

PROJECT MANUAL
WASTEWATER GRAVITY CLEANING AND CCTV
TERM CONTRACT



ORANGE COUNTY UTILITIES DEPARTMENT
August 15

Orange County Utilities Field Services

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SECTION 01001
GENERAL WORK REQUIREMENTS

PART 1 - GENERAL

1.01 NOTICES

- A. All notices or other papers required to be delivered by the Contractor to the County shall be delivered to the office of the Field Services Division, Orange County Utilities Department, 8100 Presidents Drive, Suite A, Orlando, FL 32809.

1.02 TERM CONTRACT

- A. The Contract is a term contract that shall commence on the date of award and terminate 12 months after the award date.
- B. The Contract is a Unit Price contract with the total estimated base bid equal to the sum of the pay item totals from the bid schedule. All quantities on the bid schedule are estimates and the County is not obligated to purchase a minimum or maximum amount during the Contract term.
- C. Projects will be authorized by issuance of a numbered delivery order. The delivery order will specify the location, description and completion time for the Project. Delivery orders will be emailed and mailed to the Contractor. The emailed copy of the delivery order shall be official Notice to Proceed.

1.03 METHOD OF ORDERING

- A. Routine Orders:
 - 1. Utilities will initiate a Work Request which shall include, but not be limited to the following: date; location and description of requested Work; sketch of requested Work; required bid line items and estimated quantities. The Work Request will be emailed to the Contractor.
 - 2. The Contractor shall, upon receiving the Work Request from Utilities, visit the site and familiarize themselves with the site conditions and the requested Work. The Contractor shall submit their Job Cost Proposal and confirm or adjust the estimated quantities and use the unit prices in the Contract. The signed Job Cost Proposal shall be emailed to Utilities within 7 calendar days following the date of emailed Work Request.
 - 3. Utilities will review and approve the Contractor's submitted Job Cost Proposal and process a Delivery Order authorization. If the submitted Job Cost Proposal contains quantities different from the estimated quantities, Utilities will work with the Contractor to confirm actual quantities before issuing the Delivery Order.
 - 4. A copy of the Delivery Order will be emailed to the Contractor and will include job location, Work description, and completion due date. The emailed Delivery Order

shall serve as the official Notice to Proceed. Work shall commence as soon as possible after receipt of Delivery Order by email.

5. No changes in the scope of Work will be permitted after issuance of a Delivery Order as the Delivery Order is a lump sum described by the Job Cost Proposal.
6. Delivery Orders will not be issued for Job Cost Proposals under 500 dollars.

B. Emergency Orders:

1. Contractor shall be available to commence emergency restoration requests on an on-call basis. Emergency repairs shall commence after notification by Utilities and a Delivery Order is issued.
2. Emergency repair work may be required on twenty-four hours, seven (7) day/week basis as requested. Emergency repair work shall begin as agreed on by the Project Manager or Designee. The County may waive cost estimates and the issuance of a Delivery Order prior to the start of emergency repair work. Contractor will be required to submit a formal quote listing all repairs, materials and quantities with pricing used in the completion of the emergency repair. A Delivery Order will then be processed based on that quote after it has been reviewed and approved by the Project Manager or his Designee.

1.04 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.

1.05 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.

1.06 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 section 02578, Solid Sodding.
- 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.

1.07 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.

1.08 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.

1.09 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.

1.10 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.

1.11 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.

1.12 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.

1.13 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.

1.14 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.

1.15 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.

1.16 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. The 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 for base and asphaltic overlay as specified by the requirements of the Florida Department of Transportation permit issuer or the Public Works Utilization of Right of Way specifications, 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.

1.17 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. Maintain public highway traffic within the limits of the Project for the duration of the construction period, including any temporary suspensions of work. Work shall also include construction and maintenance of any necessary detour facilities; furnishing, installing and maintaining of traffic control and safety devices, control of dust, or any other special requirements for safe and expeditious movement of vehicular and pedestrian traffic.
2. Traffic Control shall be provided at the Contractor's expense by the Contractor's personnel or off-duty uniformed police officer, depending on and as required by the applicable traffic control requirements jurisdictional to the construction or road.
3. The Contractor shall prepare and submit a Maintenance of Traffic plan (MOT) to the County/Professional and to the agency with jurisdiction for MOT (Orange County Public Works, FDOT, local municipalities, etc.) for review and acceptance prior to commencing any work. The Traffic Control Plan shall 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.
 - 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. All references to the respective agency in the above referenced standards shall be construed to also include the County for this Work.
4. The cost of any required road permits shall be borne by the Contractor.
 5. The Contractor will notify the public one (1) week in advance of any scheduled work via the use of portable message boards. The message boards shall be located at each approach to the construction area.
 6. Before closing any thoroughfare, the Contractor shall give written notice to, and if necessary, obtain a permit or permits from the duly constituted public authority having jurisdiction over the thoroughfare. Notice shall be given no less than 72-hours in advance of the time when it may be necessary in the process of construction to close such thoroughfare, or as may be otherwise provided in the acceptable Maintenance of Traffic plan.
 7. The Contractor shall sequence and plan construction operations and shall generally conduct his work in such a manner as not to unduly or unnecessarily restrict or impede existing normal traffic through the streets of the local community.
 8. If required by duly constituted public authority, the Contractor shall, at his own expense, construct bridges or other temporary crossing structures over trenches so as not to unduly restrict traffic. Such structures shall be of adequate strength and proper construction and shall be maintained by the Contractor in such a manner as not to constitute an undue traffic hazard.
 9. The Contractor shall make provisions at all "open cut" street crossings to allow a minimum of one lane to be open for vehicular traffic at all times. Lane closing shall be as permitted by the local governing authority and shall be repaired to a smooth, safe driving surface immediately following the installation of pipe or conduit.
 10. The Contractor shall make provisions at cross streets for the free passage of vehicles and pedestrians, either by bridging or otherwise, and shall not obstruct the sidewalks, gutters, or streets, nor prevent in any manner the flow of water in the latter, but shall use all proper and necessary means to permit the free passage of surface water along the gutters.
 11. The Contractor shall immediately cart away all offensive matter; exercising such precaution as may be directed by the County. All material excavated shall be so disposed of as to inconvenience the public and adjacent tenants as little as possible and to prevent injury to trees, sidewalks, fences and adjacent property of all kinds.

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.

1.18 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 comprises the cleaning and closed circuit televising of wastewater gravity mainlines and laterals throughout the Orange County Utilities Sanitary Sewer system. The Work consists of furnishing all labor, equipment and materials for the cleaning and closed circuit televising of wastewater gravity mains and laterals. Project objectives include cleaning and televising a vast underground network of sanitary sewer piping, identifying areas in need of repair or rehabilitation, identification of infiltration points, and to provide an opportunity for continuous improvement to Orange County Utilities' Geographical Information System with the information provided as a result of the work covered by this contract. Work covered by this contract includes, but is not limited to cleaning and televising wastewater gravity mainlines and laterals throughout the Orange County Utilities Sanitary Sewer system. Work includes all associated site work and restoration.
- B. The Contractor shall furnish all labor, equipment, tools, services and incidentals to complete all Work required by these Specifications and as shown on the Drawings, the Job Quotation Form, and the Delivery Order. The Contractor shall have experience with sanitary sewer cleaning and closed circuit televising.
- C. The Contractor shall perform the Work complete, in place, and ready for continuous service, and shall include repairs, testing, permits, cleanup, replacements and restoration required as a result of disruption or damages caused during this Construction.
- D. All materials, equipment, skills, tools and labor which is reasonably and properly inferable and necessary for the proper completion of the Work in a substantial manner and in compliance with the requirements stated or implied by these Specifications, Drawings, Job Quotation Form and Delivery Order shall be furnished and installed by the Contractor without additional compensation, whether specifically indicated in the Contract Documents or not.
- E. The Contractor shall comply with all Municipal, County, State, Federal, and other codes which are applicable to this Project.
- F. The Contractor shall furnish all labor, equipment, tools, services and incidentals to complete all Work required by these Specifications and as shown on the Drawings. If conflicts arise between these specifications and the latest OCU Standards and

Construction Specification Manual, then the OCU Standards shall govern.

- G. The Contractor shall perform the Work complete, in place, and ready for continuous service, and shall include repairs, testing, permits, cleanup, replacements and restoration required as a result of disruption or damages caused during this Construction.
- H. All materials, equipment, skills, tools and labor which is reasonably and properly inferable and necessary for the proper completion of the Work in a substantial manner and in compliance with the requirements stated or implied by these Specifications, Drawings, Job Quotation Form and Delivery Order shall be furnished and installed by the Contractor without additional compensation, whether specifically indicated in the Contract Documents or not.
- I. The Contractor shall comply with all Municipal, County, State, Federal, and other codes which are applicable to this Project.

1.02 WORKING HOURS

- A. Working hours for the County Inspector are an 8-hour period between the hours of 7:00 a.m. and 4:00 p.m., Monday through Friday. Any work beyond the 8-hour period is to be requested in writing 48 hours prior and paid for by the Contractor. Any work required on Saturday, Sunday or Holidays shall be requested in writing 48 hours in advance. All requests must be submitted to the County and approved by the County in advance. Under emergency situations, a verbal request may be made with a follow-up written request.
- B. The Contractor shall pay the County for County Inspector time outside of normal Working Hours at a rate of \$51.00/hour. The Contractor agrees that the County shall deduct such charges from the Contract Amount by a deductive Change Order.

1.03 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.

1.04 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 sequence of demolition and renovation of existing facilities will be in accordance with the approved demolition and removal plan.

1.05 PUBLIC UTILITY INSTALLATIONS AND STRUCTURES

- A. The Contractor shall give written notice to all governmental utility departments and other owners of public utilities of the location of the proposed construction operations, at least

seventy-two hours in advance of breaking ground in any area or on any unit of the Work.

- B. Some of the utility contacts are listed on the plans for the Contractor's convenience.
- C. The maintenance, repair, removal, relocation or rebuilding of the public utility installation and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the utility involved.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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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. Cash Allowances
 - 3. Work Not Paid for Separately
 - 4. Measurement for Payment
 - 5. 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.

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; 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.

E. 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)
- h. Hourly Rate (HR)
- i. Gallon (GAL)

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

Only those bid items included in the Bid Schedule are applicable for this Contract.

