing.
 - a. Field testing readiness includes but is not limited to the following:
 - i. New SCADA Panel has been installed.
 - ii. Conduits installation and wiring between new SCADA panel and Pump panel has been completed.
 - iii. Conduit installation between new SCADA Panel and existing antenna pole has been completed.
 - iv. Installation of new antenna, antenna grounding kits, and connection to existing ground electrode or grounding wire counterpoise has been completed.
 - v. Wiring of optional instrumentation (if available) has been terminated.
- C. If a test or a portion of the test fails and needs to be rescheduled, the Contractor will

pay all expenses of the Owner/Engineer for retesting. Include expenses for travel, accommodations, and subsistence of the same quality used for the original test for a maximum of four persons.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 GENERAL

- A. Every field test activity shall be witnessed by the Owner's Representative.
- B. Perform field testing to verify the operation of the control system. Begin testing immediately after installation of each major subsystem. Field tests include:
- C. SCADA Panel Interconnect Check-off Test Procedure. Includes optional peripherals. (i.e., instrumentation, generator, odor system, etc.)
- D. System Performance Test. (County is responsible for conducting this test and the Contractor shall provide assistance to troubleshoot and repair system if needed).
- E. Meet the following conditions prior to the start of any testing:
 - 1. Correct deficiencies noted during in-factory testing.
 - 2. Have a set of Drawings on-site. Have on site, labeled, and properly stored, spare parts, expendables, and test equipment pertinent to the part of the system being tested.
 - 3. Have all parties certify that the system has been checked and is ready for testing.
- F. Schedule all field testing through the R.P.R on a daily basis.
 - 1. Perform no testing which may affect pump station operation without Engineer concurrence.
- G. Perform tests by following the corresponding procedure, checking off, and signing the checked steps in the corresponding check-off test spreadsheet. Lack of complete, detailed test check-off spreadsheet will be cause for declaring the test to have failed regardless of the actual test results.
- H. The Owner will participate in all testing activities except when they feel that their presence will not be necessary.

3.02 SCADA PANEL INTERCONNECT CHECK-OFF PROCEDURE

- A. Perform SCADA panel interconnect testing to verify the following system connectivity:
 - 1. Validate connectivity between the SCADA panel and the Pump Panel.
 - 2. Validate connectivity of optional equipment and instrumentation.
- B. Begin to perform the SCADA panel interconnect testing after installation of new SCADA panel, and wiring interconnect between the SCADA panel and the pump panel and optional peripherals have been completed.
- C. Procedure:
 - 1. Validate each digital input by energizing them one at a time at the pump panel terminal blocks and verifying PLC digital points state changes accordingly. (Appendix H-7)
 - 2. Validate each digital output by energizing them one at a time verifying the corresponding relay at the pump panel changes state accordingly. (Appendix H-8)
 - 3. For all optional instrumentation connected, validate each analog input by connecting a 4-20mA generator to each analog input at the end of the instrument cable end verifying PLC soft data point value changes accordingly. (Appendix H-9)
 - 4. Perform PROFINET Cable Validation Report (Appendix H-10)
- D. Test documentation:
 - 1. A SCADA Panel Interconnect Check-Off test procedure and I/O List check-off worksheets are provided in Appendix H-7 through H-10.
 - 2. One (1) test procedure and one (1) set of I/O List worksheets for each pump station shall be documented by the CONTRACTOR and submitted to Orange County Utilities at pump station start up.

END OF SECTION

APPENDIX A

GEOTECHNICAL REPORT

Dated September 26, 2018

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.

**GEOTECHNICAL INVESTIGATION REPORT
OCU GRAVITY SEWER REPLACEMENTS
PACKAGE FOUR
ORANGE COUNTY, FLORIDA
AEA PROJECT No. 201805-1**

Antillian Engineering Associates, Inc.
3331 Bartlett Boulevard
Orlando, Florida 32811
(407) 422-1441



September 26, 2018

Woolpert, Inc.
5323 Millenia Lakes Boulevard
Orlando, Florida 32839

Attention: Bill Whidden, P.E.

Reference: Geotechnical Investigation Report
OCU Gravity Sewer Replacements Package 4
Orange County, Florida
AEA Project No. 201805-1

Dear Mr. Whidden:

Antillian Engineering Associates, Inc. has completed geotechnical-engineering investigations for Orange County Utilities Gravity Sewer Replacements Package Four in Orange County, Florida. This project was authorized under Orange County Continuing Utilities Engineering Services Contract Y17-901. The work was done in general accordance with the scope of services presented in our proposal dated February 1, 2018. This report contains the results of our investigations; our recommendations for gravity, sanitary-sewer-pipe replacement, earthwork, and groundwater control; and other concerns as appropriate.

It has been our pleasure to serve Woolpert and Orange County Utilities on this project. Please contact our office if you have questions, or if you need additional information.

Respectfully submitted,
ANTILLIAN ENGINEERING ASSOCIATES, INC.
State of Florida Authorization No. EB 6685



Peter G. Suah, P.E.
Principal Engineer
Florida P.E. No. 46910

Attachments: Figures

Appendix A: Field and Laboratory Investigations
Appendix B: Important Information About This Geotechnical-Engineering Report
Appendix C: Constraints and Restrictions

PROJECT DESCRIPTION

Orange County Utilities (“OCU”) intends to replace segments of gravity, wastewater pipes to address reported failures at five locations in the east-central part of the county. OCU staff combined these segments into a single project designated “Gravity Sewer RR Package 4,” and assigned the design and related services to Woolpert, Inc. (“Woolpert”) under Orange County Continuing Utilities Engineering Services Contract Y17-901. Site locations are summarized below in Table 1.

**TABLE 1
SANITARY-SEWER REPLACEMENT PACKAGE 4 SITE LOCATIONS**

LOCA-TION	OCU PIPE ID	DESCRIPTION
1	SA3054	East Orlando (Acadia Drive): replacement of one manhole and 294 feet of 8-inch vitreous clay pipe about ten feet deep.
2	SA3070	Azalea Park (Barksdale Drive): replacement of three manholes and 273 feet of 8-inch PVC pipe. along Barksdale Drive near Karden Way, Budapest Way, and Stockholm Way.
3	SA3077	Lynnwood Estates (Pompeii Way), replacement of 855 feet of 8-inch vitreous clay pipe between manholes along Pompeii Way west of Mediterranean Road.
4	SA 3368	Park Manor Estates (Park Manor Drive), replacement of two manholes and two pipe segments of 334 feet and 274 feet of 8-inch PVC pipe along Park Manor Drive near Barbados Avenue.
5	SAF3033	River Ridge Drive, replacement of 35 feet of 8-inch PVC sewer along River Ridge Drive near the intersection with Curry Ford Road.

Approximate locations are shown on Figure 1 through Figure 3. Woolpert staff advised that the five segments of existing sewer are within 15 feet of the existing ground surface and that the pipes will be replaced using conventional, excavate-and backfill (“cut-and-cover”) construction methods. Woolpert staff also requested a full-depth core of distressed asphalt-concrete pavement at Location 1 through Location 4.

Woolpert retained Antillian Engineering Associates, Inc. to conduct the geotechnical-engineering investigations, document and assess the subsurface conditions encountered at each location, and provide geotechnical-engineering recommendations for this package.

AVAILABLE INFORMATION

We examined United States Geological Survey (“USGS”) quadrangle topographic maps for the areas, and the United States Department of Agriculture Soil Conservation Service (“SCS”) Soil Survey of Orange County to obtain general information about the project areas. We also examined preliminary exhibits by Woolpert (“the Woolpert exhibits”) for project-specific information.

The USGS topographic maps (parts of which are reproduced as Figure 1 through Figure 3) showed Location 1 through Location 4 on low knolls and ridges on the broad, nearly level to level plains of east-central Orange County. Location 5 was on the eastern bank of the Little Econlockhatchee River floodplain. Areas of marsh and wetlands were shown in the general vicinity of all five locations. Land uses were shown as suburban-residential, rural-residential, rural-agricultural, and undeveloped. Commercial and residential developments known to exist near Location 5 were not shown.

The SCS Soil Survey sheets that covered the project area showed features similar to those on the USGS map, including outlines of the knolls and ridges near Location 1 through Location 4, the marshes and wetlands, and the natural river floodplain near Location 5. Soil units mapped in these locations were typical of the soils found on low ridges, knolls, and adjacent plains, and were reported to be moderately-well drained to poorly drained, with seasonal high groundwater levels between two feet above and about three feet below the natural ground surface in undeveloped areas.

The Woolpert exhibits showed the sanitary-sewer segments discussed in Table 1 superimposed on aerial images of the five locations. The drawings also showed related sanitary-sewer manholes, nearby water mains and other underground-utility facilities.

FIELD INVESTIGATIONS

We developed a boring layout plan for each location using the Woolpert exhibits as references, and designated the boring locations using the OCU Pipe ID for each segment as shown in Table 2.

**TABLE 2
TEST-BORING LOCATIONS**

LOCA-TION	OCU PIPE ID	DESCRIPTION	BORING DESIGNATIONS	ESTIMATED DEPTH (feet)
1	SA3054	Arcadia Drive	3054-1, 3054-2	15
2	SA3070	Barksdale Drive	3070-1 to 3070-4	15
3	SA3077	Pompeii Way	3412-1, 3077-2	15
4	SA3368	Park Manor Drive	3368-1, 3368-2	15
5	SAF3033	River Ridge Drive	3033-1	15

We conducted field visits to gather information about the surface conditions at each location. We set out the boring locations by estimating distances from identifiable features on the aerial imagery and adjusting to avoid visible obstructions. We marked the locations for underground-utility location in accordance with Florida statutes, and staked them for identification by the field crew. Approximate boring locations are shown on Figure 4 through Figure 6. During the field visits, we selected and marked five core-locations on the pavements in Locations 1 through 4. We designated those locations “C-1” through C-5.”

The field crew cored the full depth of the asphalt pavement at C-1 through C-5 using a four-inch diameter, diamond-tipped, core-barrel. They retrieved the cores from the pavement, measured the types and thicknesses of the surface course and base course, observed the type of subgrade (if discernible), and recorded their measurements and observations on field logs. They marked and packed the cores for transportation to our office, and backfilled the core holes to the pavement surface using hand-tamped, cold-patch, asphalt mix.

Using split-spoon-sampling and mud-rotary drilling methods, the field crew drilled the borings to the depths shown in Table 2. They conducted the Standard Penetration Test (“SPT”) with the split-spoon sampling in accordance with ASTM D 1586.

The crew logged the soils recovered in the samplers, selected representative samples; sealed them in clean, airtight containers; measured the encountered depth to groundwater in the boreholes; and recorded their observations and measurements on field logs. They backfilled the completed boreholes with soil. We cannot confirm that the boring locations were surveyed, so the locations presented and discussed in this report should be considered as approximate.

LABORATORY TESTING

A geotechnical engineer examined the recovered soil samples in our laboratory, confirmed the descriptions on the field logs, classified the soils visually in accordance with ASTM D 1452, and developed a representation of the soil stratigraphy at each boring location. The engineer selected specimens for laboratory testing, which consisted of 29 percent-fines tests. We conducted the tests in accordance with the applicable ASTM methods. Results are presented on the boring logs and on the Summary of Laboratory Test Results sheets, in Appendix A.

[END OF SECTION]

SURFACE CONDITIONS

The streets beneath which the segments of gravity, sanitary sewer line will be replaced were two-lane and multi-lane streets in suburban-residential areas. In addition to being paved with asphalt concrete, the streets had concrete sidewalks, curbs, and gutters. Unpaved areas between the sidewalks and curbs were covered with well-maintained turf grass. Landscaping trees were observed in some places. Manhole covers, above-ground junction-boxes, plastic flags, and paint markings indicated the presence of underground-utility services beneath the streets. Those utilities included the segments of the gravity-sewer pipe that OCU planned to replace.