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

BID ITEM	Orange County Utilities MEASUREMENT AND PAYMENT ITEMS Pg 1
	General
1 22 42	<p>EMERGENCY Mobilization, Demobilization, Bonds, and Permits</p> <p>a. Measurement: Emergency Mobilization and Demobilization shall be applicable only when an Emergency Order is requested from the County as specified in Section 01001 General Work Requirements. Measurement of various items for Emergency Mobilization and Demobilization shall not be made for payment and all items shall be included in the lump sum price.</p> <p>b. Payment: Payment will be made at the Contract unit price bid for each County authorized Emergency Mobilization and Demobilization successfully executed. Payment of the applicable unit 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 applicable unit price for this item shall also include 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>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>
3 23 43	<p>Complex Maintenance of Traffic</p> <p>a. Measurement: Measurement shall be based on satisfactory execution of Complex Maintenance of Traffic (Complex MOT) as defined in Section 01570 and 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>
4 24 44	<p>Traffic Control Officer</p> <p>a. Measurement: Measurement shall be based on satisfactory implementation of a Traffic Control Officer in accordance with FDOT's Standard Specifications for Road and Bridge Construction Section 102-7 and/or county requirements.</p> <p>b. Payment: Payment of the applicable Contract hourly rate price as stated in the proposal will be full compensation for furnishing all labor, materials, and equipment necessary to provide and maintain communication with the public and to direct and maintain traffic.</p>
	<p>Install/Replace Fence</p>
5 25 45	<p>Chain Link Fence Install/Replacement</p> <p>a. Measurement: Chain Link Fence Install/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 Install/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>
6 26 46	<p>Wood Fence Install/Replacement</p> <p>a. Measurement: Wood Fence Install/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 Wood Fence Install/Replacement and shall include all labor, materials, and equipment to remove and properly dispose of existing wood fence and concrete and install new wood fence including replacement fence, gate, support posts and concrete for a complete installation.</p>
	<p>Bypass Pumping</p>
7,8 27,28 47,48	<p>Bypass Pumping Sanitary Sewer Mains (diameters 13" or larger)</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;</p>

	tankers; temporary bypass and service piping; hauling and proper disposal of wastewater; plugging; gasoline/diesel fuel; protection of existing facilities, utilities, and property; MOT; signs and barriers; and all incidental work required to satisfactorily complete this item.
9 29 49	<p>Bypass Pump Station (>1,500 gpm)</p> <p>a. Measurement: Measurement for this item shall be based on the County authorized 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; ; signs and barriers; Standard MOT, flow control, one tanker, bypass pumping (12” or smaller.), permits, restoration and all incidental work required to satisfactorily complete this item.</p>
10 30 50	<p>Extra Tankers</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. Measurement for Extra Tankers shall be made per actual number of tankers used above the one tanker included in other bid items.</p> <p>b. Payment: Payment of the applicable Contract unit price shall be full compensation for each additional tanker required and 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; Standard MOT; signs and barriers; and all incidental work required to satisfactorily complete this item.</p>
	Cleaning Sanitary Sewers
11 31 51	<p>Cleaning Sanitary Sewer Laterals</p> <p>a. Measurement: Measurement for Cleaning Sanitary Sewer Laterals shall be made per actual number of sanitary sewer laterals satisfactorily cleaned with a cleaning nozzle, regardless of number of passes required, in accordance with County requirements and specifications (Section 02761).</p> <p>b. Payment: Payment for Cleaning Sanitary Sewer Laterals 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 satisfactorily clean a sanitary sewer lateral to an acceptable condition for CCTV inspection, regardless of number of passes required, with a cleaning nozzle including water, hoses, and nozzles, protection of property, restoration and clean-up, Standard MOT, flow control, plugging, one tanker, bypass pumping (12” or smaller), permits and restoration.</p>
12-14	<p>Cleaning Sanitary Sewer Mains (various diameters)</p> <p>a. Measurement: Cleaning Sanitary Sewer Mains shall be measured in actual linear</p>

<p>32-34</p> <p>52-54</p>	<p>feet of sanitary sewer main satisfactorily cleaned with a cleaning nozzle, regardless of number of passes required, as measured along the length of the centerline of sewer, which cleaning was performed, between manholes, measured to the nearest foot from inside wall of the manhole to the inside wall of the other manhole and not including the manhole chamber, in accordance with County requirements and specifications (Section 02761).</p> <p>b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for Cleaning Sanitary Sewer Mains and shall include all labor, materials, and equipment necessary to satisfactorily clean a sanitary sewer main to an acceptable condition for CCTV inspection and ready for any and all repairs with a cleaning nozzle, regardless of number of passes required, including water, hoses, and nozzles, protection of property, restoration and clean-up, Standard MOT, flow control, plugging, one tanker, bypass pumping (12" or smaller), permits and restoration.</p>
<p>15</p> <p>35</p> <p>55</p>	<p>Mechanical Root or Grease Removal</p> <p>a. Measurement: Mechanical Root or Grease Removal shall require written County approval before this bid item may be used. Mechanical Root or Grease Removal shall be measured in actual linear feet of sanitary sewer mains satisfactorily cleaned by removing roots from the interior of the main and de-scaling the main. Measurement shall be along the length of the centerline of sewer, which cleaning was performed, between manholes, measured to the nearest foot from inside wall of the manhole to the inside wall of the other manhole and not including the manhole chamber, in accordance with County requirements and specifications (Section 02761).</p> <p>b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for Mechanical Root or Grease Removal and shall include all labor, materials, and equipment necessary to satisfactorily remove roots from the interior of the main and de-greasing the main including water, hoses, and nozzles; mechanical methods of root removal and grease removal, all herbicides or chemical treatment, protection of property, restoration and clean-up, Standard MOT, flow control, plugging, one tanker, bypass pumping (12" or smaller), permits and restoration.</p>
<p>16</p> <p>36</p> <p>56</p>	<p>Mechanical Tuberculation/Mineral Deposit Removal</p> <p>a. Measurement: Mechanical Tuberculation/Mineral Deposit Removal shall require written County approval before this bid item may be used. Mechanical Tuberculation/Mineral Deposit Removal shall be measured in actual linear feet of sanitary sewer mains satisfactorily cleaned by mechanically removing tuberculation/mineral deposit from the interior of the main and de-scaling the main. Measurement shall be along the length of the centerline of sewer, which cleaning was performed, between manholes, measured to the nearest foot from inside wall of the manhole to the inside wall of the other manhole and not including the manhole chamber, in accordance with County requirements and specifications (Section 02761)</p> <p>b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for Mechanical Tuberculation/Mineral Deposit Removal and shall include all labor, materials, and equipment necessary to satisfactorily remove tuberculation/mineral deposits from the interior of the</p>

	main including water, hoses, and nozzles, protection of property, restoration and clean-up, Standard MOT, flow control, plugging, one tanker, bypass pumping (12" or smaller), permits and restoration.
	CCTV Sanitary Sewers
17-19 37-39 57-59	<p>CCTV Inspection Sanitary Sewer Mains (various diameters)</p> <p>a. Measurement: CCTV Inspection Sanitary Sewer shall be measured in actual linear feet of satisfactory visual inspection completed utilizing closed-circuit television in accordance with the County requirements and specifications (Section 02762). CCTV inspection shall be measured along the length of the centerline of the inspected sanitary sewer. These bid items do not apply to CIPP lining pre/post CCTV inspections.</p> <p>b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for CCTV Inspection Sanitary Sewer and shall include, but is not necessarily limited to, all labor, materials, and equipment necessary for a complete CCTV visual inspection of the sanitary sewer and subsequent report including qualified personnel, DVD, and all incidentals related to sewer main inspection, Standard MOT, flow control, plugging, one tanker, bypass pumping (12" or smaller), permits and restoration.</p>
20 40 60	<p>CCTV Lateral Inspection from Main</p> <p>a. Measurement: Measurement for CCTV Lateral Inspection from Main shall be made per actual number of sanitary sewer laterals satisfactorily visually inspected utilizing closed-circuit television panned and tilted from the main in accordance with the County requirements and specifications (Section 02763). This bid item does not apply to CIPP lining pre/post CCTV inspections.</p> <p>b. Payment: Payment for CCTV Lateral Inspection from Main 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 CCTV visual inspection of the sanitary sewer lateral from the main and subsequent report including qualified personnel, DVD, and all incidentals related to sewer lateral inspection, Standard MOT, flow control, plugging, one tanker, bypass pumping (12" or smaller), permits and restoration.</p>
21 41 61	<p>CCTV Lateral Inspection from Cleanout</p> <p>a. Measurement: Measurement for CCTV Lateral Inspection from Cleanout shall be made per actual number of sanitary sewer laterals satisfactorily visually inspected utilizing closed-circuit television in accordance with the County requirements and specifications (Section 02763). This bid item does not apply to CIPP lining pre/post CCTV inspections.</p> <p>b. Payment: Payment for CCTV Lateral Inspection from Main 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 CCTV visual inspection of the sanitary sewer lateral from the cleanout and subsequent report including qualified personnel, DVD, and all incidentals related to sewer lateral inspection, Standard MOT, flow control, plugging, one tanker, bypass pumping (12" or smaller), permits and restoration.</p>

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PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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 or agency 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.

D. Maintenance of Traffic

1. See section 01570, Maintenance of Traffic.

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)
DegC	degree(s) Centigrade
DegF	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
LS	lump sum
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)
VF	vertical foot
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
MOT	maintenance of traffic
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 01101
SPECIAL REQUIREMENTS (GRAVITY INSPECTION ONLY)

PART 1 - GENERAL

1.01 REQUIREMENTS

- A. The Contractor shall meet these minimum qualifications for closed circuit televising (CCTV) inspections of manholes and gravity sewers. Attend coordination meeting, provide proper notifications, and maintain an accurate weekly schedule. Contractor shall abide by the causes for rejection of Work in this section and other provisions described in other sections.

1.02 MINIMUM CONTRACTOR QUALIFICATIONS

- A. The following requirements shall be met to qualify for the CCTV project.
1. Company Experience
 - a. Sanitary Sewer Mains- A minimum total of 500,000 LF shall be previously completed within the previous 10-years.
 - b. Sanitary Sewer Laterals - A minimum total of 10,000 LF shall be previously completed within the previous 10-years.
 - c. Documented company QA/QC plan and procedures
 2. Company equipment
 - a. At least one (1) pan and tilt CCTV camera with rotating lights
 - b. At least one (1) push type lateral cameras with footage counter and ability to display footage on screen and/or lateral launch type lateral camera with footage counter and ability to display footage on screen
 - c. Digital video capture system capable of capturing MPEG or Windows Media Video files on board the camera truck
 - d. PACP compliant inspection data logging software
 - e. At least one (1) jetter/vacuum truck
- B. The following requirements shall be met to qualify for the manhole inspection project:
1. Company
 - a. Five (5) reference manhole inspection projects with a minimum total of 1,000 manholes
 - b. Documented company QA/QC plan and procedures
 - c. Listing of management personnel (minimum of two (2) certified personnel with PACP certifications)
 - (1) Minimum of one (1) person with PACP certification that will lead or supervise each field manhole inspection crew and a minimum of 2-years in the role of lead person or supervisor
 - (2) Minimum of one (1) person with PACP certification serving in the role as a QA/QC management supervisor

2. Company equipment
 - a. At least one - 2 Mega Pixel digital camera with strobe flash
 - b. Camera attached to pole
 - c. Traffic control equipment
 - d. Confined space entry equipment

1.03 SUBMITTALS

- A. The CCTV Inspection Contractor shall submit a completed qualification form with the required information (see Table A - CCTV Inspection Contractor Qualification Form).
- B. Previous Work Products: The Contractor shall submit one (1) example of previous closed circuit televising (CCTV) inspections, manhole inspections and gravity sewers inspection work for approval. The submitted example shall be the work of the field supervisor or foreman to be used on this Project.



TABLE - A
ORANGE COUNTY UTILITIES
CCTV INSPECTION CONTRACTOR
QUALIFICATION FORM

Contractors that desire to be added to the approved list shall submit a request to the Standards Committee via e-mail to standards.committee@ocfl.net. For other information, please contact a Standards Committee representative at 407-254-9900.

<i>Company Reference Projects</i>		<i>Total Footage</i>	<i>Project Completed</i>	<i>Client Company</i>	<i>Contact Name</i>	<i>Contact (Phone Number and/or E-mail Address)</i>
<i>Listing of Company Management Personnel</i>	<i>PACP (Certification #)</i>	<i>MACP (Certification #)</i>	<i>Years of Experience in CCTV</i>	<i>Years of Experience as Supervisor</i>	<i>QA/QC Mgmt Supervisor (Y or N)</i>	<i>Position Title</i>
<i>Company Equipment Item</i>	<i>Manufacturer</i>	<i>Model No.</i>	<i>Description</i>			
Main Line CCTV Camera						
Lateral Camera (push type)						
Lateral Camera (launch type)						
Video Capture System						
PACP-Compliant Inspection Data Logging System						
Combination Jetter/Vacuum Truck						

Para más información, por favor llame al Departamento de Servicios Públicos del Condado de Orange y pida hablar con un representante en español. El número de teléfono es 407-254-9903. Website: www.ocfl.net/utilities/

(Rev.6/27/2011)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONTRACT COORDINATION MEETING

- A. Prior to commencing field activities, the Contractor shall attend a Coordination Meeting with the County. Contractor shall be prepared to discuss the following agenda items:
 1. Project contacts
 2. County notification procedures
 3. Public notification requirements
 4. Inspection QA/QC
 5. Deliverables
 6. Schedule

3.02 GENERAL PROGRESSION OF WORK

- A. Contractor shall submit an updated schedule of inspection activities on a weekly basis.
- B. Contractor shall notify the County a minimum of 48-hours prior to any inspection work.
- C. All work shall be performed in an orderly, organized fashion, progressing through the project area(s) in a systematic manner. Contractor shall adhere to submitted and communicated schedules.

3.03 QUALITY ASSURANCE

- A. The Contractor shall have a QA/QC plan and procedures to ensure accurate data collection, documentation and submittal.
- B. The County has adopted the NASSCO PACP quality control procedures as the minimum standard to be applied to all submitted CCTV and Manhole Inspection data. All submitted data shall be quality checked in accordance with these procedures.
- C. The County will perform QA/QC checks on a minimum 5% of submitted inspection data.
- D. All submitted data will be subject to County QA/QC following the same procedures set forth herein following in paragraph 3.04 "CCTV and Manhole Inspection QA/QC Procedures."

3.04 CCTV AND MANHOLE INSPECTION QA/QC PROCEDURES

- A. The Contractor shall determine the approximate number of inspections performed by each inspection field supervisor/foreman that submitted data on a weekly basis to determine the quality control sampling population. A review of a minimum of 5% of the total inspections is required.
- B. The Contractor shall number the inspection reports in the order they were inspected.
- C. The Contractor shall utilize a random number generator to determine the inspection report numbers for review.
- D. Each inspection report that corresponds to the random numbers will be marked for review, the inspection report printed and the video copied to the QA/QC directory.
- E. Each selected inspection report will be reviewed in detail against the inspection digital video.
- F. Each field that is populated and those that should have been populated will be counted to produce a "number of fields checked" for the required header information and detailed inspection information. The fields with errors, or missing data, regardless of the error will be totaled to determine the "error count". The accuracy level will then be calculated as follows: $100 - ((\text{error count} / \text{number of fields checked}) * 100) = \text{accuracy percentage}$.

- G. The percentage accuracy shall be entered onto a graph so that the on-going accuracy of each supervisor (operator) can be seen.
- H. The accuracy of each field supervisor/foreman's data shall exceed 90%.
- I. The Contractor shall submit, along with the inspection deliverables, quality control forms that include a hard copy print out of the inspection reports checked with errors and omissions clearly marked.
- J. The Contractor shall enter the accuracy level calculations in each supervisor (operator) quality control log.

3.05 REJECTION OF WORK

- A. Failure of County QA/QC checks will result in a "quality deficiency" notification to request from the Contractor how the rejected Work shall be addressed.
- B. Failure to notify County prior to field work being performed in accordance with the County notification procedures may constitute rejection of Work that was performed without notification.
- C. Payment shall be withheld for inspection work not passing the County QA/QC check, until such time that the data is re-submitted and verified accurate.
- D. Subsequent failures of County QA/QC checks may result in the County requiring a change in field supervisor.

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
- B. Photographs shall be from locations to illustrate the condition of Construction and state of progress adequately.
- C. Deliver electronic images, to the County.
- D. 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.
- E. 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 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 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; and use of temporary road crossings designed to remain in compliance with federal bridge laws of 20,000 lbs. Single Axle. 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 of 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

pipng 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

- A. 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, warning devices, temporary pavement markings, delineators, etc., to control 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. This Work shall also include all costs associated with the erecting, maintaining, moving, adjusting, cleaning, relocating, and storing the materials necessary to ensure safe movement of vehicular and pedestrian traffic throughout the project area. The Contractor may request that the County approve the detouring of traffic around the Construction area if it is in the best interest of public safety and the County. Detouring shall be limited to normal construction hours and two-way traffic patterns shall be re-established at the end of each workday.
- B. Standard Maintenance of Traffic (Standard MOT) shall be defined as FDOT Design Standards Index Numbers 601, 602, 603, 604, 605, 607, 611, 612, 613, 616, 617, 618, 619, 625, 628, 635 and 660.
- C. Complex Maintenance of Traffic (Complex MOT) shall be defined as FDOT Design Standards, Index Numbers 614, 615, 621 and 622.

1.02 REQUIREMENTS

- A. 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.
- B. Permitting, 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.
- C. The Contractor will ensure all personnel involved in traffic control are properly trained

and capable of communicating with the public during closures and detours. The Contractor may be required to hire off-duty uniformed police officers, in addition to flag persons, to direct and maintain traffic on heavily traveled thoroughfares on which traffic is subject to delays or detours caused by the Contractor's operations. Locations and conditions requiring such uniformed police officers shall be as directed by the County and applicable permits.

- D. 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 approved by the proper governing entity, to the County prior to Delivery Order being issued. Sequence the Work in a manner that will minimize disruption of vehicular and pedestrian access through and around the construction area.
- B. 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:
 - 1. Standard Specifications for Road and Bridge Construction, latest edition including all subsequent supplements issued by the Florida Department of Transportation, (FDOT Spec.).
 - 2. Manual of Traffic Control and Safe Practices for Street and Highway Construction, Maintenance and Utility Operations, FDOT.
 - 3. Right-of-Way Utilization Regulations, Orange County, Florida, latest edition.
- C. All references to the respective agencies in the above referenced standards shall be construed to also include the municipality as applicable for this Work.
- D. 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.
- E. 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 will furnish barricades, warning signs, delineators, pilot cars and other traffic control materials and equipment in accordance with the Manual of Uniform Traffic Control Devices for Streets and Highways published by the United States Government Printing Office.

2.02 FLAG PERSONS

- A. All flag persons used on this Project will adhere to the following requirements:
1. 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.
 2. 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.
 3. 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.
 4. Flag persons will not be assigned other duties while working as authorized flag persons.
 5. 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 adjacent to worksite in writing, with copies to the county, 72-hours in advance of any disruption to their access to those buildings and/or use of public ways adjacent to the buildings or prohibiting the stopping and parking of vehicles.
- B. Before closing any vehicle or pedestrian thoroughfare, the Contractor will give written notice to the County. Notice will be given no less than 72-hours in advance of the proposed closure, or as may be otherwise provided in the accepted Traffic Control Plan, so that the final approval of such closings can be obtained at least 48-hours in advance.

- C. The Contractor is responsible for notifying Fire and Ambulance Departments whenever roads are impassable.
- D. 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 passways will be drained and kept reasonably smooth, and in a suitable condition at all times in order to provide minimum interference to traffic consistent with the prosecution of the Work.
- 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.

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SECTION 01580
PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

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

1.02 SUBMITTALS

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

1.03 PROJECT IDENTIFICATION SIGN

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

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

1.04 INFORMATIONAL SIGNS

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

PART 2 - PRODUCTS

2.01 SIGN MATERIALS

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

PART 3 - EXECUTION

3.01 PROJECT IDENTIFICATION SIGN

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

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

3.02 MAINTENANCE

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

3.03 REMOVAL

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

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SECTION 01610
DELIVERY, STORAGE AND HANDLING

PART 1 - GENERAL

1.01 DESCRIPTION

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

1.02 REQUIREMENTS

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

1.03 DELIVERY

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

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

1.04 STORAGE AND HANDLING

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

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

1.05 SPECIFIC STORAGE AND HANDLING

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

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

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

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01700
PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

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

1.02 SCOPE OF WORK

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

1.03 RELATED WORK

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

1.04 PREREQUISITES FOR SUBSTANTIAL COMPLETION.

When the Contractor considers 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. Deliver tools, spare parts, extra stock, and similar items.
- G. 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.

1.06 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.

1.07 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.

1.08 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 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 counter-sign 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 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. Sheeting 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 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 02571
LIMEROCK BASE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Furnish and install a base course composed of limerock.

1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO) latest edition:
- B. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, latest implemented edition.

1.03 QUALITY ASSURANCE

- A. Density, thickness, and moisture content shall be determined and tested in accordance with this specification.

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. Lime rock 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. The minimum of carbonates of calcium and magnesium in the limerock material shall be 70%.
- B. The maximum percentage of water-sensitive clay mineral shall be 3%.

- C. The liquid limit shall not exceed 35 and the material shall be non-plastic.
- D. Limerock material shall not contain cherty or other extremely hard pieces, lumps, balls, or pockets of sand or clay size material in sufficient quantity as to be detrimental to the proper bonding, finishing, or strength of the limerock base.
- E. At least 97% (by weight) of the material shall pass a 3-1/2-inch sieve and the material shall be graded uniformly to dust. The fine material shall consist entirely of dust of fracture. All crushing or breaking-up which might be necessary in order to meet such size requirements shall be done before the material is placed on the road.
- F. Limerock shall have an average LBR of not less than 100.

PART 3 - EXECUTION

3.01 GENERAL

- A. The limerock shall be transported to the point where it is to be used, over rock previously placed if practicable, and dumped on the end of the preceding spread. Hauling over the subgrade and dumping on the subgrade will be permitted only when, in the County's opinion, these operations will not be detrimental to the base.

3.02 SPREADING LIMEROCK

- A. The limerock shall be spread uniformly. All segregated areas of fine or coarse rock shall be removed and replaced with properly graded rock.
- B. When the specified compacted thickness of the base is greater than 6-inches, the base shall be constructed in 2 courses. The thickness of the first course shall be approximately one-half the total thickness of the finished base, or enough to bear the weight of the construction equipment without disturbing the subgrade.
- C. All operations for constructing limerock base for shoulder construction at any particular location shall be done prior to placing the final course of pavement on the traveled roadway. In the construction of limerock base on the shoulders, the Contractor shall assure that the dumping of the limerock material shall be at such points and in such manner, that no significant material is allowed on the adjacent pavement, to scar or contaminate the pavement surface. Any limerock material which is deposited on the surface course for any reason shall be immediately swept off.

3.03 COMPACTING AND FINISHING BASE

- A. For single course base, after the spreading is completed the entire surface shall be scarified and then shaped so as to produce the required grade and cross section after compaction.

- B. For double course base, the first course shall be cleaned of foreign material and bladed and brought to a surface cross section approximately parallel to that of the finished base. Prior to the spreading of any material for the upper course, the density tests for the lower course shall be made and the County shall have determined that the required compaction has been obtained. After the spreading of the material for the second course is completed, its surface shall be finished and shaped so as to produce the required grade and cross section after compaction, and free of scabs or laminations.
- C. When the material does not have the proper moisture content to insure the required density, wetting or drying will be required. When water is added it shall be uniformly mixed in by disking to the full depth of the course which is being compacted. Wetting or drying operations shall involve manipulation, as a unit, of the entire width and depth of the course which is being compacted.
- D. As soon as proper conditions of moisture are attained the material shall be compacted to a density of not less than 98% of maximum density as determined by AASHTO T-180. The minimum density which will be acceptable at any location outside the traveled roadway (such as intersections, crossovers, turnouts, shoulders, etc.) shall be 98% of such maximum.
- E. At least 3 density determinations shall be made on each day's final compaction operations on each course and the density determinations shall be made at more frequent intervals if deemed necessary by the County. During final compaction operations, if grading of any areas is necessary to obtain the true grade and cross section, the compacting operations for such areas shall be completed prior to making the density tests on the finished base.

3.04 CORRECTION OF DEFECTS

- A. If at any time the subgrade material should become mixed with the base course material, the Contractor shall without additional compensation dig out and remove the mixture, reshape and compact the subgrade, and replace the materials removed with clean base material.
- B. If cracks or checks appear in the base, either before or after priming, which in the opinion of the County would impair the structural efficiency of the base, the Contractor shall remove the cracks or checks by re-scarifying, reshaping, adding base material where necessary, and re-compacting.

3.05 TESTING SURFACE

- A. The finished surface of the base course shall be checked with a template cut to the required crown and a 15-foot straightedge placed parallel to the center line of the road. Both templates shall be provided by the Contractor. All irregularities greater than 1/4-inch shall be corrected by scarifying and removing or adding limerock as required, after which the entire area shall be re-compacted.