PAVEMENT CORES

Pavement-core characteristics are presented below in Table 3.

**TABLE 3
PAVEMENT THICKNESSES ENCOUNTERED IN CORES**

CORE	LOCATION	TEST BORING DESIGNATION	THICKNESS (inches)		BASE TYPE
			ASPHALT CONCRETE	PAVEMENT BASE	
C-1	1	3054-2	4¼	5½	Limerock
C-2	2	3070-3	3	5¼	Limerock
C-3	2	3070-4	3¾	2½	Limerock
C-4	3	3077-1	2	2½	Limerock
C-5	4	3368-1	5	½	Limerock

These core characteristics represent a small sample of possible locations on the pavement surface. The locations were selected without the aid of a pavement-condition survey, so the core information should be used with care. The soils beneath the cores were dark brown and dark grayish brown sands. Our field crew did not report observing any stabilized subgrade.

[END OF SECTION]

SUBSURFACE CONDITIONS

The stratigraphy, soil types, and groundwater levels described below are based on the results of the test borings, visual-examination-based classifications, and a limited number of laboratory tests. We classified the soils using Unified Soil Classification System (“USCS”) group-names and group-symbols where applicable, and we used SPT N-values as empirical indicators of soil condition. The descriptions below are general and describe the major soil types that we encountered. Detailed subsurface characteristics at the boring locations are shown on the boring logs in Appendix A.

Location 1 - Arcadia Drive (SA 3054, Borings 3054-1 and 3054-2)

The uppermost soils encountered by borehole 3054-1 were dark brown, and mixed brown and dark brown sands that contained small amounts of clay. Encountered thicknesses were between two feet and three feet. No SPT N-value was obtained. We classified these soils visually as “poorly graded sand (SP)” and “sand with clay (SP-SC).” Because the observed variations in color and composition did not appear to be naturally caused, and because the borehole had been drilled at the edge of the pavement, we also characterized these these soils as “possible stabilized subgrade.”

Uppermost in 3054-2, and beneath the possible stabilized subgrade in 3054-1 were dark brown, very dark brown, brown, very dark yellowish brown, and pale brown sands that contained small amounts of silt. Encountered thicknesses were about four feet and about 13 feet. SPT N-values, where obtained, ranged from 8 blows per foot (“bpf”) to 25 bpf, indicating loose to medium-dense conditions. Percent-fines testing of three samples indicated fines contents (fraction by dry weight passing the US Standard No. 200 sieve) of 7 percent. Based on visual examination and the laboratory test results, we classified these soils as “sand with silt (SP-SM).”

Beneath the sands, the boreholes encountered brown and grayish brown sands that contained clay. Encountered thicknesses were about two feet and about eight feet. Actual thicknesses could not be confirmed because both boreholes had been terminated at the authorized depth before completely penetrating these soils. SPT N-values ranged from 6 bpf to 21 bpf, indicating loose to medium-dense conditions. Percent-fines testing of three samples indicated fines contents between 12 percent and 17 percent. Based on visual examination and the laboratory test results, we classified these soils as “clayey sand (SC).”

The boreholes encountered groundwater between four feet and five feet below the existing ground surface. Details of the subsurface conditions encountered at each location are shown on the boring logs in Appendix A.

Location 2 - Barksdale Drive (SA 3070, Borings 3070-1 to 3070-4)

The uppermost soils were very dark brown, dark brown, very dark gray, dark gray, dark grayish brown, very dark grayish brown, dark yellowish brown, and brown sands that contained small amounts of silt and clay. Some sands were cemented, and some contained nodules of clayey sand. Encountered thicknesses ranged from about four feet to about nine feet. SPT N-values, where

obtained, ranged from 5 bpf to 18 bpf, indicating loose to medium-dense conditions. Percent-fines testing of three samples indicated fines contents (fraction by dry weight passing the US Standard No. 200 sieve) between 4 percent and 10 percent. Based on visual examination and the laboratory test results, we classified these soils as “poorly graded sand (SP)” and “sand with silt (SP-SM).” Because of observed variations in color and composition that did not appear to be naturally caused, the presence of clayey sand nodules, and the proximity to underground-utility markings on the ground surface, we also characterized the uppermost soils in 3070-1 and 3070-3 as “possible backfill.”

Beneath the sands and the possible backfill, boreholes 3070-1 and 3070-2 encountered dark brown sands that contained a trace of silt. Encountered thicknesses were about five feet and about seven feet. SPT N-values ranged from 6 bpf to 27 bpf, indicating loose to medium-dense conditions. Percent-fines testing of two samples indicated fines contents of 4 percent. Based on visual examination and the laboratory test results, we classified these soils as “poorly graded sand (SP).”

Beneath the sands in 3070-1 and 3070-2, and beneath the possible backfill in 3070-3 were brown, dark brown, and dark yellowish brown sands that contained silt. Encountered thicknesses were between two feet and about nine feet. Actual thicknesses could not be confirmed in 3070-1 and 3070-2, which had been terminated at the authorized depth before completely penetrating these soils. SPT N-values ranged from 12 bpf to 30 bpf, indicating medium-dense to dense conditions. Percent-fines testing of three samples indicated fines contents between 6 percent and 9 percent. Based on visual examination and the laboratory test results, we classified these soils as “sand with silt (SP-SM).”

Beneath the sand with silt in 3070-3, and beneath the near-surface sands in 3070-4 were very dark brown to black, very dark grayish brown, dark yellowish brown, and brown to grayish brown sands that contained silt and clay. Encountered thicknesses were about two feet and about 11 feet. Actual thicknesses could not be confirmed because these boreholes had been terminated at the authorized depth before completely penetrating these soils. SPT N-values ranged from 10 bpf to 33 bpf, indicating loose to dense conditions. Percent-fines testing of three samples indicated fines contents between 13 percent and 19 percent. Based on visual examination and the laboratory test results, we classified these soils as “silty sand (SM)” and “clayey sand (SC).”

The boreholes encountered groundwater between three feet and four feet below the existing ground surface. Details of the subsurface conditions encountered at each location are shown on the boring logs in Appendix A.

Location 3 - Pompeii Way (SA 3077, Borings 3077-1 and 3077-2)

The uppermost soils were very dark brown, dark brown, brown, brownish gray, dark brownish gray, dark grayish brown, very dark grayish brown, and dark yellowish brown sands that contained small amounts of silt and clay. Encountered thicknesses were about nine feet. SPT N-values, where obtained, ranged from 15 bpf to 34 bpf, indicating medium-dense to dense conditions. Percent-fines testing of three samples indicated fines contents (fraction by dry weight passing the US Standard

No. 200 sieve) between 2 percent and 9 percent. Based on visual examination and the laboratory test results, we classified these soils as “poorly graded sand (SP),” “sand with silt (SP-SM),” and “sand with clay (SP-SC).” Because of observed variations in color and composition that did not appear to be naturally caused, and the proximity to underground-utility markings on the ground surface, we also characterized the uppermost portions of these soils as “possible backfill.”

Beneath the sands and the possible backfill, the boreholes encountered brown sands that contained clay. Encountered thicknesses were about five feet. SPT N-values were 22 bpf and 37 bpf, indicating medium-dense to dense conditions. Percent-fines testing of one sample indicated a fines content of 28 percent. Based on visual examination and the laboratory test results, we classified these soils as “clayey sand (SC).”

Beneath the clayey sands were brown and pale brown sands that contained small amounts of clay. Encountered thicknesses were about two feet. Actual thicknesses could not be confirmed because both boreholes had been terminated at the authorized depth before completely penetrating these soils. SPT N-values were 11 bpf and 18 bpf, indicating medium-dense conditions. Percent-fines testing of two samples indicated fines contents of 7 percent. Based on visual examination and the laboratory test results, we classified these soils as “sand with clay (SP-SC).”

The boreholes encountered groundwater between four feet and five feet below the existing ground surface. Details of the subsurface conditions encountered at each location are shown on the boring logs in Appendix A.

Location 4 - Park Manor Drive (SA 3368, Borings 3368-1 and 3368-2)

The uppermost soils were dark gray, brown, light brownish gray, and light gray sands that contained small amounts of clay. Encountered thicknesses were about one foot and 15 feet. The actual thickness could not be confirmed by 3368-2, which had been terminated at the authorized depth before completely penetrating these soils. SPT N-values, where obtained, ranged from 1 bpf to 10 bpf, indicating very loose to loose conditions. Percent-fines testing of two samples indicated fines contents of 6 percent and 9 percent. Based on visual examination and the laboratory test results, we classified these soils as “sand with clay (SP-SC).”

Beneath the sands with clay, 3368-2 encountered sand that contained clay. Its encountered thickness was about 12 feet. SPT N-values ranged from 7 bpf to 11 bpf, indicating loose to medium-dense conditions. Percent-fines testing of two samples indicated fines contents of 12 percent and 14 percent. Based on visual examination and the lab test results, we classified these soils as “clayey sand (SC).”

Beneath the clayey sand was very pale brown sand that contained trace amounts of silt or clay. Its encountered thickness was about two feet. The actual thickness could not be confirmed because 3368-2 had been terminated at the authorized depth before completely penetrating this soil. The only SPT N-value obtained in this soil was 13 bpf, indicating medium-dense conditions. Percent-fines

201805-1

OCU Gravity Sewer RR Package 4

September 26, 2018

testing of one sample indicated a fines content of 3 percent. Based on visual examination and the laboratory test results, we classified this soil as “poorly graded sand (SP).”

The boreholes encountered groundwater about four feet below the existing ground surface. Details of the subsurface conditions encountered at each location are shown on boring logs in Appendix A.

Location 5 - River Edge Drive (SAF 3033, Boring 3033-1)

The uppermost soil encountered by the borehole was very dark brown sand that contained small amounts of silt. Its encountered thickness was about seven feet. SPT N-values, where obtained, were 13 bpf and 15 bpf, indicating medium-dense conditions. Percent-fines testing of one sample indicated a fines content of 6 percent. Based on visual examination and the laboratory test results, we classified these soils as “sand with silt (SP-SM).”

Beneath the sand with silt, 3033-1 encountered sand that contained clay. Its encountered thickness was about 12 feet. The actual thickness could not be confirmed because the borehole had been terminated at its authorized depth before completely penetrating these soils. SPT N-values ranged from 7 bpf to 19 bpf, indicating loose to medium-dense conditions. Percent-fines testing of one sample indicated a fines content of 21 percent. Based on visual examination and the laboratory test results, we classified these soils as clayey sand (SC).”

We encountered groundwater in this borehole at a depth of about nine feet below the existing ground surface. Details of the subsurface conditions encountered at each location are shown on the boring logs in Appendix A.

[END OF SECTION]

GENERAL COMMENTS ON RECOMMENDATIONS

The following recommendations are based upon a review of the available information, the field and laboratory test results, our understanding of the planned sanitary-sewer pipe replacements, and our experience with similar projects and subsurface conditions. Soils are natural materials, so variations in composition and other physical characteristics are normal and should be expected. Because of natural variations in depth, composition, condition and consistency of soils, and the limited number of borings that we drilled for this investigation, unsuitable materials and other soils not encountered by the boreholes may exist beyond each exploration location, and should be anticipated. If subsurface conditions encountered during construction differ significantly from those encountered in the borings, those conditions should be reported to us promptly for our observation and comment.

The recommendations contained in this report are based on our understanding that conventional, “cut-and-cover” construction methods will be used to install the sanitary-sewer replacement pipes for this project. If plans for the proposed pipe-replacements change from those discussed in this report, we request the opportunity to review our recommendations and revise them as needed to accommodate those changes. We also recommend that you ask our staff to review the project plans and specifications before delivery to OCU, to ensure that the geotechnical recommendations contained in this report have been properly interpreted and presented in those documents.