3.06 PRIMING AND MAINTAINING

- A. The prime coat shall be applied when the base meets the specified density requirements and moisture content in the top half of the base does not exceed 90% of the optimum moisture of the base material. At the time of priming, the base shall be firm, unyielding, and in such condition that no undue distortion will occur.
- B. The Contractor shall be responsible for assuring that the true crown and template are maintained, with no rutting or other distortion, and the base meets all the requirements at the same time the surface course is applied.

3.07 THICKNESS REQUIREMENTS

- A. Thickness of the base shall be measured in intervals of not more than 200-feet. Measurements shall be taken at various points on the cross section, through holes not less than 3-inches in diameter.
- B. Where the compacted base is deficient by more than 3/8-inches from the thickness called for in the Drawings, the Contractor shall correct such areas by scarifying and adding limerock. The base shall be scarified and limerock added for a distance of 100-feet in each direction from the edge of the deficient area. The affected areas shall then be brought to the required state of compaction and to the required thickness and cross section.

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 are 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 50-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, DRIVEWAYS, CURBS AND GUTTERS

PART 1 - GENERAL

1.01 DESCRIPTION

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

1.02 QUALITY ASSURANCE

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

1.03 SHOP DRAWINGS AND SUBMITTALS

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

1.04 JOB CONDITIONS

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

1.05 GUARANTEE

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

PART 2 - PRODUCTS

2.01 GENERAL

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

2.02 CONCRETE MATERIALS

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

2.03 CONCRETE MIX, DESIGN, AND TESTING

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

PART 3 - EXECUTION

3.01 CONCRETE SIDEWALK, DRIVEWAY, AND CURB AND GUTTER

A. Surface Preparation:

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

B. Form Construction:

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

C. Concrete Placement:

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

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

D. Concrete Finishing:

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

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

E. Curing:

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

F. Repairs and Protections:

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

3.02 FIELD QUALITY CONTROL

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

END OF SECTION

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SECTION 02578

SOLID SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

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

1.02 SHOP DRAWINGS AND SUBMITTALS

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

PART 2 - PRODUCTS

2.01 GENERAL

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

2.02 GRASS SOD

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

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

2.03 FERTILIZER

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

2.04 WATER FOR GRASSING

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

PART 3 - EXECUTION

3.01 PREPARATION OF GROUND

- A. The area over which the sod is to be placed shall be scarified or loosened 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.
- B. The area needs to be graded so as to eliminate high and low areas where they didn't exist before construction asking into account the thickness of the sod being placed so it is placed at the same height as the existing surrounding grass or the same height as prior to construction.

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. Sod should not protrude above or below existing surrounding sod after being placed and tamped.
- 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 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 manhole.
- 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, 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 pipe 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 on the cleaning report form.
- C. The designated sewer pipe segment 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. Cleaning of sewers and laterals consists of any number of jet nozzle passes required to remove debris to a County acceptable level as necessary to perform a thorough television inspection of the sewer.
 - b. 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. 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.

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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 on digital media storage devices acceptable to the county 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 a digital media storage device acceptable to the county. 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 digital media storage device acceptable to the county 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 pipe segments 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 inspections on a digital media storage device acceptable to the county, with each pipe segment 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 digital media storage device acceptable to the county. 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. Media Device 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. Media Device Identification number
 - i. Recording clock 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 prior to lowering the camera, down the manhole, and 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 from the upstream to downstream direction, with the flow. 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-foot.
 - 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 pipe segment 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-foot 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 digital media storage device acceptable to the county, 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 PACP 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 weekly as specified in 3.11, I, and 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 the digital media storage devices shall have typed labels attached to the face of each device. 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 a digital media storage device acceptable to the county.

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 digital media storage devices for the video recordings to be determined by county.
- 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 digital media storage device acceptable to the county. Each device shall be filled with as much data as practical to minimize the number of devices submitted. Sections of a single segment of sewer main shall not be recorded to more than one (1) device. 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, all or portions of the data shall be delivered to the County on a digital media storage devices acceptable to the county labeled with project information. The device shall clearly indicate the date of the inspection, the designated segment(s) of sewer mains(s) contained on the device, the name of the project, the project CIP number, the pump station number, and Contractor name. The media device 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, and 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
TELEVISISING 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 a media storage device acceptable to the county, 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 media storage device is acceptable.

1.03 SOFTWARE

- A. The Contractor shall utilize a NASSCO Pipeline Assessment Certification Program (PACP/LACP 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 a digital media storage device that is acceptable to the county.

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 a digital media storage device acceptable to the county. 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 02764
TELEVISION EXISTING MANHOLES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall perform visual inspections of the existing manholes and record any defect discovered. The visual inspection shall include surface photo, manhole cover and frame, chimney, walls, invert, and all appurtenances.
- B. The nature of the inspections shall be to verify the physical condition of the manhole and to provide a permanent record of the existing condition as it relates to dimensions, materials, obstructions, breakage, connections, and deterioration. Inspections may be performed by personnel entry or from the surface utilizing pole mounted camera equipment to visually inspect the chimney, cone, wall, bench, pipe seals and invert conditions, and conditions of connecting pipes.

1.02 REQUIREMENTS

- A. The Contractor shall inspect the manhole surroundings and the manhole interior using visual means and a digital camera for documentation.
- B. All inspections shall be recorded on Orange County standard manhole forms.
- C. All inspection forms shall be scanned and submitted as .PDF files.
- D. All inspection data shall be entered into a NASSCO Manhole Assessment Certification Program (MACP) compliant database provided by the County. The database shall be submitted along with the scanned .PDF files and all digital photographs in .JPG format.
- E. The inspection photographs, report documents, and inspection database shall be in accordance with County data standards and NASSCO MACP. Where discrepancies exist between MACP and County standards, the County standards shall be used.
- F. Contractor shall maintain a copy of all report materials. The Contractor shall provide comments as necessary to fully describe the existing condition of the manhole on the inspection forms.
- G. Contractor shall be responsible for modifications to equipment and/or inspection procedures to achieve County report requirements.
- H. No Work shall commence prior to approval of the submitted materials by the County. Once accepted, the report materials 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 inspection supervisor shall be NASSCO PACP/MACP certified. Use of PACP/MACP certified technicians to review/document defects in the office (post process) is not acceptable.
- C. The CCTV Contractor must have an internal quality assurance/quality control (QA/QC) 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.

A QA/QC shall be performed by NASSCO MACP and PACP certified personnel.

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."
- B. The following deliverables shall be submitted at the completion of inspection:
 - 1. Electronic version (.pdf) of the manhole inspection reports
 - 2. Populated Orange County Standard manhole inspection database (.mdb or Excel) saved on CD-R's, DVD, or portable hard drives.
 - 3. Inspection digital photographs in JPEG format saved on CD-Rs, DVD or portable hard drives.
 - 4. QA/QC report
- C. The above deliverables shall be submitted to the County for approval.
- D. The manhole inspection reports and database shall be in accordance with County data standards and NASSCO MACP.

1.05 NOTIFICATION

The Contractor shall notify the County a minimum of 48-hours prior to performing any inspection work. The County may be present during part or all of the inspections. No payment will be made for inspections performed without proper schedule notification.

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 DIGITAL CAMERA FOR REMOTE INSPECTIONS

All manhole photographs required as part of this specification shall be obtained using a minimum 2-megapixel digital camera with strobe flash capable of producing digital images with minimum resolution of 640 x 480.

PART 3 - EXECUTION

3.01 GENERAL

- A. The inspection crew shall mobilize to the site of the manhole inspection and immediately establish traffic control measures per Orange County Public Works (OCPW) and Florida Department of Transportation (FDOT) requirements as well as any measures required to protect pedestrians. The crew shall inspect each manhole and record required information.
- B. All manhole structures shall be located. Metal detectors shall be used to locate buried manholes. Once a buried manhole has been located, it shall be marked with paint and/or flagging, if necessary. All pertinent information available shall be recorded including area photo, address, etc. Contractor shall notify the County weekly with a list of those manholes that could not be fully inspected due to access issues. The County may arrange to have some or all these manholes exposed, or otherwise made accessible for full inspection. The County will notify Contractor of the status and may authorize re-inspection.

3.02 MANDATORY INSPECTION HEADER INFORMATION

- A. Once the manhole is located, the following mandatory information shall be recorded on the inspection form (template is located in the forms section). Note that the mandatory fields noted below are more inclusive than the MACP requirements. All available information shall be collected and recorded for those manholes that are buried, could not open, surcharged, etc.
 - 1. Manhole Number (County standard Asset Number)
 - 2. Sheet number
 - 3. Purchase Order No.
 - 4. Date
 - 5. Time
 - 6. Surveyor's Name
 - 7. Certification Number
 - 8. System owner
 - 9. Locality (Orange County)
 - 10. Drainage area (tributary Pump Station Number)
 - 11. Map number
 - 12. Location (street number and name)
 - 13. Downstream pipe length (feet)
 - 14. Rim to grade (nearest 0.1 foot)
 - 15. Pre-cleaning method (using approved MACP codes)

16. Location code (using approved MACP codes)
17. Manhole surface type (using approved MACP codes)
18. Potential for runoff (using approved MACP codes)
19. Access point type (using approved MACP codes)
20. Inspection status (using approved MACP codes)
21. Area photo image reference (using County standard naming convention)
22. Internal photo image reference (using County standard naming convention)

3.03 MANHOLE COMPONENT OBSERVATIONS

- A. The inspection crew shall complete all fields within the manhole component/observation section of the inspection form. The following information shall be collected:
 1. Cover type (solid, vented, bolted)
 2. Cover size (top surface diameter in inches)
 3. Cover material
 4. Number of vent holes
 5. Cover/Frame fit (cover to frame fit, MACP codes)
 6. Cover condition (MACP codes)
 7. Cover insert type
 8. Cover insert condition
 9. Frame condition
 10. Frame seal condition
 11. Frame offset distance
 12. Frame seal inflow
 13. Wall material
 14. Interior wall coating
 15. Wall diameter
 16. Bench present
 17. Channel installed
 18. Additional remarks relevant to the manhole

3.04 MANHOLE INTERIOR INSPECTION

- A. The inspection crew shall determine the types of defects within the manhole, document each defect on the manhole form and take a photograph of each defect. The manhole chimney, cone, wall, bench, and channel shall be inspected for structural integrity, signs of inflow/infiltration and the presence of roots. All documentation shall follow NASSCO MACP standards. Each defect will be documented on the inspection form with the following information:
 1. Defect number
 2. Component of manhole containing defect
 3. Defect code (using approved MACP codes)
 4. Image Reference (using County approved file naming structure)

3.05 CONNECTING PIPE DETAILS

- A. Each pipe entering and exiting the manhole shall be photographed where possible and inspected to determine diameter, pipe material, debris levels, and rim to invert distance (to 0.1-feet). The pipe inspection will include the following information:
 - 1. Pipe photo (using County approved file naming structure)
 - 2. Pipe direction (incoming or outgoing)
 - 3. Pipe clock positions (6:00 position = outgoing)
 - 4. Pipe diameter
 - 5. Pipe material (using PACP codes)
 - 6. Rim to invert distance (measured to nearest 1/10th of a foot)
 - 7. Pipe special condition (drops, force mains, etc. using approved MACP codes)
 - 8. Debris depth
 - 9. Connecting structure number; if manhole or cleanout, service line clock position, stubout clock position, etc.
 - 10. Pipe seal condition (using approved MACP codes)
 - 11. Pipe seal roots (using approved MACP codes)
 - 12. Observed pipe defects, obstructions, roots, etc. (using PACP codes)

3.06 MANHOLE SKETCH, MAP UPDATE, AND NOTES

The inspection crew shall complete the manhole plan view sketch noting all connecting pipes. Any special observations or notes may be added to the profile sketch on the field form.

Influent and effluent lines in each manhole shall be compared to the existing map and corrections noted in the sketch section of the field form.

3.07 NOTIFICATION OF EMERGENCY CONDITIONS

Inspection crews shall immediately notify the County and/or on-site inspector of any defects posing imminent danger to the public (missing lids, covers broken during inspection, sink holes, etc.) and any observed pipe blockages or potential overflow conditions.

3.08 COMPLETION

- A. Once the inspection is complete the field crew shall make certain the ring is clean and does not have any debris preventing a proper cover fit. The manhole lid shall be replaced and any displaced items moved back into place.
- B. A list of manholes that could not be fully inspected, along with the problem explanation, shall be forwarded to the County weekly throughout the inspection work.
- C. If the Contractor has completed accessible inspections, and the County authorizes, then Contractor may be required to re-mobilize at the same unit price and complete the requested inspections. All re-inspections will be at the same contracted unit price.

- D. Any map updates shall be consolidated and forwarded to the County with the submitted inspections.

3.09 PHOTOGRAPH REQUIREMENTS

- A. During each inspection the following series of photographs shall be taken:
 - 1. Area Photograph: During the inspection, a photograph shall be taken of the manhole cover showing location within the roadway, shoulder, or easement as appropriate. Photographs shall be taken of any indications of previous overflows such as watermarks and paper or other debris typical of sewer overflows. Surface photographs shall be oriented in the direction of the outgoing pipe to show the pipeline cover and easement condition. The area photographs should show the manhole visible in the foreground where possible. A minimum of 1 area photo is required.
 - 2. Internal Photograph: Take a photograph of the manhole interior in plan view showing the general arrangement of the incoming and outgoing sewers, manhole walls, and other appurtenances. The internal condition photograph shall be oriented with the direction of the outgoing main line flow at the bottom of the photograph (6:00 position). A minimum of 1 internal photograph is required.
 - 3. Manhole Defect Photographs: During manhole inspections digital photographs shall be taken of all defects. Photographs must clearly and accurately show each defect and correspond to defects and photo numbers logged on the manhole inspection form. A minimum of 1 photo for each observed defect is required.
 - 4. Connecting Pipe Photographs: The camera should then be pointed into all incoming and outgoing pipes where possible to capture general conditions within the pipes. Any obvious blockages or defects should be noted using PACP defect codes. A minimum of 1 photo of each incoming or outgoing pipe is required.
- B. During inspections manholes shall be free of steam, fog, water vapor, or other conditions that will impact the quality of photographs.
- C. All photographs shall adequately capture the manhole conditions and details of defects. Lighting and camera quality shall provide a clear, in-focus picture of the manhole interior, manhole defects, and manhole. The lighting shall provide uniform light free from shadows or hot spots.
- D. If larger than 640 x 480 resolution, then photo will be converted to 640 x 480. Photos less than 640 x 480 are not acceptable and converting upward to 640 x 480 is not acceptable. All photographs shall be resized to 640 x 480 resolution to minimize file size.
- E. The images shall be kept electronically, copied to a CD, DVD, or external hard drive, and submitted with the inspection forms per paragraph 3.06. Photographs shall be named according to the photograph naming conventions included herein.
- F. All digital photographs shall be referenced on the manhole inspection form and electronic spreadsheet/database.

G. All digital photographs shall be renamed in accordance with the following photo file naming convention:

1. Area Photo = Manhole ID, A, Photo Number, jpg
Example: 3965002A0001.jpg
Manhole: 39650002
A=Area Photo
Photo No.0001
2. Internal Photo = Manhole ID, I, Photo Number, jpg
Example: 3965002I0001.jpg
Manhole: 3965002
I=Internal Photo
Photo No.0001
(Note: Photo oriented with the outgoing pipe on the bottom)
3. Manhole Defect Photo = Manhole ID, M, Photo Number, jpg
Example: 3965002M0015
Manhole: 3965002
M=Manhole Defect Photo
Photo No. 0015
4. Pipe Photo = Manhole ID, P, Photo Number, jpg
Example: 3965002P0002.jpg
Manhole: 3965002
P=Pipe Photo
Photo No. 0002

3.10 MANHOLE NUMBERING, INSPECTION FORMS AND DEFECT CODES

The Contractor shall use the County manhole numbering system when performing the inspections for this Project. Manhole numbers will be provided by the County.

Defect codes shall conform to those specified in the NASSCO MACP specification. Standard Orange County manhole defect codes (a subset of MACP) are included along with a standard manhole inspection form at the end of this specification.

3.11 SITE RESTORATION

After inspecting manholes in an area, the work site shall be cleaned and restored to pre-Work conditions. If manhole is buried and exposed, then restore site by placing material back over exposed manhole. No re-sodding is anticipated or included in the pricing.

3.12 DELIVERABLES

The Contractor will be required to submit the following deliverables at the completion of inspection.

- A. Scanned Field Inspection Reports to include:
1. Inspection session header information (see required fields above)
 2. Component observations

3. Manhole inspection details including defects observed and photo image references
4. Connecting pipe details
5. Manhole plan view sketch
6. Format:
 - a. Adobe Acrobat PDF files: 1 report PDF per manhole
 - b. File name: <MH ID> <Date (year_mo_day format)>.PDF

Example: 30060002_2010_02_16.pdf

- B. Inspection digital photograph in County approved format and resolution, and assigned file names in accordance with the County standard.
- C. Electronic Inspection Data stored and exported in County approved NASSCO Manhole Assessment and Certification Program (MACP) compliant Microsoft Access database (.MDB) version 4.4, or Excel file delivered on DVD or portable hard drive.
- D. Marked up field maps detailing map corrections and/or discrepancies noted during inspection.
- E. All digital files shall be submitted on DVD or portable hard drive, labeled as follows:
 1. DVD/Hard drive Labels: Typed labels shall be attached to the face of each DVD. The typed index labels shall include the following information:
 - a. Content (Manhole Inspections)
 - b. Contractor name
 - c. Purpose of Survey (CIP R/R)
 - d. Tributary Pump station number
 - e. Manholes included (listing of manholes using County standard Asset Numbers)
 - f. Date of survey
 - g. Contract Number / Delivery Order Number (if applicable)
 - h. QA/QC report including listing of manhole inspections reviewed and results.

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 in the . 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
 - D1222 – 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, reach length, 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. Manufacturers 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 (CIPP Liner), National Liner (CIPP Liner), LMK Enterprises (Performance Liner), Steven's Technologies (CIPP Liner 2 part 100% epoxy), Inner Cure Technologies (Reichold/Dion CIPP Liner), Lanzo Lining (Lanzo CIPP Lining System), and Premier Pipe (Premier Pipe CIPP Lining System). 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 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 5 ft. 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 tamper proof 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 of 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 miss-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 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.
- C. 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.

- D. 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 WARRANTY INSPECTION

- A. 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 02772
CURE-IN-PLACE PIPE FOR LATERAL RENEWAL

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Renewal of existing sanitary sewer laterals by installation of a resin impregnated flexible felt tube into the existing lateral line utilizing a vertical inversion standpipe and hydrostatic head, pulled in place, or other approved method and curing by circulating hot water or other approved means to produce a hard, impermeable pipe.
- B. Work shall include the installation of cleanouts to access laterals to CCTV specific laterals listed in the Drawings. Contractor shall perform a pre-CCTV inspection of the laterals per Section 02762, "Televising Sanitary Sewers". County will determine upon review of the CCTV inspection which laterals will be renewed or replaced.
- C. Post CCTV inspection after renewal as per Section 02762 "Televising Sanitary Sewers."

1.02 INSTALLER EXPERIENCE AND QUALIFICATIONS

- A. These qualifications shall include detailed descriptions of the following:
 - 1. To be acceptable, the contractor must have a minimum of 1,500 lateral liner installations in Florida.
 - 2. To be acceptable, the contractor must have had a minimum of 3-years active experience in the commercial installation of the lateral lining.

1.03 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. The Contractor shall provide a bypass pumping plan to the County for approval prior to the start of bypass operations.
- 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.

1.04 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. Submit the following:
 - 1. The Qualifications of the installer shall be submitted 1-week prior to Pre-Construction conference.
 - a. Name: business address and telephone number of the Contractor
 - b. Name(s) of all supervisory personnel to be directly involved with this project
 - c. 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.
 - d. Specialty technicians shall be certified by the equipment manufacturer and/or its authorized representative. Certifications shall be submitted to the County/Professional.
 - e. The Contractor shall provide his references of previous project lists going back 3-years including his customer's names, owner's contact name, phone number, owner's project number, County's project name and the list must include the number of laterals rehabilitated as well as the number and type of connection seals installed.
 - 2. Certified copies of test reports of factory tests required by the applicable standards and this Section.
 - 3. Manufacturer's installation instructions and procedures
 - 4. Contractor's procedures and materials for service renewal including time and duration of sewer service unavailability
 - 5. The thickness calculations, signed and sealed by a Professional Engineer registered in the State of Florida and certified by the manufacturer as to the compliance of his materials to the values used in the calculations shall be submitted to the County prior to CIPP installation.
 - 6. Sampling procedures and locations for obtaining representative samples of the finished liner.
 - 7. Both a pre-lining and post-lining digital data video shall be submitted for review and approval. The digital data video shall be clearly and properly labeled. A digital data video and suitable log shall be prepared by the Contractor during the Work and provided for review.

- C. A final certificate of compliance with this specification shall be provided by the manufacturer for all lining material furnished. Tests for compliance by an independent laboratory shall be made according to the applicable ASTM specification and the manufacturer's quality control program.
- D. Furnish an extended warranty for liner materials from the Contractor and liner manufacturer for a total of one (1) year from date of acceptance.
 - 1. If, at any time during the warranty period, any leakage, cracking, loss of bond, or other discontinuity is identified, the Contractor shall make repairs acceptable and at no additional cost to the County.
- E. As part of the design calculation submittal, 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 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. This information shall be submitted in a timely fashion prior to construction. The minimum liner thickness is for materials with characteristics as shown. Bidders with materials with other characteristics must supply complete information in their bids of the values as listed for ascertaining minimum thickness.

1.05 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.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The system proposed (materials, methods, workmanship) must be proven through previous successful installations to an extent and nature satisfactory to the County that is consistent with the size of the project being proposed. Since CIPP is intended to have a minimum 50-year design life, only products deemed to have this performance will be accepted.
- B. All CIPP lining products shall comply with the latest versions of ASTM D5813 and ASTM F1216 or ASTM F1743, including appendices.

2.02 STRUCTURAL REQUIREMENTS

- A. The liner shall be fabricated to a size that when installed will neatly fit the internal circumference of the conduit to be repaired as specified by the County.

- B. The minimum required structural CIPP wall thickness shall be based on the physical properties described above and in accordance with the design equations in the appendix of ASTM F 1216, and the following design parameters:

Design Considerations	Criteria
Tube Design	ASTM F 1216 Appendix X1
Design Safety Factor	2.0
Retention Factor for Long Term Flexural Modulus to be used in Design	50 %
Ovality	2 %
Groundwater Depth = Pipe Depth (above invert)*	100% depth from pipe to surface
Lining enhancement factor	7 maximum
Soil Modulus	1,000 psi
Soil Density	120 pcf
Live Load	One (1) H20 passing truck
Design Condition	Fully deteriorated

- C. Each CIPP shall be designed to withstand internal and/or external loads as dictated by the site and pipe conditions. When not specified by the County in the contract documents, the design thickness of the CIPP shall be arrived at using standard engineering methodology as found in ASTM F1216. In no case shall the finished thickness of the cured liner be less than three millimeters. 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 thickness calculations, signed and sealed by a professional engineer registered in the State of Florida, shall be submitted to the County prior to CIPP installation.
- D. 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. The CIPP design for the lateral tube shall assume no bonding to the original pipe, in accordance with ASTM F1216. Any reoccurrence may be cause for rejection of the work. The cured liner shall meet TABLE 02772 - 1 Minimum Physical Properties.