GENERAL ASSESSMENT OF ENCOUNTERED SOILS

As discussed in the SUBSURFACE CONDITIONS section of this report, the soils encountered by the boreholes were generally loose to dense sands, sands with silt or clay, clayey sands, and some silty sands. Overall encountered thicknesses were 15 feet, i.e., the full depth of the boreholes. We characterized some of the uppermost soils at Location 1, Location 2, Location 3 as possible backfill because of observed, likely man-made variations in soil composition and color, and the proximity of underground-utility markings on the ground surface. We encountered groundwater at depths between three feet and five feet below the existing ground surface.

Based on the subsurface conditions encountered during this investigation, it is our professional opinion that the encountered soils are generally favorable for the proposed construction, with certain limitations. Generally speaking, most contractors bidding pipe-replacement projects anticipate that customary excavating equipment and methods should be able to remove the original backfill over the existing pipes and that excavated materials can be re-used as backfill. However, soils and other materials not meeting current OCU standards may have been buried with the original backfill. Bidders should be advised to expect saturated soils, clayey sands and silty sands (including some with fines contents higher than about 20 percent). Soils with high fines contents tend to retain excess moisture, can exhibit plastic behavior, and typically do not respond favorably to the impact and vibratory equipment and methods widely used for compacting backfill. Some soils at the intended pipe-bedding depths may need to be densified in order to provide adequate support for the replacement pipes and any buried structures. Although not encountered, cemented soils are also possible and should be anticipated.

Bidders should be cautioned to anticipate soils that are less favorable for construction than those encountered during this investigation, as well as materials that may be unsuitable for construction to OCU standards. Such materials include, but are not limited to, clays, plastic silts, organic soils, roots, abandoned utility lines, and debris. Unfavorable materials encountered during construction should be treated as directed by OCU's authorized on-site representative. Soils to be used for construction should be prepared in accordance with the EARTHWORK section of this report

PIPELINE DESIGN

A minimum modulus of soil reaction (E') value of 1,000 pounds per square inch (psi) may be used for sanitary-sewer-pipeline design provided the recommendations described in the EARTHWORK FOR CUT-AND-COVER CONSTRUCTION section of this report are implemented.

FOUNDATION SUPPORT

Manholes and other underground structures that may be needed should be supported on soils that are compacted as recommended in the EARTHWORK FOR CUT-AND-COVER CONSTRUCTION section later in this report. Soils compacted to that condition should support bearing pressures up to 1,500 pounds per square foot (psf) with total settlements less than an inch.

DESIGN HIGH WATER LEVEL

For design of all temporary and permanent project features, we recommend setting the groundwater level at the existing or finished ground surface level, whichever is higher.

UPLIFT RESISTANCE

All buried pipes and structures should be designed to resist hydrostatic pressure corresponding to the design high groundwater level. Uplift resistance calculations should consider the weight of the pipes or structures, the weight of any soils directly above the pipe or structures, and the weight of backfill over any parts of possible structural foundations that project horizontally beyond the side walls. Side friction resistance along the side walls of buried structures should not be considered.

EARTHWORK FOR CUT-AND-COVER CONSTRUCTION

Pavement materials, grass and other vegetation, topsoil, roots, or any other materials unsuitable for earthwork should be removed from within the limits of the proposed construction, and should either be discarded, or stockpiled away from immediate work areas for re-use as appropriate. Any organic materials encountered during trench excavation, including roots, should be treated in a similar fashion. Roots should be expected more than a foot below the ground surface.

We encountered saturated soils, medium dense to dense sands, cemented soils, and clayey sands. Large roots may also exist in these pipe-replacement segments, even where trees do not exist now,

because trees and their stumps may have been removed in the past. We recommend advising bidders to select equipment that can operate efficiently even if these, or other, less-favorable conditions are encountered while excavating.

Excavations should be dug to the required depths and to the width needed to provide working room for proper installation of pipes, buried structures, and any excavation support that may be needed. This work should be supervised by a suitably qualified member of the Contractor's staff. All below-grade construction activity should be conducted in accordance with the recommendations for excavation safety and groundwater control presented later in this report.

Pipes and buried structures should be bedded on firm, stable soil compacted to exceed the minimum criteria selected by OCU for this project, to a depth of at least one foot below the bedding surface for pipes and two feet below the bearing surface for structures. Soils should be tested for adequate compaction as required by OCU before placing any pipes or structures. Soils that cannot be improved should be removed and replaced with compacted backfill.

Backfill material should be free from mud, muck, stumps, roots and other vegetable matter, debris, rubbish, or other materials that might decompose or otherwise cause excessive settlement. It should consist of sand with fines content lower than 12 percent. Backfill should be placed in loose, level, uniform lifts approximately one foot thick. It should be placed uniformly and equally on both sides of the pipe and around all sides of buried structures before initiating compaction.

Each lift of backfill should be compacted to exceed the minimum criteria selected by OCU for this project. Special care should be taken to ensure that backfill beneath the pipe haunches is properly compacted. Although in-place dry density not less than 95 percent of the maximum obtained by the Modified Proctor method (ASTM D 1557) is widely accepted throughout the industry, some agencies have more stringent requirements for utilities installed near, and beneath, streets. As a result, standard specifications from other agencies should not be adopted for this project without consulting OCU staff. Backfill should be tested for adequate compaction at the frequency required by OCU or at a maximum spacing of one test per vertical foot per 300-foot run of pipe.

Typical vibratory equipment used to compact trench backfill should not affect adjacent structures. However, some vibratory equipment can cause settlement of loose to very loose soils. If any disturbance, or other undesirable effects are noted on more than an isolated or random basis, compaction should be halted immediately. If necessary, procedures should be modified so that satisfactory compaction can still be achieved at no additional cost to OCU.

REUSE OF MATERIALS EXCAVATED ON SITE

Most bidders expect that soils excavated for below-grade construction on a project site can be reused as backfill. We anticipate that a substantial portion of the soils encountered in the borings may not be suitable for reuse when excavated, because the generally high fines contents combined with natural wetness may make these soils difficult to work. This is a particular concern for this project because of the proximity of street traffic to some work areas, the limited room available to handle excavated soils, excavation depths that are deeper than usual, and the difficulties that underground-utility contractors can face when attempting to control the groundwater effectively in order to maintain dry, stable, below-grade work areas. Backfill materials should meet the criteria discussed in the EARTHWORK FOR CUT-AND-COVER CONSTRUCTION section of this report.

Bidders should be cautioned not to rely on dewatering in preparation for excavation to reduce in-situ water contents to favorable levels. Bidders should be advised that it may not be possible to stockpile excavated soils to drain, spread them to dry, or blend them with drier materials to achieve a suitable moisture condition. Any changes to soil composition as a result of mixing should be accompanied by additional moisture-density testing in the laboratory to maintain reliable references for field testing.

Because of the spacing between the borings we drilled for this investigation, variations in consistency and fines content of the soils are likely, and should be expected. As a result, soil types encountered during excavations are likely to differ. Possible soil types that might be encountered within the planned depths of excavation and general suitability for reuse are discussed below for general guidance. These guidelines should not override the project specifications. Other soils may be encountered during construction that do not fall into one of the following categories.

Poorly Graded Sands (SP)

These soils have fines contents of 5 percent or less, and are commonly referred to as “clean” sands. They are highly desirable for use as fill and backfill in central Florida because they drain freely. That characteristic allows these soils to be placed and compacted readily, even if excavated from below the groundwater level. Satisfactory compaction can be achieved using a wide variety of compaction equipment and across a broad range of moisture contents. Some instability or “pumping” should be expected if these soils are compacted near saturation.

Sands with Silt (SP-SM) and Sands with Clay (SP-SC)

These soils consist of sands with fines contents between 5 percent and 12 percent. These soils do not drain as freely as clean sands, but they are still quite suitable for use as fill. If excavated from below the groundwater surface, they may have to be stockpiled and allowed to drain (or spread to dry) before being placed as fill. Satisfactory compaction can be achieved using a variety of compaction equipment and across a moderate to wide range of moisture contents. However, efforts should be made during compaction to maintain the moisture content below optimum. Some instability or “pumping” should be expected if these soils are compacted near saturation.

Silty Sands (SM) and Clayey Sands (SC)

These soils consist of sands with fines contents higher than 12 percent. They do not drain as well as sands with silt. These soils may be reused successfully as fill, but will require very close attention to moisture content and careful selection of compaction equipment. Suitable compaction is generally achieved in these soils only across a narrow range of moisture contents, and this range narrows even further as the fines content increases. Silty sands should be compacted below the optimum moisture content to reduce the potential for moisture-related instability. Soils with more than 20 percent fines should not be used as backfill material, unless OCU utilizes a proven standard that allows backfill materials with higher fines contents.

Silts, Clays and Organic Soils (ML, MH, CL, CH, OL, OH, and PT)

Soils classified under these categories should not be used as backfill.

CONSTRUCTION MONITORING

A program should be established to ensure that earthwork and related operations are conducted in accordance with the project plans and specifications. Backfill placement should be monitored closely to ensure that only those materials recommended in this report are used. In-place density testing should be conducted at the bottoms of excavations, and during backfilling and compaction operations. Trench subgrade and trench backfill should be tested for adequate compaction at a frequency not less than one test per vertical foot per 300-foot run of pipe. Subgrade soils beneath buried structures should be tested for adequate compaction at a minimum of one location per structure. Backfill around buried structures should be tested for adequate compaction at a frequency not less than one test per vertical foot of backfill. The moisture content of the subgrade soils and backfill soils should be within the range that will optimize the densification process. The Contractor should be prepared to adjust the moisture content and change equipment, procedures, and lift thickness as needed at no additional cost to OCU in order to achieve the recommended compaction.

An OCU representative should be present during pipe installation to confirm that the Contractor complies with the earthwork specifications, and that excavation, excavation support, and dewatering activities are done in accordance with the plans, specifications, and approved submittals.

GROUNDWATER CONTROL

The Contractor should expect that groundwater will influence below-grade construction activities. The contract documents should require the Contractor to verify groundwater levels before starting construction. The Contractor should be responsible for all aspects of dewatering, regardless of the groundwater levels at the time of construction. That responsibility includes not only the installation and operation of an effective dewatering system, but also all permits needed to satisfy applicable environmental regulations, and all systems needed for monitoring groundwater volume and quality.

All excavations and below-grade construction should be conducted in the dry. The Contractor should be prepared to lower and maintain the groundwater level at least two feet below the bottoms of all excavations for the duration of below-grade construction activity. Groundwater should be lowered to recommended levels prior to excavation to minimize the potential for instability of excavations, bottom-heave, or quick conditions within the excavation. Dewatering systems should be maintained in operation until buried pipes and any buried structures have been placed and completely backfilled in a satisfactory manner such that sufficient dead weight is imposed on and around buried pipes and structures to prevent uplift. Decommissioning of dewatering systems should be addressed in the Contractor's dewatering submittal.

Water from dewatering pumps should be discharged as far as practically possible away from the work area to prevent return flow or erosion into the excavations. The Contractor should also have submersible pumps ready on site to intercept and remove any localized inflows. The ground surface around excavations should be graded to minimize inflow of runoff.

EXCAVATION SAFETY

In accordance with the latest regulations promulgated by the Occupational Safety and Health Administration ("OSHA"), the sides of all excavations more than four feet deep must be sloped or supported to withstand lateral forces exerted by the existing soils. Excavation support systems also must be able to support possible hydrostatic pressures and surcharge loads. For calculating the lateral loads due to the site soils, we recommend a soil unit weight of 125 pounds per cubic foot (pcf) and a lateral earth pressure coefficient of 0.4 for unbraced temporary excavation support systems. This factor should be increased to 0.5 if the system is braced. The same coefficients should be applied to loads on the ground surface from construction equipment and other vehicular traffic near the excavations. Those loads should be represented by a uniformly distributed surcharge of 250 psf.

All excavations should be kept dry so that work can proceed safely and efficiently. Excavation support systems should be designed in conjunction with the dewatering systems. As indicated in the GROUNDWATER CONTROL section, groundwater should be maintained at least two feet below the bottom of excavations for below-grade construction activity. However, dewatering systems can fail, allowing groundwater to return to its natural level and pool in excavations. Pumping the water out to resume work could create a "rapid drawdown" condition that can reduce soil strength to its minimum. This condition should be analyzed using the design groundwater level.

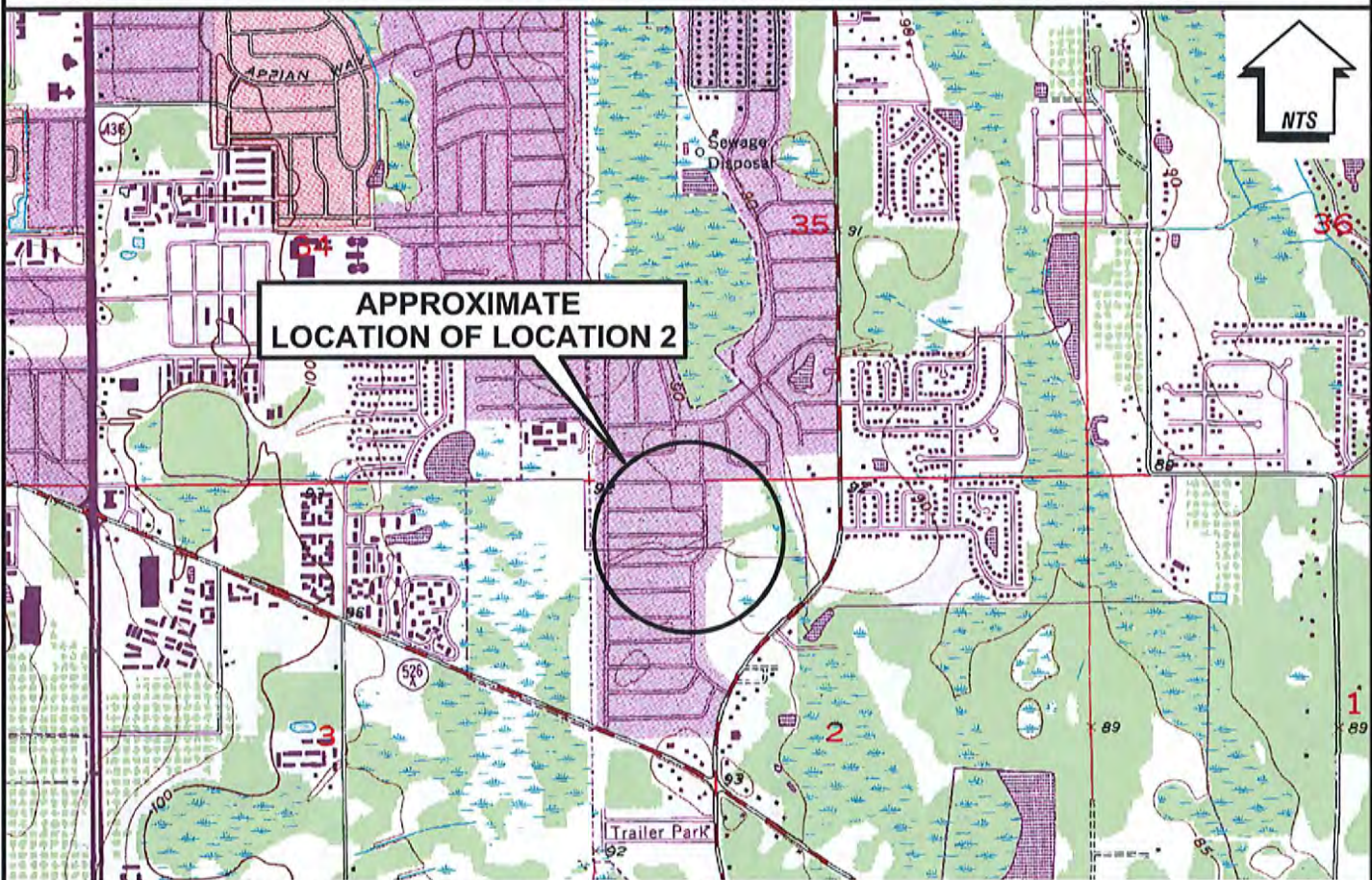
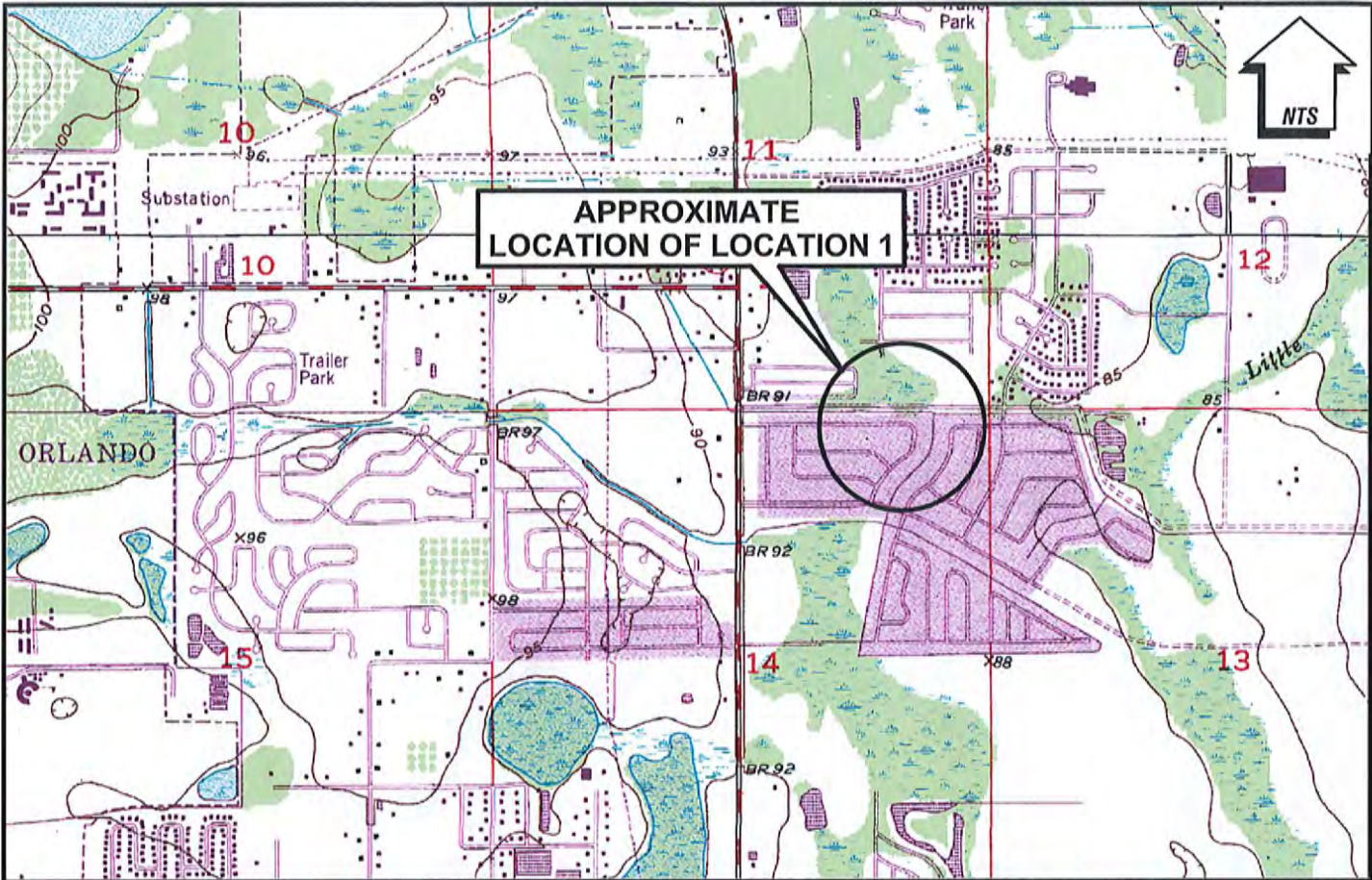
[END OF SECTION]

LIMITATIONS

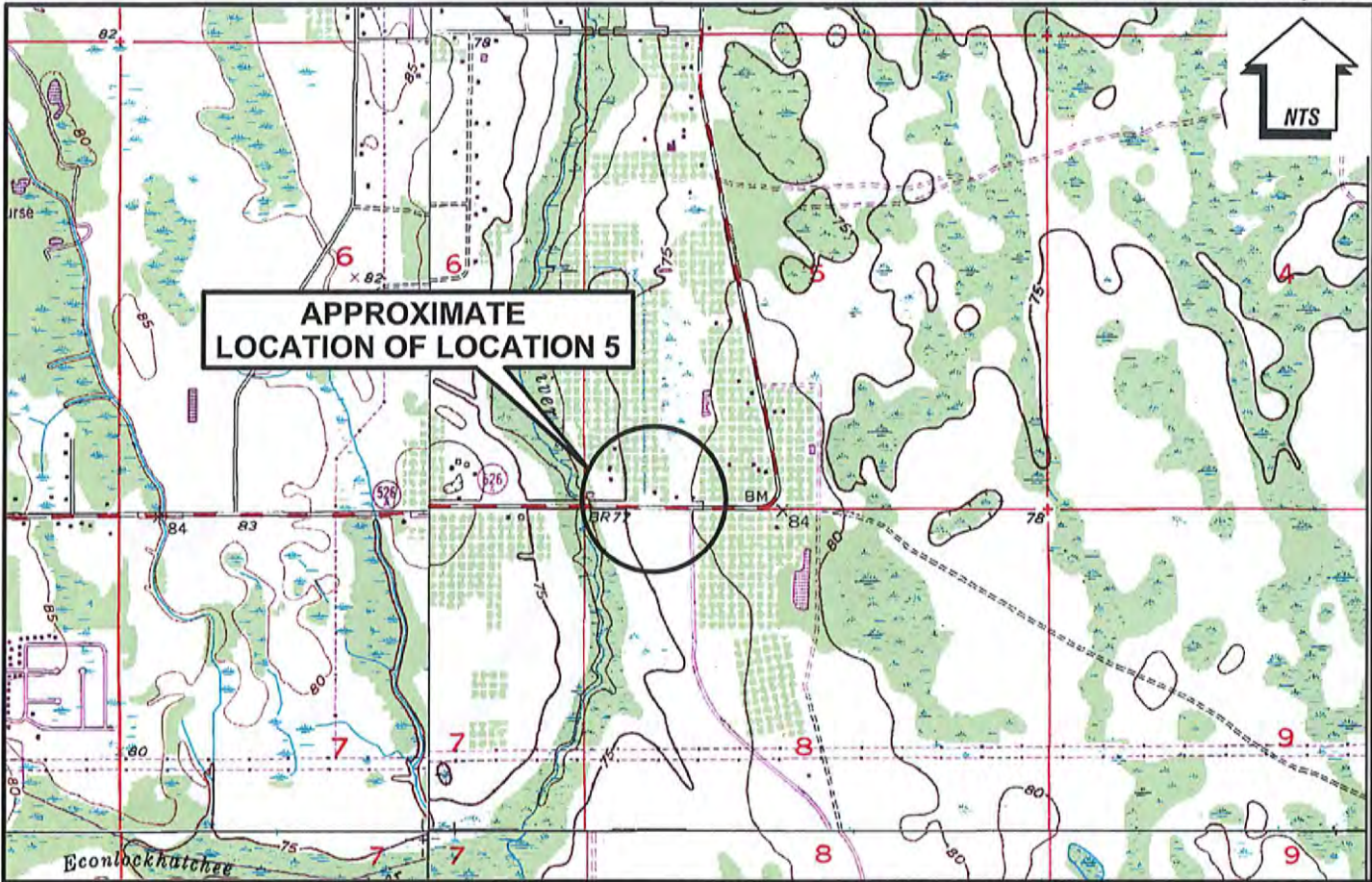
This report presents an evaluation of the subsurface conditions on the basis of accepted geotechnical procedures for site characterization. The recovered soil samples were not examined or tested in any way for chemical composition or environmental hazards. The investigation was confined to the zone of soil which is likely to be affected by the proposed construction, and did not address the potential of surface expression of deep geologic activity such as sinkholes. This type of evaluation requires a more extensive range of services than those performed for this study.