**TABLE 02772- 1
Minimum Physical Properties**

Physical Characteristics	Test Procedure	Minimum Value
Flexural Strength	ASTM D790	4,500-psi
Flexural Modulus	ASTM D790	250,000-psi
Flexural Modulus (50-year)	ASTM D790	125,000-psi

2.03 MATERIALS

A. Lateral Liner Tube

1. The sewer service lateral liner shall be a single piece liner that lines the lateral and be a contiguous part of the mainline. The tube shall consist of 1 or more layers of a flexible needled felt or an equivalent non-woven or woven material, or a combination of non-woven and woven materials, capable of carrying resin, withstanding installation pressures and curing temperatures. The tube should be compatible with the resin system to be used on this project. The material should be able to stretch to fit irregular pipe sections and negotiate bends. Projected changes in groundwater level, temperature and other loading factors shall cause no significant changes in the service characteristics or service life of the sewer pipe liner. The liner will be continuous in length and the wall thickness shall be uniform. The tube will be capable of conforming to offset joints, bells, and disfigured pipe sections. The mainline liner will be flat with one end overlapping the second end and sized accordingly to create a circular lining equal to the diameter of the mainline pipe. The resin will be polyester or vinyl ester with proper catalysts as designed for the specific application. The cured-in-place pipe shall provide a smooth bore interior. Installation will be accomplished remotely using air or water for inversion and curing. The cured pipe repair system shall be watertight and shall conform to the existing pipe and eliminate any leakage or connection to the outside of the host pipe/service.
2. The liner shall be polyester fiber felt tubing saturated with an epoxy vinyl ester or polyester resin prior to insertion which when cured, will be chemically resistant to reagents as defined in ASTM F1216, ASTM F1743, and ASTM D543 as applicable.
3. The system proposed (materials, methods, workmanship) must be proven through previous successful installations to an extent and nature satisfactory to the County that is consistent with the size of the project being proposed. Since CIPP is intended to have a minimum 50-year design life, only products deemed to have this performance will be accepted.
4. The lateral liner shall be fabricated under controlled conditions to a size that, when installed, will tightly fit the internal circumference and the length of the original conduit. Allowances should be made for the longitudinal and circumferential stretching that occurs during placement of the tube. Maximum stretching allowances shall be as defined in ASTM F1216 or ASTM F1743. The Contractor shall verify the lengths in the field before cutting the liner to length. 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.
5. All CIPP lining products shall comply with the latest versions of ASTM D5813 and ASTM F1216 or ASTM F1743, including appendices.
6. The tube shall be uniform in thickness and when subjected to the installation pressures shall meet or exceed the designed wall thickness
7. Any plastic film applied to the tube on what will become the interior wall of the finished CIPP shall be compatible with the resin system used, translucent enough that the resin is clearly visible, and shall be firmly bonded to the felt material.

8. At time of manufacture, each lot of liner shall be inspected and certified to be free of defects. The tube shall be marked for distance at regular intervals along its entire length, not to exceed 5-feet. Such markings shall also include the Manufacturer's name or identifying symbol.
9. Liners may be made of single or multiple layer construction where any layer must not be less than 1.5-mm thick and total minimum thickness is 3.0-mm. A suitable mechanical strengthener membrane or strip may be placed in between layers where required to control longitudinal stretching.

B. Resin Components

1. The resin system shall be a corrosion resistant epoxy vinyl ester or polyester that when properly cured within the tube composite meets the minimum requirements given herein or those that are to be utilized in the design of the CIPP for this project. The catalyst system may be accelerated to promote curing.
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.

C. Interface Seal

1. The interface seal shall be a polyester impregnated, corrosion resistant fiberglass insert. The seal shall be of 1-piece construction and shall be designed such that when expanded shall tightly fit both T and Y connections at the interface between the mainline and lateral sewer. The seal shall extend into the mainline a minimum of 4-inches and shall provide a minimum of a 3-inch overlap inside the mainline pipe and be of equal thickness as the lateral liner at the interface.
2. An epoxy sealant rated for piping applications shall be applied to the seal to ensure that any gap between the interface of the mainline pipe and the CIPP lateral lining is air and watertight.

PART 3 - EXECUTION

3.01 DETERMINATION OF LATERALS TO BE LINED OR REPLACED

- A. Install cleanouts to access laterals for CCTV inspection for the specific laterals listed in the Drawings.
- B. Contractor shall perform a pre-CCTV inspection of the laterals per Section 02762, "Televising Sanitary Sewers". County will determine upon review of the CCTV inspection the quantity of laterals which will be renewed.
- C. After completing the video inspection, the Contractor shall provide the CCTV videos to the County for review and to determine which laterals requires renewal or replacement.

3.02 GENERAL

- A. The Contractor shall carry out his operations in strict accordance with all OSHA, State, local, and manufacturer's safety requirements. Particular attention is drawn to those safety requirements involving entering confined spaces. Curing with pressurized steam creates additional safety concerns with regard to high temperatures, quick burn times, potential blow offs, etc. Contractors shall take additional precautions to insure the safety of everyone nearby curing mechanisms.
- B. It is the intent of this specification to provide for the renewal of sewer service laterals by the installation of a resin-impregnated flexible tube and a mainline/lateral connection seal. The tube is either inverted or pulled into the original service lateral through a newly installed cleanout and then expanded to fit tightly against the lateral by the use of water or air pressure. The resin system shall then be cured by elevating the temperature of the fluid (water/air) used for the inflation to a sufficient enough level for the initiators in the resin to effect a reaction. The finished pipe shall be such that when the thermosetting resin cures, the total wall thickness shall be a homogeneous and monolithic felt and resin composite matrix that will be chemically resistant to withstand internal exposure to domestic sewage.
- C. The system shall be provided with a seal at the mainline/lateral interface. The finished seal shall be such that when the thermosetting resin cures, the seal bonds to the lateral liner forming an airtight and watertight interface and will provide chemical resistance to domestic sewage.
- D. The Contractor shall deliver the liner to the site and provide all equipment required to insert the liner into the host pipe and cure it in place. The Contractor shall designate a location where the tube will be vacuum impregnated prior to installation. The Contractor shall notify the County at least 72-hours prior to wet out to allow the County to observe the materials and wet out procedure. All procedures to prepare the liner for installation will be in strict accordance with the manufacturer's recommendations. Any material not properly prepared shall be rejected and replaced with acceptable materials at the Contractor's expense.
- E. The liner shall be impregnated with resin and stored according with manufacturer recommendations.

3.03 PREPARATION

- A. The Contractor shall notify all residents affected by this construction at least 24-hours prior to any service disruption affecting their service connection. The mainline sewer shall be kept in operation during the lateral lining operations. Customers shall be notified by the Contractor with door hanger advising the customers of when the Work will begin, expected date of completion, the type of work and contact person for any questions.
- B. The Contractor shall install a cleanout at the respective right-of-way line, property line or easement line prior to or immediately after the lining procedure. Cleanouts shall be installed per the County's requirements as shown on the drawings and specified herein.

- C. The Contractor shall perform cleaning of the lateral and affected areas of the existing sewer line in accordance with the liner manufacturer's recommendations, videotaping, and inspection prior to installation of the CIPP lateral. The Contractor, when required, shall remove all internal debris out of the pipeline that will interfere with the installation of the CIPP. The Contractor shall provide an appropriate dumpsite for all debris removed during the cleaning operations. 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. It shall be the responsibility of the Contractor to notify the County of line obstructions, offset joints, or collapsed pipe that will prevent the insertion of the tube or significantly reduce the capacity of the lateral. The County with input from the Contractor shall determine the method of pipe repair required and shall address these concerns on a case-by-case basis.
- E. Protruding laterals or services shall be trimmed flush with the inside of the main sewer wall prior to lining. Trimming shall not cause damage to the lateral or service beyond the inside face of the main sewer.

3.04 PRETREATMENT 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 require a pretreatment plan to remove the regulated chemicals to acceptable levels prior to discharge. The Contractor shall submit the pretreatment 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.

3.05 BYPASS PUMPING

- A. When the flow demand on the lateral dictates that bypass pumping is required, the Contractor shall furnish all necessary pumping equipment, conduit, etc. to adequately and safely divert sewage flow around the Work in a manner approved by the County and as set forth in Section 01516 "Collection System Bypass." No flow shall be discharged on the surface, into storm sewers, in ditches, or in waterways.
- B. 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.

3.06 CLEANING SEWER LINES

- A. Prior to any lining of a pipe so designated, 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 Section 02761 "Cleaning Sanitary Sewer Systems." Both mainline and lateral line shall be cleaned.
 1. 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.
 2. 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.
 3. 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.
 4. The County shall inspect the prepared pipe for cleanliness and smoothness before the Contractor is authorized to proceed with pipe lining operations.
- B. Pipe Preparation: The liner method must be compatible with the existing mainline pipes interior coatings or materials that could cause a separation or a natural joint because of the lack of adhesion.

3.07 PRE AND POST TELEVISION INSPECTION

- A. Television survey shall be performed in accordance with Section 02762 "Televising Sanitary Sewer Systems", including Pre-construction and Post-construction Surveys. The Contractor shall provide television equipment capable of properly documenting the conditions as found within the lateral. The camera equipment shall be capable of launching into the full length of each lateral and providing an accurate picture of the lateral to be lined. Lighting for the camera shall illuminate the entire periphery of the lateral.

- B. Both a pre-lining and post-lining digital data video shall be submitted to the County for approval. The Contractor shall launch into each lateral connection on both pre and post inspections. The digital data video shall be clearly and properly labeled. A digital data video and a suitable log shall be prepared by the Contractor during the Work and provided to the County.
- C. 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). There shall be no damage, deflection, holes, delaminating, uncured resin or other visual defects in the liner. The liner surface shall be smooth and free of waviness throughout the pipe. No visible leakage through the liner or at manhole or service lateral connections will be allowed. 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. The Contractor shall not reactivate any section of lined sewer pipe until authorized to do so by the County.

3.08 CIPP LINER INSTALLATION

- A. The CIPP shall be installed in accordance with the practices given in ASTM F1216 (for direct inversion installations) or ASTM F1743 (for pulled-in-place installations). The quantity of resin used for the tube's impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances being made for polymerization shrinkage and the loss of any resin through cracks and irregularities in the original pipe wall. A vacuum impregnation process shall be used in conjunction with a roller system to achieve a uniform distribution of the resin throughout the tube.
- B. The resin-impregnated tube shall be installed into the host pipe by methods approved by the manufacturer and proven through previous successful installations. The insertion method shall not cause abrasion or scuffing of the tube. Hydrostatic or air pressure shall be used to inflate the tube and mold it against the walls of the host pipe. There will be no use of sewage in place of clean water for insertion of the tube, or for the curing of the liner.
- C. The tube is to be installed at a rate sufficient to cause controlled installation of the tube into the conduit. The tube shall be installed in such a manner that no damage is done to the tube.
- D. Should there be any difference between the referenced requirements, the more stringent shall govern. Prior to construction, the Contractor shall submit to the County such written information which shall include, but not be limited to, storage and handling of lateral liner before installation, preparing liner for installation, installing the liner in the sewer lateral, temperature and pressure requirements for inverting and setting the liner, curing and cool down procedures, end seals and service restore.
- E. The Contractor shall have on hand at all times, for use by his personnel and the County, a digital thermometer or other means of accurately and quickly checking the temperature of exposed portions of the liner.

3.09 CURING

- A. After inversion is completed the Contractor shall supply suitable heat source and recirculation equipment. The equipment shall be capable of delivering heat throughout the section to uniformly 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.
- B. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing heat supply. Thermocouples shall be placed between the tube and the host pipe to determine the liner temperature during cure. The water or air temperature in the pipe during the cure period shall be as recommended by the resin manufacturer.
- C. 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 installation process, during which time the recirculation and cycling of the heat exchanger to maintain the temperature continues. The heat source shall be shut down during the post cure.
- D. 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.

3.10 COOL DOWN

- A. Cool down may be accomplished by the introduction of cool water or air into the installation standpipe to replace the initial heating agent. The Contractor shall cool the hardened pipe to a temperature below 100°F before relieving the pressure in the pressure apparatus. A minimum period of post cure shall be maintained under a static head to provide a minimum hoop tension on the tube felt. Care shall be taken in the release of the static head so that a vacuum will not be developed.