Because of the natural limitations inherent in working with the subsurface, a geotechnical engineer cannot predict and address all possible problems. During construction, geotechnical issues not addressed in this report may arise. The bulletin "Important Information About This Geotechnical-Engineering Report" published by the Geoprofessional Business Administration is presented in Appendix B to help explain the nature of geotechnical issues. Additional information is presented in Appendix C to discuss the potential concerns and the basic limitations of a typical geotechnical investigation report.

FIGURES



SITE LOCATION MAPS

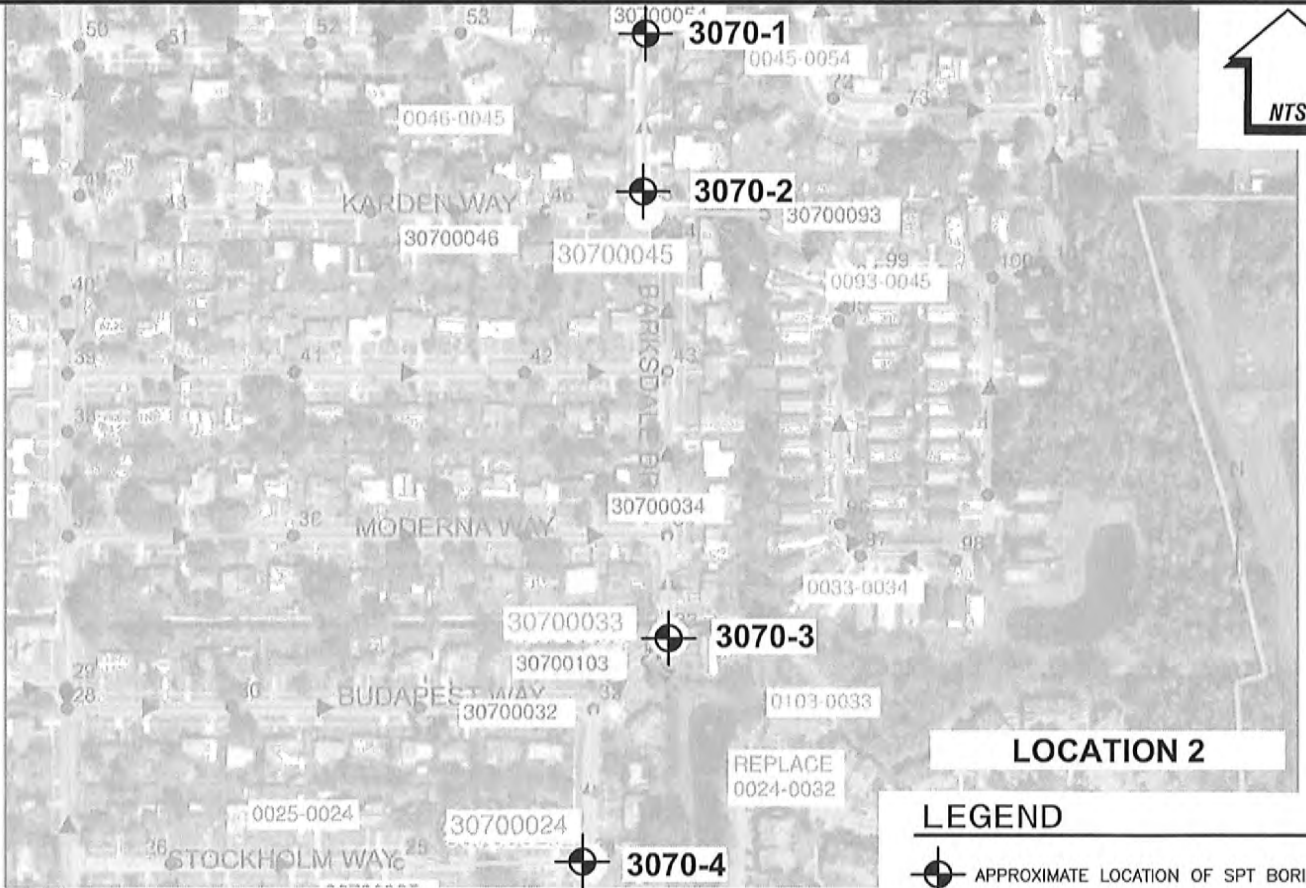


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SITE LOCATION MAPS



Source: Esri, DataCube, C...
 CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User



LEGEND
 APPROXIMATE LOCATION OF SPT BORING

Figure developed from site plan furnished by Client

EXPLORATION LOCATION PLANS

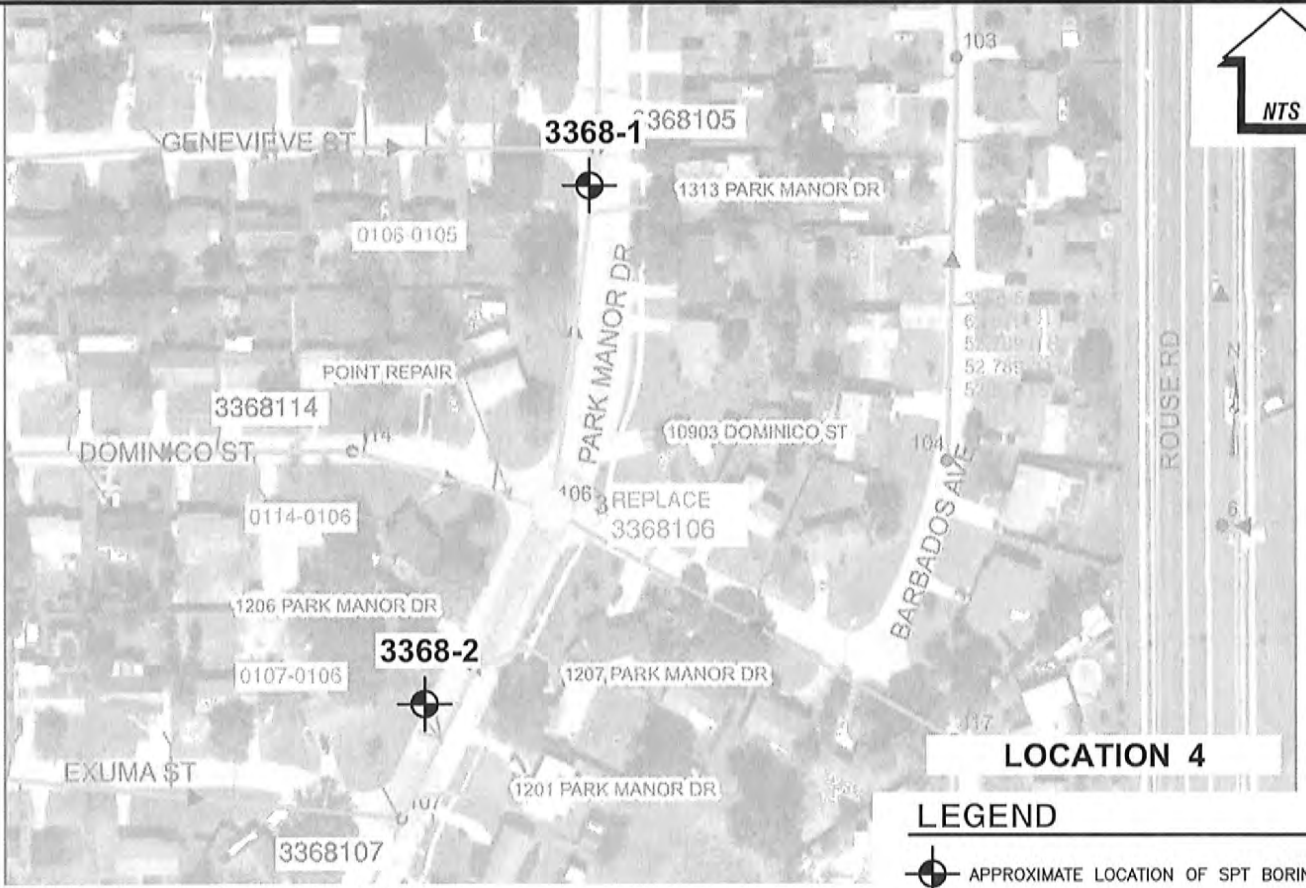
201805-1

GRAVITY SEWER RR PACKAGE 4

FIG. 4



LOCATION 3



LOCATION 4

LEGEND


 APPROXIMATE LOCATION OF SPT BORING

Figure developed from site plan furnished by Client

EXPLORATION LOCATION PLANS

201805-1

GRAVITY SEWER RR PACKAGE 4

FIG. 5



LOCATION 5



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 APPROXIMATE LOCATION OF SPT BORING

Figure developed from site plan furnished by Client

EXPLORATION LOCATION PLAN

201805-1

GRAVITY SEWER RR PACKAGE 4

FIG. 6

APPENDIX A

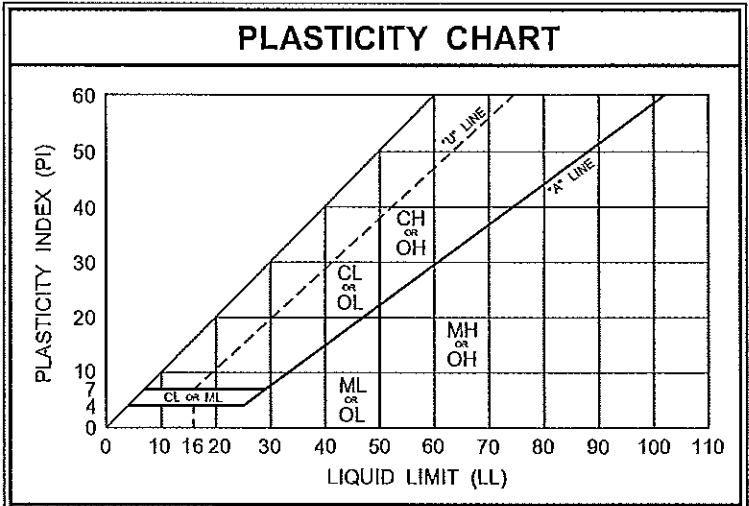


KEY TO BORING LOGS

SYMBOLS	
10	SPT N-Value (number of blows a 140-lb weight falling 30 inches required to drive a Standard Split-Spoon sampler one foot into otherwise undisturbed soil)
WR	Penetration of sampler under weight of drill rods
WH	Penetration of sampler under weight of drill rods and hammer
SS	Split Spoon sample
ST	Undisturbed thin-walled Shelby Tube sample
—	Observed change in soil type
- - -	Unobserved change in soil type
▽	Estimated seasonal high groundwater level
▼	Encountered groundwater level

SOIL CONSISTENCY	
(Based on empirical correlation with SPT N-Value)	
GRANULAR SOILS	
Very Loose	- Less Than 4 blows/ft.
Loose	- 4 to 10 blows/ft.
Medium Dense	- 10 to 30 blows/ft.
Dense	- 30 to 50 blows/ft.
Very Dense	- More Than 50 blows/ft.
FINE-GRAINED SOILS	
Very Soft	- Less Than 2 blows/ft.
Soft	- 2 to 4 blows/ft.
Firm	- 4 to 8 blows/ft.
Stiff	- 8 to 15 blows/ft.
Very Stiff	- 15 to 30 blows/ft.
Hard	- More Than 30 blows/ft.