3.11 INTERFACE SEAL INSTALLATION

- A. The interface seal between the mainline and the lateral shall be installed by remote device from inside of the sewer main. The seal shall be properly expanded with air pressure to tightly fit the lateral interface.
- B. Seal installation shall be installed in strict accordance with the manufacturer's written specifications, recommendations and these specifications.

- C. The finished seal shall be continuous over the entire interface and be as free as commercially practical from visual defects such as foreign inclusions, dry spots and pinholes. The seal shall be homogeneous, impervious, and free of any leakage from the surrounding ground to the inside of the lined pipe. The interface seal shall not inhibit the post video televising of the mainline or the service lateral pipes.
- D. During the warranty period, any defects which will affect the integrity or strength of the seal, collect solids, or reduce hydraulic flow capabilities of the product shall be repaired at the Contractor's expense in a manner mutually agreed upon by the County and the Contractor.

3.12 CLEANUP

- A. After the installation work has been completed and all testing acceptable, the Contractor shall cleanup the entire project area. The Contractor shall dispose of all excess material and debris not incorporated into the permanent installation. The work area shall be left in a condition equal to or better than prior condition.

3.13 WARRANTY

- A. The County shall conduct the warranty television inspection within 1-year after the date of acceptance. Any defective sections of liner located during the inspection shall be promptly repaired or replaced by the Contractor as directed by the County. In the event that a lateral liner or interface seal is found to be leaking during the inspection, the Contractor shall be required to promptly replace it with a new section of pipe or liner or, if approved by the County, to eliminate the leak(s) by other means of repair.

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 pipes 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 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, 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"

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 02778
PACKER INJECTION GROUTING**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to grout pipeline joints, lateral tap connections, and joints in laterals connected to sewer mains using a packer injection method.
- B. Packer injection grouting is used to reduce the infiltration within the pipeline, seal annular space between liners and host pipes at lateral tap connections, seal pipe joints and prevent further loss of pipe bedding into the pipe.
- C. Packer injection grouting shall be accomplished by pressure injection of chemical grout into the soils encompassing the pipe joint. Chemical grouts are designed to be injected into the soil surrounding the pipe and into the annular space between liners and host pipes, which stabilize the soil and forms a permanent impermeable seal called a soil ring. Adequate volumes of grout must be injected to form an effective seal.

1.02 REQUIREMENTS

- A. This Contract requires work in active sewers and must adhere to all federal, state and local requirements for safety in confined spaces.
- B. Worker safety training should include reviewing the hazards associated with hoses, pumps, tanks, couplers, compressors, bottles, motors, and all other related application apparatus. Additional safety considerations including safely handling, mixing, and transporting of chemical grouts should be provided by the grout manufacturer or supplier or both. Safe operating practices and procedures should describe in detail appropriate personal protective equipment (PPE) for the various grouting operations. Operations should include the proper storage, transportation, mixing, and disposal of grouts, additives, and their associated containers.

1.03 QUALIFICATIONS

- A. CONTRACTOR shall have a history of at least five years of pressure testing and grouting sewers.
- B. All work shall be supervised by a foreman having previously performed pressure testing and chemical grout sealing of a minimum of 3000 sewer pipeline joints and 250 lateral tap connections.

1.04 SUBMITTALS

- A. Chemical grout, grout mixture ratio (including additives), and MSDS sheets.
- B. Equipment operating procedures and systems to be used, including manufacturer's literature on grout pumps, packers, and lateral blockage clearing equipment.
- C. Upon completion of grouting each reach, submit to the County a report showing the following data for each joint tested and/or grouted or attempted to be grouted.
 - 1. Stationing.
 - 2. Time and date.
 - 3. Grout mixture formation, including additives and catalyst mixture formulation and proportion of each. Include procedure for adjusting grout mixture for variations in ambient temperatures and changes of temperature of grout through hoses exposed to the atmosphere.
 - 4. Pumping pressure.
 - 5. Gel time.
 - 6. Quantity of grout (if applicable) used to seal the joint.
 - 7. Post-grout pressure test results.
 - 8. Re-grouting and retesting giving above data as required.
 - 9. Recording cross-reference index.
- D. Calculation of the annular space between the lateral tap connection packer and host pipe, per Article 3.3.G.
- E. Documentation of Post-construction Inspection in accordance with Section 02651.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All grout materials must have the following characteristics:
 - 1. While being injected, the grout must be able to react/perform in the presence of water (groundwater).
 - 2. The cured grout must withstand submergence in water without degradation.
 - 3. The resultant grout formation must prevent the passage of water (infiltration) through the pipe joint.
 - 4. The grout, after curing, must be flexible, under both dry and wet conditions.
 - 5. The grout must not be biodegradable.
 - 6. The cured grout should be chemically stable and resistant to acids, alkalis and organics found in sewage.

7. Materials shall be capable of being pumped through a minimum of 450 feet of ½-inch to ¾-inch diameter hose.
 8. Residual grout shall be easily removable from the sewer line to prevent blockage of the sewage flow.
- B. Handle, formulate, and store grout in conformance with the manufacturer's recommendations. The uncured grout shall be delivered to the Site in unopened containers with the date of manufacture clearly indicated. Do not utilize uncured grout manufactured more than six months prior to the date of application. Immediately remove from the Site any uncured grout compound determined to be more than six months old. Once a container of uncured grout has been opened it shall be used within 72 hours.
 - C. All material shall be clearly dated by the manufacturer. The County shall be provided the opportunity to inspect the Contractor's storage facilities at any time. Any material found to have exceeded its shelf life or found to be stored under improper temperature and humidity conditions, as determined by manufacturer's recommendation, shall be marked rejected, shall not be used and shall be removed from the Site immediately.
 - D. Mix and handle the grout and the constituents producing it, which may be toxic on contact or inhalation, as recommended by the manufacturer and to minimize hazard to personnel. Provide appropriate protective measures to ensure that the grout components and the chemicals produced in mixing are under the control of the Contractor at all times and are not available to unauthorized personnel or others. Dispose of excess grout resulting from sewer grouting operations in a safe manner. All equipment and material shall be subject to the review by the County.
 - E. All grout materials used shall meet the following minimum application requirements:
 1. All component materials shall be easily transportable by common carriers.
 2. Packing of component materials shall be compatible with field storage requirements.
 3. Grout components shall be packed in such a fashion as to provide for maximum worker safety when handling the materials and minimize spillage when preparing for use.
 4. Mixing of the components shall be compatible with field applications and not require precise measurements.
 5. The concentration of the grout and additives shall be within the limits recommended by the manufacturer.
 6. Catalyzation shall take place at the point of injection/repair.
 7. Cleanup shall be done without inordinate use of flammable or hazardous chemicals.

F. Prohibitions

1. Do not use this method to attempt repair of longitudinally cracked pipe, structurally unsound pipe, flattened or out-of-round-pipe.

2.02 SYSTEM DESCRIPTION

- A. Grouting equipment shall consist of two separate pumping systems capable of supplying an uninterrupted flow of sealing materials to completely fill the voids. The gel side of the system shall be a closed system to minimize exposure to moisture. Pumps, fittings and hoses shall be designed to transport a high viscosity material and shall not be affected by acetone or ketone solvents. The sizing of the system shall be such that the water side can transport materials at 1 to 1 or 8 to 10 times the ratio of the gel side. Pumps shall be sized to deliver a minimum of 3 gpm.
- B. Grout shall pass from the pumping system through instant reading, controlled flow meters and then through a dual hose system into the sealing device. The device (referred to hereafter as a packer) shall be a cylindrical case of a size less than pipe size, with the cables at either end used to pull it through the line. The packer device shall be constructed in such a manner as to allow a restricted amount of sewage to flow at all times.
- C. Generally, the equipment shall be capable of performing the specified operations in sewers where flows do not exceed 25 percent of pipe diameter.
- D. Tap and lateral service sealing shall be accomplished with a lateral packer. The objective of the lateral service packer is to seal the tap connection to the main sewer and a portion of the lateral service. The lateral sealing tube shall be designed to accommodate 4-inch and 6-inch diameter laterals and laterals with a transition diameter. Sealing of lateral tap connections directly connected to the mainline sewer shall be completed using a 3-foot long sleeve.
- E. Provide back-up bladders for all packers on-site any time grouting work is being conducted. Equipment for cleaning lateral blockages shall be present on-site any grouting work is being conducted.

2.03 GROUTS

- A. Acrylamide base grout shall have the following characteristics:
 1. A minimum of 12% acrylamide base material by weight in the total grout mix. A higher concentration of acrylamide base material may be used to increase strength or offset dilution during injection.
 2. The ability to tolerate some dilution and react in moving water during injection.
 3. A viscosity of approximately 2 centipoise, which can be increased with additives.
 4. A constant viscosity during the reaction period.
 5. A controllable reaction time from 10 seconds to 1 hour.

6. A reaction (curing) that produces a homogenous, chemically stable, non-biodegradable, firm, flexible gel.
7. The ability to increase mix viscosity, density and gel strength by the use of additives.
8. Product Manufacturer:
 - a. Avanti AV-100; or equal.

2.04 ADDITIVES

- A. Add latex additive (or equal) to strengthen the grout. The quantity of latex additive will be according to the manufacturer recommendation. Adjust the grout admixture to meet specified viscosity and reaction time. Follow manufacturer's recommendations for product handling and start. Latex additive shall have the following characteristics.

Solids Content	49% minimum	ASTM D-1010
pH	7.5-8.5	8.0 Average
Viscosity	130 cps @ 77°F	ASTM D-1638
Density	8.52 lbs./gal.	ASTM D-1564W
Solvent	Water	

1. Shall provide protection against shrinkage and improve the strength of the gel.
 2. Shall not contain organic solvents.
- B. Add a root deterrent chemical such as dichlobenil to the grout in proportions as recommended by the manufacturer.
 - C. Use a shrink control agent that is a water-based emulsion with the grout. The shrink control agent shall reduce shrinkage and improve strength of the grout providing the resultant cured material with both improved hydrostatic pressure resistance and flexibility. The agent shall be added in proportions as recommended by the manufacturer.
 - D. If the County directs that the use of latex is not necessary, add a fluorescent green dye to all grouts so that a visual residual layer of grout remains to provide confirmation that the void was filled during sealing.
 - E. Add gel time extending agent in accordance with the manufacturer's recommendations to extend gel time as necessary. The use of water to increase gel time is not specifically prohibited.
 1. Product Manufacturer:
 - i. Avanti Potassium ferricyanide (KFe); or equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. Remove all roots affecting the long term viability of the grout seal.
- B. Grouting shall be by the injection method or equal. Generally, this shall be accomplished by forcing grout through a system of pumps and hoses into and through the joints of the sewer from the packer within the sewer pipe. Jetting or driving pipes from the surface that could damage or cause undermining of the pipelines, shall not be allowed. Except where specifically shown on the Drawings or called for in the Specifications, do not uncover the pipe by excavation.
- C. Remove excess grout from pipe and laterals. Excess grout shall be defined as a thickness of grout greater than 1/4" at any point or an amount of grout that, in the judgment of the County, could cause a blockage. Flush or push forward to the next downstream manhole, remove from the sewer system, and properly dispose of excess grout. In no case shall excess grout material be allowed to accumulate or flushed down the sewer. For lateral taps, a special lateral jetter launched from mainline is required to remove excess grout after lateral tap sealing.
- D. Do not test or grout pipe joints, lateral tap connections or laterals connected to manholes in the absence of the County.

3.02 SEWER FLOW CONTROL

- A. During grouting, provide sewer flow control so as to provide unimpeded view of the packer.