UNIFIED SOILS CLASSIFICATION SYSTEM			
ASTM D 2487			
(Based on material passing the 3-inch (75-mm) sieve)			
MAJOR DIVISIONS		GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW Well-graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	GP Poorly graded gravels and gravel-sand mixtures, little or no fines
		GC Silty gravels, gravel-sand-silt mixtures	
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW Well-graded sands and gravelly sands, little or no fines
		SANDS WITH FINES	SP Poorly graded sands and gravelly sands, little or no fines
		SM Silty sands, sand-silt mixtures	
FINE-GRAINED SOILS	SILTS AND CLAYS Liquid limit 50% or less	ML Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	
		CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		OL Organic silts and organic silty clays of low plasticity	
	SILTS AND CLAYS Liquid limit greater than 50%	MH Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts	
		CH Inorganic clays of high plasticity, fat clays	
		OH Organic clays of medium to high plasticity	
HIGHLY ORGANIC SOILS	Pt	Peat, muck and other highly organic soils	





LOG OF BORING 3054-1

SHEET 1 OF 1

PROJECT NO: 201805-1	SURFACE ELEVATION: Unknown
PROJECT: OCU Gravity RR Package 4	GROUNDWATER DEPTH: 5.0
DATE: 8/27/18	COMPLETION DEPTH: 15.0
LOCATION: Location 1	DRILLING METHOD: Split-Spoon+Mud Rotary

DEPTH, ft.	SAMPLES SPT N-VALUE (bpcf)	SAMPLE TYPE	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	- 200	MC %	LL	PI	OC %
0		HA	Dark brown fine SAND (SP)							
			Mixed brown and dark brown fine SAND with clay (SP-SC) (POSSIBLE STABILIZED SUBGRADE)							
			Very pale brown fine SAND with silt (SP-SM)	2.5						
	8	SS	- loose			7				
5	15	SS	- medium dense							
	19	SS	Medium dense, brown to grayish brown CLAYEY SAND (SC)	7.0						
	21	SS				17				
10										
	6	SS	- loose, less clayey							
15				15.0		14				



LOG OF BORING 3054-2

SHEET 1 OF 1

PROJECT NO: 201805-1	SURFACE ELEVATION: Unknown
PROJECT: OCU Gravity RR Package 4	GROUNDWATER DEPTH: 4.0
DATE: 8/27/18	COMPLETION DEPTH: 15.0
LOCATION: Location 1	DRILLING METHOD: Split-Spoon+Mud Rotary

DEPTH, ft.	SAMPLES SPT N-VALUE (bpcf)	SAMPLE TYPE	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	- 200	MC %	LL	PI	OC %
0		HA	Very dark brown fine SAND with silt (SP-SM)							
			- dark brown							
5	9	SS	- loose, very dark yellowish brown		▼					
	10	SS								
	25	SS	- medium dense, brown							
	25	SS				6				
10										
				13.0						
	16	SS	Medium dense, brown CLAYEY SAND (SC)							
15				15.0		12				



LOG OF BORING 3070-1

SHEET 1 OF 1

PROJECT NO: 201805-1	SURFACE ELEVATION: Unknown
PROJECT: OCU Gravity RR Package 4	GROUNDWATER DEPTH: 3.0
DATE: 8/25/18	COMPLETION DEPTH: 15.0
LOCATION: Location 2	DRILLING METHOD: Split-Spoon+Mud Rotary

DEPTH, ft.	SAMPLES SPT N-VALUE (bpcf)	SAMPLE TYPE	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	- 200	MC %	LL	PI	OC %
0		HA	Very dark brown fine SAND with clay (SP-SC) Gray CLAYEY SAND (SC) Very dark brown SILTY SAND (SM)							
6	6	SS	Loose, dark brown CLAYEY SAND (SC) (POSSIBLE BACKFILL)							
6	6	SS	Loose, very dark brown fine SAND (SP)	5.5		4				
12	12	SS	- medium dense							
18	18	SS								
13.0	30	SS	Dense, brown fine SAND with silt (SP-SM)	13.0		8				
15.0				15.0						



LOG OF BORING 3070-2

SHEET 1 OF 1

PROJECT NO: 201805-1	SURFACE ELEVATION: Unknown
PROJECT: OCU Gravity RR Package 4	GROUNDWATER DEPTH: 3.0
DATE: 8/25/18	COMPLETION DEPTH: 15.0
LOCATION: Location 2	DRILLING METHOD: Split-Spoon+Mud Rotary

DEPTH, ft.	SAMPLES SPT N-VALUE (bpcf)	SAMPLE TYPE	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	- 200	MC %	LL	PI	OC %
0		HA	Dark grayish brown fine SAND with silt (SP-SM) - occasionally cemented - very dark grayish brown							
5	5	SS	- loose			10				
10	10	SS								
18	18	SS	- medium dense							
22	22	SS	Medium dense, dark brown fine SAND (SP)	8.5		6				
10						4				
13	13	SS	Medium dense, dark brown fine SAND with silt (SP-SM)	13.0						
15				15.0		9				



LOG OF BORING 3070-4

SHEET 1 OF 1

PROJECT NO: 201805-1	SURFACE ELEVATION: Unknown
PROJECT: OCU Gravity RR Package 4	GROUNDWATER DEPTH: 3.5
DATE: 8/25/18	COMPLETION DEPTH: 15.0
LOCATION: Location 2	DRILLING METHOD: Split-Spoon+Mud Rotary

DEPTH, ft.	SAMPLES SPT N-VALUE (bpcf)	SAMPLE TYPE	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	- 200	MC %	LL	PI	OC %
0		HA	Dark gray fine SAND (SP)							
			- grayish brown			4				
5	19	SS	Medium dense, very dark yellowish brown to black SILTY SAND, no organic odor (SM)	4.0		13				
	33	SS	- dense							
	26	SS	- medium dense							
	20	SS	- very dark grayish brown to dark brown							
10										
	24	SS	Medium dense, dark yellowish brown CLAYEY SAND (SC)	13.0		19				
15				15.0						



LOG OF BORING 3077-1

SHEET 1 OF 1

PROJECT NO: 201805-1	SURFACE ELEVATION: Unknown
PROJECT: OCU Gravity RR Package 4	GROUNDWATER DEPTH: 4.0
DATE: 8/27/18	COMPLETION DEPTH: 15.0
LOCATION: Location 3	DRILLING METHOD: Split-Spoon+Mud Rotary

DEPTH, ft.	SAMPLES SPT N-VALUE (bpcf)	SAMPLE TYPE	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	- 200	MC %	LL	PI	OC %
0		HA	Very dark brown fine SAND with silt, a few fine roots (SP-SM)							
			Pale brown, fine to medium SAND (SP)							
			Dark brown fine SAND with silt (SP-SM)			2				
5	15	SS	- medium dense (POSSIBLE BACKFILL)							
	34	SS	Dense, pale brown fine SAND (SP)	7.0						
	37	SS	Dense, brown CLAYEY SAND (SC)	8.5		28				
10										
	18	SS	Medium dense, brown, fine to medium SAND with clay (SP-SC)	13.0						
15				15.0		7				



LOG OF BORING 3368-1

SHEET 1 OF 1

PROJECT NO: 201805-1	SURFACE ELEVATION: Unknown
PROJECT: OCU Gravity RR Package 4	GROUNDWATER DEPTH: 4.0
DATE: 8/27/18	COMPLETION DEPTH: 15.0
LOCATION: Location 4	DRILLING METHOD: Split-Spoon+Mud Rotary

DEPTH, ft.	SAMPLES SPT N-VALUE (bpcf)	SAMPLE TYPE	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	- 200	MC %	LL	PI	OC %
0		HA	Dark gray fine SAND with CLAY (SP-SC)							
1	1	SS	- very loose							
2	2	SS								
6	6	SS	- loose, light brownish gray							
10	10	SS	- light gray, with more clay							
15	10	SS		15.0						



LOG OF BORING 3368-2

SHEET 1 OF 1

PROJECT NO: 201805-1	SURFACE ELEVATION: Unknown
PROJECT: OCU Gravity RR Package 4	GROUNDWATER DEPTH: 4.0
DATE: 8/27/18	COMPLETION DEPTH: 15.0
LOCATION: Location 4	DRILLING METHOD: Split-Spoon+Mud Rotary

DEPTH, ft.	SAMPLES SPT N-VALUE (bpcf)	SAMPLE TYPE	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	- 200	MC %	LL	PI	OC %
0		SS	Brown fine SAND with clay (SP-SC)							
			Pale brown CLAYEY SAND (SC)	1.0						
						14				
7	7	SS	- loose							
6	6	SS								
11	11	SS	- medium dense, less clayey							
11	11	SS				12				
13	13	SS	Medium dense, very pale brown, fine to medium SAND (SP)	13.0						
15				15.0		4				



LOG OF BORING 3033-1

SHEET 1 OF 1

PROJECT NO: 201805-1	SURFACE ELEVATION: Unknown
PROJECT: OCU Gravity RR Package 4	GROUNDWATER DEPTH: 9.0
DATE: 8/27/18	COMPLETION DEPTH: 15.0
LOCATION: Location 5	DRILLING METHOD: Split-Spoon+Mud Rotary

DEPTH, ft.	SAMPLES SPT N-VALUE (bpcf)	SAMPLE TYPE	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	- 200	MC %	LL	PI	OC %
0		HA	Very dark brown fine SAND with silt (SP-SM)							
	15	SS	- medium dense			6				
	13	SS								
	7	SS	Loose, brown CLAYEY SAND (SC)	7.0						
	9	SS				21				
	19	SS	- medium dense, brown to grayish brown							
15				15.0						

Manager: _____ Client: _____ Project Description: _____
 Location: _____

Boring Depth	Sample Description					Fines #200	Water Content	LL	PI	Organic Content	k (ft/day)	Stratum Number	AASHTO	USCS
	#4	#10	#40	#60	#100									
3033-1 4.0	Very dark brown sand with silt					6.3								SP-SM
3033-1 8.5	Brown clayey sand					20.5								SC
3054-1 4.0	Very pale brown sand with silt					7.0								SP-SM
3054-1 8.5	Brown clayey sand					16.6								SC
3054-1 15.0	Brown clayey sand					13.7								SC
3054-2 8.5	Brown sand with silt					6.5								SP-SM
3054-2 15.0	Brown clayey sand					11.9								SC
3070-1 7.0	Very dark brown sand					4.0								SP
3070-1 15.0	Brown sand with silt					7.7								SP-SM
3070-2 4.0	Very dark grayish brown sand with silt					9.9								SP-SM
3070-2 8.5	Very dark grayish brown sand with silt					5.9								SP-SM
3070-2 10.0	Dark brown sand					4.3								SP
3070-2 15.0	Dark brown sand with silt					9.3								SP-SM
3070-3 5.5	Dark yellowish brown sand with silt					5.5								SP-SM
3070-3 15.0	Grayish brown silty sand					18.3								SM
3070-4 2.5	Dark gray sand					4.0								SP
3070-4 5.5	Very dark grayish brown silty sand					13.0								SM
3070-4 15.0	Dark yellowish brown clayey sand					18.6								SC
3077-1 4.0	Pale brown sand					2.4								SP

**Summary Of
Laboratory Test Results**



Project: **OCU Gravity RR Package 4**

Job Number: **201805-1**

Sheet **2** of **2**

Manager: _____ Client: _____ Project Description: _____
 Location: _____

Boring	Sample Description					Fines #200	Water Content	LL	PI	Organic Content	k (ft/day)	Stratum Number	AASHTO	USCS	
	Depth	#4	#10	#40	#60										#100
3077-1	10.0	Brown clayey sand					28.2								SC
3077-1	15.0	Brown sand with clay					7.4								SP-SC
3077-2	4.0	Dark yellowish brown sand with clay					9.0								SP-SC
3077-2	8.5	Very dark grayish brown sand with clay					5.9								SP-SC
3077-2	15.0	Pale brown sand with clay					7.4								SP-SC
3368-1	5.5	Dark gray sand with clay					6.0								SP-SC
3368-1	10.0	Light gray sand with clay					9.0								SP-SC
3368-2	4.0	Pale brown clayey sand					14.4								SC
3368-2	8.5	Pale brown clayey sand					11.5								SC
3368-2	15.0	Very pale brown sand					3.6								SP

**Summary Of
Laboratory Test Results**



APPENDIX B

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply this report for any purpose or project except the one originally contemplated.*

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an

assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by:* the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help

others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold-prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical-engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your GBC-Member geotechnical engineer for more information.



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APPENDIX C

ANTILLIAN ENGINEERING ASSOCIATES, INC. CONSTRAINTS AND RESTRICTIONS

WARRANTY

Antillian Engineering Associates, Inc. has prepared this report for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering practices, and makes no other warranty either expressed or implied as to the professional advice provided in the report.

UNANTICIPATED SOIL CONDITIONS

The analysis and recommendations submitted in this report are based upon the data obtained from soil borings performed at the locations indicated on the Boring Location Plan. This report does not reflect any variations which may occur between these borings.

CHANGED CONDITIONS

We recommend that the specifications for the project require that the contractor immediately notify Antillian Engineering Associates, Inc., as well as the owner, when subsurface conditions are encountered that are different from those present in this report.

No claim by the contractor for any conditions differing from those anticipated in the plans, specifications, and those found in this report, should be allowed unless the contractor notifies the owner and Antillian Engineering Associates, Inc. of such changed conditions. Further, we recommend that all foundation work and site improvements be observed by a representative of Antillian Engineering Associates, Inc. to monitor field conditions and changes, to verify design assumptions and to evaluate and recommend any appropriate modifications to this report.

MISINTERPRETATION OF SOIL ENGINEERING REPORT

Antillian Engineering Associates, Inc. is responsible for the conclusions and opinions contained within this report based upon the data relating only to the specific project and location discussed herein. If the conclusions or recommendations based upon the data presented are made by others, those conclusions or recommendations are not the responsibility of Antillian Engineering Associates, Inc..

CHANGED STRUCTURE OR LOCATION

This report was prepared in order to aid in the evaluation of this project and to assist the architect or engineer in the design of this project. If any changes in the design or location of the structure as outlined in this report are planned, or if any structures are included or added that are not discussed in the report, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions modified or approved by Antillian Engineering Associates, Inc..

USE OF REPORT BY BIDDERS

Bidders who are examining the report prior to submission of a bid are cautioned that this report was prepared as an aid to the designers of the project and it may affect actual construction operations.

Bidders are urged to make their own soil borings, test pits, test caissons or other investigations to determine those conditions that may affect construction operations. Antillian Engineering Associates, Inc. cannot be responsible for any interpretations made from this report or the attached boring logs with regard to their adequacy in reflecting subsurface conditions which will affect construction operations.

STRATA CHANGES

Strata changes are indicated by a definite line on the boring logs which accompany this report. However, the actual change in the ground may be more gradual. Where changes occur between soil samples, the location of the change must necessarily be estimated using all available information and may not be shown at the exact depth.

OBSERVATIONS DURING DRILLING

Attempts are made to detect and/or identify occurrences during drilling and sampling, such as: water level, boulders, zones of lost circulation, relative ease or resistance to drilling progress, unusual sample recovery, variation of driving resistance, obstructions, etc.; however, lack of mention does not preclude their presence.

WATER LEVELS

Water level readings have been made in the drill holes during drilling and they indicate normally occurring conditions. Water levels may not have been stabilized at the last reading. This data has been reviewed and interpretations made in this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, tides, and other factors not evident at the time measurements were made and reported. Since the probability of such variations is anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based upon such assumptions of variations.

LOCATION OF BURIED OBJECTS

All users of this report are cautioned that there was no requirement for Antillian Engineering Associates, Inc. to attempt to locate any man-made buried objects during the course of this exploration and that no attempt was made by Antillian Engineering Associates, Inc. to locate any such buried objects. Antillian Engineering Associates, Inc. cannot be responsible for any buried man-made objects which are subsequently encountered during construction that are not discussed within the text of this report.

TIME

This report reflects the soil conditions at the time of investigation. If the report is not used in a reasonable amount of time, significant changes to the site may occur and additional reviews may be required.

APPENDIX B

ORANGE COUNTY UTILITIES

FORMS

Digital Data Submission

Pressure Test

Pump Station Start-up

Right of Entry Form for work on private property

Risk Management June 02

Water Main Disinfection Certification

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

Prior to the pump station start-up, the CONTRACTOR shall submit this completed form to the COUNTY and the following shall have been successfully met.

- A walk through letter of acceptance; and
- All wire checks, video inspections and valve locates
- Video inspections completed;
- FDEP Water Clearance received;
- FDEP placard for fuel tank if applicable; and
- Completed "Pump Station Start-Up" form (Appendix B).

Transfer of utility bills after final acceptance shall be requested by submitting the final utility power billing statement to Utilities Water Reclamation Operations Processing Center located at 8100 Presidents Drive, Suite A, or fax to 407-836-6819.

GENERAL INFORMATION

Inspection Date: _____ Final Acceptance Date: _____
Station Name: _____ PS # _____ FILE # _____
Address: _____ Subdivision: _____
Power Company: _____ Meter Number: _____
Water Company: _____ Meter Number: _____

PRESENT AT START-UP

Contractor Name: _____ Phone Number: _____
Consulting Engineer: _____ Phone Number: _____
Pump Manufacturer Rep: _____ Phone Number: _____
Orange County
Utilities Inspector: _____ Phone Number: _____
Orange County Utilities
Transmission Reps: _____

ELECTRICAL EQUIPMENT

Control Panel Enclosure Mfg. _____ Control Panel Built By _____
Control Panel SN: _____ Date of Manufacture: _____
Main Service Voltage: _____ Amperage: _____
Main Disconnect Breaker Model #: _____ Amperage: _____
Control Panel Main Breaker Model #: _____ Amperage: _____
Emergency Circuit Breaker Model: _____ Amperage: _____
Pump Breaker Model #: _____ Amperage: _____

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

ELECTRICAL EQUIPMENT (Continued)

Control Breaker Model # _____ Amperage: _____
SPD Type: _____ Model: _____ Receipt Received Yes No
Transformer Model: _____ Primary: _____ Secondary: _____ KVA: _____
Transformer Model: _____ Primary: _____ Secondary: _____ KVA: _____
Alternator Name: _____ Model: _____
Phase Monitor Name: _____ Model: _____
Alarm Horn Manufacturer: _____ Model: _____
Hour Meter Manufacturer: _____ Model: _____
Starter Name: _____ Starter Size: _____ Heater Size: _____
Starter Coil Part Number: _____
Pump Voltage: _____ Phase: _____ Pump F.L.A.: _____ Pump HP.: _____
Pressure Transducer Manufacturer: _____ Model: _____

PUMP EQUIPMENT

Pump Manufacturer: _____ Model #: _____
Impeller Size: _____ Number: _____
Pump #1 Serial #: _____ Pump #2 Serial #: _____
Pump #3 Serial #: _____ Pump #4 Serial #: _____
Pump #5 Serial #: _____ Pump #6 Serial #: _____

FLOAT BALLS

Float Ball Manufacturer: _____ Float Ball Type: _____
Off Level Depth: _____ Lead Start Depth: _____
Lag 1 Start Depth: _____ Lag 2 Start Depth: _____
Lag 3 Start Depth: _____ High Level Depth: _____

MECHANICAL

Valve Vault Cover Mfg: _____ Valve Vault Cover Size _____
Wet Well Cover Manufacturer: _____ Wet Well Cover Size: _____
Wet Well Diameter: _____ Wet Well Depth: _____ Guide Rail Size: _____
Base Elbow Size: _____ Riser Pipe Material _____ Riser Pipe Size: _____
Plug Valve Manufacturer: _____

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

MECHANICAL (Continued)

Plug Valve Size: _____ Plug Valve Lay Length _____
Check Valve Manufacturer: _____
Check Valve Size: _____ Check Valve Type: _____
Check Valve Lay Length: _____ Pipe Size Entering Wet-Well: _____
Oil Filled Gauges: Yes No Gauge Manufacturer: _____
Emergency Pump Out Size: _____ Female Cam-Lock Yes No

GENERATOR

Generator Receptacle Mfg. _____ Model: _____
Transfer Switch Mfg. : _____ Model: _____
Fuel Tank Manufacturer: _____ Fuel Tank Capacity: _____
Fuel Tank Model: _____ Fuel Tank SN: _____
Generator Manufacturer: _____ KVA _____ KW _____
Generator Model Number: _____
Generator Serial Number: _____
Engine Manufacturer: _____ Year of Manufacture: _____
Engine Model Number: _____
Engine Serial #: _____

BACKFLOW

Backflow Manufacturer: _____ Size: _____ Model #: _____

FLOW METER

Flow Meter Manufacturer: _____ Flow Meter Model #: _____

BIOFILTER

Biofilter Manufacturer: _____ Biofilter Model: _____
Biofilter Media: _____
Name of Approved Nutrient: _____
Blower Motor Manufacturer: _____
Blower Motor Model: _____ Blower Motor SN: _____
Blower Motor Belt Size: _____ Number of Belts: _____
Blower Horsepower: _____ Blower Voltage: _____

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

For COUNTY Use Only

DESIGN CRITERIA

Point 1 GPM: _____ At TDH: _____
 Point 2 GPM: _____ At TDH: _____
 Point 3 GPM: _____ At TDH: _____

PUMPING CAPACITY AT STARTUP						
	Pump # 1	Pump # 2	Pump # 3	Pump # 4	Pump # 5	Pump # 6
GPM at Startup:						
TDH at Startup:						
PSI at Startup:						

ELECTRICAL DATA AT STARTUP						
	PHASE A:		PHASE B:		PHASE C:	
Pump # 1 Amps at Startup						
Pump # 2 Amps at Startup						
Pump # 3 Amps at Startup						
Pump # 4 Amps at Startup						
Pump # 5 Amps at Startup						
Pump # 6 Amps at Startup						
Pump Megs Phase to Ground	Pump # 1:		Pump # 2:		Pump # 3:	
	Pump # 4:		Pump # 5:		Pump # 6:	
Incoming Service Voltage	A to GND:		B to GND:		C to GND:	
	A to B:		A to C:		B to C:	

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

CONTROL PANEL SPARE PARTS TRANSMITTAL

Project Name: _____

Project Number: _____

Quantity	Spec. Section	Manufacturer	Part Number	Part Description
1 set				Indicator pilot lamps of each type and voltage
1 ea				One-hundred percent replacement on lens caps, all colors
1 ea				Phase Monitor
1 ea				Alternator
1 ea				Time delay per starter
1 set				24-volt 8-pin relay
1 set				Fuses (as applicable)
1 set				Overload heaters per starter
1 ea				Elapsed Time Meter per pump
2 ea				Float Balls

Comments:

Delivered by: _____ Date: _____
 Contractor

Witnessed by: _____ Date: _____
 Construction Observation

Received by: _____ Date: _____
 Water Reclamation Division

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

GENERATOR SPARE PARTS TRANSMITTAL

Project Name: _____

Project Number: _____

Quantity	Spec. Section	Manufacturer	Part Number	Part Description
2 ea				Air filter elements
2 ea				Fuel filter elements
3 ea				Complete replacement sets of fuses of each different size and type
1 set				Indicator pilot lamps of each type and voltage
1 ea				Jacket Water Heater
1 ea				One spill kit containing proper quantities and sizes of spill booms, pads, pillows, etc to control spills

Comments:

Delivered by: _____ Date: _____
Contractor

Witnessed by: _____ Date: _____
Construction Observation

Received by: _____ Date: _____
Water Reclamation Division

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

PUMP SPARE PARTS TRANSMITTAL

Project Name: _____

Project Number: _____

Quantity	Spec. Section	Manufacturer	Part Number	Part Description
1 ea				Upper bearing
1 ea				Lower bearing
1 set				Upper and lower shaft seals
1 set				O-Rings or gaskets required for replacement of bearings and seals
1 set				Impeller wear ring or bottom wear plate
1 ea				Shaft sleeve (if applicable)
1 ea				Cable cap for each pump (if applicable)
1 set				Allen sockets
1 ea				Impeller pullers

Comments:

Delivered by: _____ Date: _____

Contractor

Witnessed by: _____ Date: _____

Construction Observation

Received by: _____ Date: _____

Water Reclamation Division

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

BIOFILTER SPARE PARTS TRANSMITTAL

Project Name: _____

Project Number: _____

Quantity	Spec. Section	Manufacturer	Part Number	Part Description
				Belts (One set of each type)
				Pillar block bearings if applicable.
				Spare PLC as applicable with location software preinstalled.
				Fuses (Three sets of each type)
				Couplings (One set if applicable)
				Pilot Lights (One set of each type)
				Lens Caps (Complete replacement for all types)
				Spare Hydrogen Sulfide Sensing Element
				Any specialty tools for normal operation and maintenance
				Sufficient amount of required supplemental nutrients for continued operations to last through monitoring and service period.

Comments:

Delivered by: _____ Date: _____
Contractor

Witnessed by: _____ Date: _____
Construction Observation

Received by: _____ Date: _____
Water Reclamation Division

**LICENSE AGREEMENT FOR CONTRACTOR TO ENTER UPON LANDS TO
CONNECT RESIDENCES TO PUBLIC SEWER SYSTEM**

_____, (Licensor/Property Owner) hereby grants to _____, (Contractor/Contractor's Plumbing Subcontractor), a licensed plumbing contractor (hereinafter called Plumbing Contractor), the license and privilege to enter on the property described below, for the purposes of connecting the residential or commercial unit to the public wastewater system being installed by the Orange County Utilities Department (County) in public rights-of-way pursuant to the Delhi Street – West Orlando 1st Addition Retrofit Improvement Project.

- A. Licensor grants said License to Plumbing Contractor in consideration of the sum of \$1.00, the sufficiency of which is hereby acknowledged. Licensor and Plumbing Contractor acknowledge and agree the Plumbing Contractor may utilize the services of a subcontractor to connect the residence to the public wastewater system authorized and permitted by this License Agreement.
- B. The purpose of this License Agreement is to allow Plumbing Contractor, its officers, employees, agents, and assigns to enter upon the described property for the purposes set forth in paragraph "A" above.
- C. This license shall be a term of two hundred and ten (210) days from the date hereof. Licensor, and Plumbing Contractor agree that this License Agreement may be renewed one time for up to an additional sixty (60) days upon further written notice to Licensor from Plumbing Contractor at least fifteen (15) days prior to the expiration of the initial terms of this License Agreement. Notice to Licensor shall be sent to:

Property Owners Name: _____
Mailing Address: _____
City/State/Zip: _____
Phone: _____
Facsimile: _____
Site Address: _____
Site Parcel ID: _____
Site Legal: _____

- D. The person executing this License Agreement as Licensor represents that he has the authority to grant the License and that he/she is the _____ (owner, partner, corporate officer, trustee of the owner).
- E. The Property Owner granting this License acknowledges and agrees that the services of the Plumbing Contractor will be paid for by the County.
- F. The Property Owner granting this License acknowledges and agrees that the services of the Plumbing Contractor will include installation of new gravity sewer piping from a connection to the house to a point of connection with the County defined as the sewer lateral connection with a clean out connection located in the right of way.

- G. The Property Owner granting the License acknowledges that the utilities constructed by the Plumbing Contractor on private property beyond the County point of connection are owned and shall be maintained by the Property Owner.
- H. Utilities constructed by the Plumbing Contractor and owned by the Property Owner will have a warranty period of three hundred and sixty five (365) days from the date of Project final completion.

DONE AND EXECUTED AND EFFECTIVE this _____ day of _____, 2004.

LICENSOR:

WITNESSES:

By: _____
 Print Name: _____
 Title: _____

By: _____
 Print Name: _____
 Title: _____

By: _____
 Print Name: _____
 Title: _____

AS TO LICENSOR:

STATE OF: _____
 COUNTY OF: _____

The foregoing instrument was acknowledged before me this _____, 2004
 (date)

by _____ as _____.
 (name) (owner, partner, corporate officer,
 trustee)

He/She is personally known to me () or has produced _____
 as identification.

 Signature – Notary Public – State of

 Type or Print Name

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: _____

APPENDIX C

ORANGE COUNTY UTILITIES

PERMITS OBTAINED BY COUNTY

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FLORIDA DEPARTMENT OF Environmental Protection

Ron DeSantis
Governor

Jeanette Nuñez
Lt. Governor

Noah Valenstein
Secretary

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

NOTIFICATION OF ACCEPTANCE OF USE OF A GENERAL PERMIT

PERMITTEE: Orange County Utilities 9150 Curry Ford Road Orlando, FL 32825 Brandon Bryant, Chief Engineer	PERMIT NUMBER: 0379099-001-DWC/CG
	ISSUE DATE: August 16, 2019
	EXPIRATION DATE: August 15, 2024
	COUNTY: Orange
	PROJECT NAME: Orange County Pump Station PS3759 (Replac'nt Package 4)
	CONNECTED TO: OCUD Eastern WRF
Email: brandon.bryant@ocfl.net	FACILITY ID: FL0038839

Dear Mr. Bryant:

This letter acknowledges receipt of your Notification/Application for Constructing a Domestic Wastewater Collection/Transmission System for the subject project. Our office received the Notice on August 13, 2019. This project includes the construction of 42 feet of 8-inch gravity sewer main and replace electrical control and water service at pump station.

This is to advise you that the Department does not object to your use of such General Permit.

Please note the attached requirements apply to your use of this General Permit for constructing the proposed domestic wastewater collection/transmission system.

You are further advised that the construction activity must conform to the description contained in your Notification/Application for Constructing a Domestic Wastewater Collection/Transmission System and that any deviation will subject the permittee to enforcement action and possible penalties.

Sincerely,

A handwritten signature in black ink, appearing to read "OHM".

Osama Mahmoud
Engineer
Permitting and Waste Cleanup Program

OHM/ohm

cc: Kent Veech, PE, Woolpert, kent.veech@woolpert.com
Charles LeGros, DEP, Charles.LeGros@dep.state.fl.us
Osama Mahmoud, DEP, osama.mahmoud@dep.state.fl.us
Reggie Phillips, DEP, reggie.phillips@floridadep.gov

REQUIREMENTS FOR USE OF THE GENERAL PERMIT FOR DOMESTIC WASTEWATER COLLECTION/TRANSMISSION SYSTEMS:

1. This general permit is subject to the general permit conditions of Rule 62-4.540, F.A.C., as applicable. This rule is available at the Department's Internet site at:
<http://www.dep.state.fl.us/legal/Rules/shared/62-4/62-4.pdf> [62-4.540]
2. This general permit does not relieve the permittee of the responsibility for obtaining a dredge and fill permit where it is required. [62-604.600(6)(b)1]
3. This general permit cannot be revised, except to transfer the permit. [62-604.600(6)(b)2]
4. This general permit will expire five years from the date of issuance. If the project has been started and not completed by that time, a new permit must be obtained before the expiration date in order to continue work on the project. [62-4.030]
5. Upon completion of construction of the collection/transmission system project, and before placing the facilities into operation for any purpose other than testing for leaks or testing equipment operation, the permittee shall submit to the Department's Central District Office Form 62-604.300(8)(b), Request for Approval to Place a Domestic Wastewater Collection/Transmission System into Operation. This form is available at the Department's Internet site at: <http://www.dep.state.fl.us/water/wastewater/dom/dw-forms.htm>. [62-604.700(2)]

Please submit the entire clearance document package in electronic format to DEP_CD@dep.state.fl.us, with a copy to osama.mahmoud@dep.state.fl.us . If the file is very large, you may post it to the Wastewater Electronic Applications folder on the following ftp site at:

<ftp://ftp.dep.state.fl.us/pub/wastewater/>

After posting the document, send an e-mail to DEP_CD@dep.state.fl.us, with a copy to osama.mahmoud@dep.state.fl.us , alerting us that it has been posted. Any submitted drawings (should be sized 11" x 17") and the engineer of record's signed seal and dates on the required document must be legible for acceptance.

For further clarification contact:
(Osama Mahmoud), (407) 897-4125
3319 Maguire Blvd, Suite 232
Orlando, Florida 32803-3767

6. The new or modified collection/transmission facilities shall not be placed into service until the Department clears the project for use. [62-604.700(3)]
7. Abnormal events shall be reported to the Department's Central District Office in accordance with Rule 62-604.550, F.A.C. For unauthorized spills of wastewater in excess of 1000 gallons per incident, or where information indicates that public health or the environment may be endangered, oral reports shall be provided to the STATE WATCH OFFICE TOLL FREE NUMBER (800)320-0519 as soon as practical, but no later than 24 hours from the time the permittee or other designee becomes aware of the circumstances. Unauthorized releases or spills less than 1000 gallons per incident are to be reported orally to the Department's Central District Office within 24 hours from the time the permittee, or other designee becomes aware of the circumstances. [62-604.550]

APPENDIX D

ORANGE COUNTY UTILITIES Standards and Construction Specification Manual

LIST OF APPROVED PRODUCTS

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APPENDIX D

LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

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.						
		Certaiteed 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.						
		Certaiteed 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	

APPENDIX D

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	

APPENDIX D

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		
			NA	NA	NA	NA	5600 or 5800 (FLG)	4" & up		
Val-Matic	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			

APPENDIX D

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		

APPENDIX D

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	

APPENDIX D

LIST OF APPROVED PRODUCTS - GRAVITY SYSTEMS

FEBRUARY 11, 2011

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		

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
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 D99100 Fill and Mount Charge		
	Winter Gauges	NA	NA	NA	NA	PFQ770 0-60 PSI D70950 top D70954 Bottom		
Pumps	Submersible Pumps							
	ABS	NA	NA	NA	NA			
	Flygt	NA	NA	NA	NA			

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
Pumps	Floats	Float Regulator (FR) - Duplex and Triplex Pump Stations						
		Atlantic Scientific	NA	NA	NA	NA	Roto-Float	
Pumps	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	

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	AL	Alarm Light / With Base and Globe (AL)							
	American Electric	NA	NA	NA	NA	F32552			
	Red Dot Globe	NA	NA	NA	NA	VGLR-01			
	Red Dot Base					VA-01			
	AH	Alarm Horn (AH)							
	Wheelock	NA	NA	NA	NA	3IT-115-R			
	Fuse	Fuses (F)							
	Bussmann	NA	NA	NA	NA	FNQ-R or KTK-R			
	HOA	Hand-Auto-Off Selector (HOA)							
	Square D	NA	NA	NA	NA	9001-SKS43B			
	HSS	Horn Silence Button (HSS)							
	Square D	NA	NA	NA	NA	9001-SKR1RH5			
	Inter-lock	Mechanical Interlock							
	Square D	NA	NA	NA	NA	S29354			
	Breakers	Control Panel Main Circuit Breaker (MCB) 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)		
		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			
	MS	Motor Starter (MS)							
Square D	NA	NA	NA	NA	Type S Class 8536				
OL	Overload Heater(OL)								
Square D	NA	NA	NA	NA	Part number will vary with size needed				
OR	Overload Reset								
Square D	NA	NA	NA	NA	9066-RA1				
Transformer	Control Circuit Transformer (XMFR)								
	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			
SPB	Supplemental Protector Breaker - 3 pole, 1-amp for Phase Monitor								
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			