3.03 GROUT PREPARATION

- A. Mix all grout at the Site in the presence of the County. Do not use grout that has been mixed off-Site and is in the Contractors tank when the truck arrives on Site. Follow the manufacturer's recommendations for the mixing and safety procedures to protect personnel from any adverse effects of the grouting compounds. Add and mix powder and additives at rates that will eliminate the formation of lumps within grout tanks solutions. Use accurate scales to weigh the various non-water grout solution components. Thoroughly mix all additives in the grouting component tanks. Provide accurate thermometers to verify temperature of grouting components in tanks.
- B. At the beginning of each day, prior to application of grout, perform a pump test to determine if proper ratios are being pumped from the grout component tanks at the proper rates. Use separate containers to capture the discharges from the grout component tanks. Take corrective action if unequal quantities are being pumped. Repeat the pump test until equal quantities are pumped from the grout tanks. Pump one gallon of grout and count the pump strokes to confirm the number of pump

strokes required to achieve a delivery rate of 3 to 5 gallons per minute. Repeat the pump test until proper ratios and delivery rates are pumped from the grout tanks.

- C. At the beginning of each day, when new batches of grout are mixed, when grout additives are modified to change gel times, at the beginning of any new pipe segment or manhole, and whenever the temperature in the tanks and hoses have changed by more than 10°F from the previous gel test, perform a grout gel test with quantities of grout in the presence of the County to determine the grout mixture gel time by performing a cup test at the grout component tanks or collecting a sample of grout from the packer discharge.
- D. Add gel time extending agent as necessary in the presence of the County to compensate for changes in temperature in grout component tanks or hoses. The addition of dilution water to extend gel times is not acceptable.
- E. During the grouting process, the Contractor and the County shall monitor the grout component tanks to make sure that proper ratios are being pumped. If unequal levels are noted in the tanks, repeat the pump test as described above.
- F. For mainline sewer pipe joint sealing and sealing laterals connected to manholes by packer injection grouting, gel times shall be 35 seconds ± 5 seconds unless otherwise approved by the County.
- G. Submit calculations of the expected annular space between the packer and the lateral pipe for approval by the County. For lateral tap connection sealing for laterals directly connected to the mainline sewer and for lateral pipe joints sealing for laterals directly connected to manholes, gel times shall be the following unless otherwise approved by the County:

$$Gel\ Time = \left(\frac{Volume\ of\ Annular\ Space\ (gal)}{Pumping\ Rate\ (gpm)} \right) \left(\frac{60\ sec}{1\ min} \right) + 20\ seconds\ (\pm\ 5\ seconds)$$

3.04 LATERAL TAP CONNECTION SEALING BY PACKER INJECTION GROUTING

- A. Lateral tap sealing begins if the lateral tap does not pass the air test or shows evidence of leakage or if a lateral connection is to be grouted after opening the tap connection after lining the mainline pipe. The lateral packer shall remain in position during the pressure test, thus maintaining the isolated void. Pressure inject grout through the lateral packer into the annular space between the inversion tube and the lateral pipe. Pump the grout out into the soil through leaking joints and pipe defects and into the annular space between the liner and the host pipe.
- B. Pump grout materials into this isolated area through the hose system at controlled pressures that are in excess of groundwater pressures. Run the pump continuously until refusal. Refusal shall mean the mixed grout has flowed through any joint failure, through any annular space, and into the surrounding soil; gelled or filled the available void space; and formed a cohesive seal stopping further grout flow, and an 8 psi back pressure is achieved while pumping. If the grout pumped exceeds 1 gallon per foot

of lateral bladder plus 3 gallons, it will be suspected that there are significant voids on the outside of the pipe. Construct a grout dam by repeatedly pumping and curing the grout until the area is dammed off and a refusal pressure of 8 psi is obtained.

- C. Upon cessation of pumping, the pressure shall be monitored. If after a twenty second period the initial 8 psi refusal pressure does not drop below 6 psi, the sealing is considered successful. If the pressure drops below 6 psi, pump additional grout immediately so the grout in the void space does not set. Record the amount of grout pumped on the sealing log.
- D. If a lateral connection requires more than 10 gallons of grout, modify grouting procedure to step grouting by pumping additional grout in 4 gallon increments, waiting 1 full minute, retesting, and, if needed, continuing with additional 4 gallon grout steps until successful test or until directed to stop by the County.

Upon completion of the lateral tap sealing procedure, air test the lateral tap a second time to confirm the sealing of the connection. If the lateral tap fails this air test, repeat the grouting procedure at no additional cost to the County. Repeat this sequence of air testing, grouting and subsequent air testing until either the lateral tap is sealed or it is determined that the grout consumption is too high and may result in the blockage of the lateral pipe. The final determination to stop subsequent attempts to seal a lateral tap will be made by the County.

- E. Confirm lateral flow after the successful sealing of each lateral tap. With the lateral packer in position, retract the inversion tube and inject air pressure into the lateral. Should a pressure build in the lateral and not drop to approximately zero in a few seconds, move the packer off the connection and view the connection with a television camera. With the camera viewing the connection point, attempt to obtain a water flush by the occupant. If no water is viewed during this procedure, it will be assumed that the building sewer connection is blocked with grout and the Contractor shall clear the lateral at no additional cost to the County. Blockages in the lateral that are not the result of grouting operations shall not be the responsibility of the Contractor.

3.05 JOINT SEALING VERIFICATION

- A. Record grouting of joints in conjunction with the testing of joints. Record the pressure drop immediately before sealing, and immediately after grouting. After the packer is deflated and moved, record the visual inspection of the joint.
- B. At the completion of the sewer line segment (i.e. manhole to manhole), conduct joint grouting verification testing of grouted joints and laterals for quality control purposes on 5% of the grouted mainline joints (minimum of two repaired joints), 25% of the grouted lateral taps (minimum of one lateral tap), and two joints for one grouted lateral connected to a manhole. The County may select the joints and laterals to be re-tested.

Within a sewer line segment, if any joints, lateral taps or laterals connected to a manhole fail the retest after sealing, retest all joints and laterals, as applicable, in the sewer line segment. Perform this post repair testing and any additional testing/sealing required beyond the initial retest area at no additional cost to the

County.

3.06 DISPOSAL

- A. Collect and properly dispose of cleaning solvents used in the cleaning of the grouting equipment. Do not dispose of cleaning solvents into the sewer system or into natural watercourses.

END OF SECTION

SECTION 02779

WASTEWATER PUMP STATION WETWELL REHABILITATION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Sanitary sewer wetwell rehabilitation including:
 - 1. Rehabilitation and leak proofing of wetwells 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 wetwell, walls, floor, top/cap 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"

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. Wetliner Liner
- B. Submittals shall be submitted to the County for review and acceptance at least 14-days prior to starting wetwell 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 wastewater pump station rehabilitation and the specific application in which they are used. The materials shall have a proven history of performance in wastewater pump station 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 wetwell surfaces.
- B. The following shall be used for stopping active leaks in concrete and masonry wetwells :
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 wetwells:
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 wetwell lining
1. The material applied to the surface of the wetwell 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 wetwell walls.
 2. A monolithic liner shall be formed which covers all interior wetwell 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 wetwell lining.
1. The material sprayed onto the surface of the wetwell 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 wetwell.

- F. Multi-component stress skin panel liner system.
1. The material applied onto the surface of the wetwell 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 WETWELL 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 wetwell rehabilitation in this Section requires some degree of wetwell 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 wetwell and not discharged downstream or allowed to remain on wetwell floor or installed equipment.
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, lining/coating of the wetwell structure
 6. Remove all loose grout and rubble from existing sewage inlets 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 wetwells greater than 12-feet in depth, the lining shall withstand the pressures associated with a groundwater depth equal to the wetwell depth. Linings for all other wetwells shall withstand the pressures associated with groundwater depth of 12-feet. Measure groundwater depth from wetwell base 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 base/floor covers used to catch debris shall be removed and the base/floor sprayed such that a gradual slope is maintained in the same geometry as the uncoated structure. The wall-floor 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 wetwell 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 base/floor covers used to catch debris shall be removed and the base/floor sprayed such that a gradual slope is maintained in the same geometry as the uncoated structure. The wall-floor 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 wetwell 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 wetwell walls, base/floor, and top/cover 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 wetwell 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 wetwell base/floor 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 wetwell walls, base/floor, and top/cover 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 CONNECTIONS TO WETWELLS

- A. Sanitary sewer connections to rehabilitated wetwells shall be reinstated to provide a seamless, leak free, and unobstructed flow connection between the new wetwell lining or coating system and the sanitary sewer connection per 3.01A.
- B.

3.07 WETWELL REHABILITATION ACCEPTANCE

- A. After the wetwell rehabilitation work has been completed, the wetwell 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 wetwell liner with new material at no cost to the County. No field repair shall be approved.
- C. Furnish an extended warranty for wetwell rehabilitation materials from the Contractor and liner manufacturer for a total of 5-years from date of final completion.

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 coating and lining including but not limited to manholes and lift stations 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. Fiberglass liners shall be used for new or existing precast manholes and wetwells. Fiberglass liners shall meet or exceed ASTM D 3753 and shall withstand ASSHTO H-20 Loading.
- B. 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.
- C. Exterior Surface: The exterior surface shall be relatively smooth with no sharp projections and shall be free of blisters larger than 1/2-inch in diameter, delamination and fiber show. Hand work finish is acceptable if enough resin is present to eliminate fiber show.

D. Interior Surface: The interior surface shall be resin rich with no exposed fibers. The surface shall be free of crazing, delamination, and blisters larger than 1/2-inch in diameter, and wrinkles of 1/8-inch or greater in depth. Surface pits shall be permitted up to 6 per square feet if they are less than 3/4-inch in diameter and less than 1/16-inch deep. Voids that cannot be broken with finger pressure and that are entirely below the resin surface shall be permitted if they are less than 1/2-inch in diameter and less than 1/16-inch thick.

E. Physical Properties:

Property	Hoop Direction	Axial Direction
a. Tensile Strength (psi)	18,000	5,000
b. Tensile Modules (psi)	0.6 x 10e	0.7 x 10e
c. Flexural Strength (psi)	26,000	4,500
d. Flexural Modules (psi)	1.4 x 10e	0.7 x 10e
e. Compressive Strength (psi)	18,000	12,000

F. Stiffness

Liner Length in FT.	PSI
3 – 6.5	0.75
7 – 12.5	1.26
13 – 20.5	2.01
21 – 25.5	3.02
26 – 35	5.24

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. Connections: Openings for pipe connections will be core drilled in the field. Pipes shall be placed through concrete wetwell and fiberglass liner in the locations indicated on the Drawings. Pipes shall then be grouted in place with the grout filling the entire void and being as thick as the concrete wetwell. The pipe on the interior of the wetwell shall be fiberglassed to the fiberglass liner. To fiberglass the PVC or Ductile Iron pipe to the fiberglass liner, the surface to be fiberglassed must first be sanded. In the case of Ductile Iron pipe, the protective coating on the exterior of the pipe must be removed and then the pipe sanded. After sanding and cleaning the area to be fiberglassed, apply a coat of primer resin. When the resin becomes tacky, begin normal installation of the fiberglass, taking care to roll out all of the air pockets. All field fiberglassing must be accomplished by a manufacturer certified installer. Submit certification to the County.

- I. **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.
- J. PVC stub-outs shall be factory installed for new installations to accept approved boots for gravity lines or compression seals for force mains.

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 respectively. 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, wetwells, or similar. New precast structures shall be lined only. All specialty coatings applicators shall follow the procedure as outlined below:**

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

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

5. Holiday Testing: The protective lining/coating protection system shall be cured in accordance with the manufacturer's recommendations prior to holiday testing at a minimum of 14,500 volts.

C. **System SC-2:** Tnemec Perma-Shield Coating System.

1. Additional Preparation: To ensure a good bond, the newly blasted surface shall be thoroughly vacuumed to remove all sand and debris and surface shall be dry prior to application and surface shall be minimum 5°F above the dew point. Moisture content not to exceed 3-pounds per 1,000 square feet in a 24-hour period verify dryness using a "plastic film tape-down test" ASTM D4263 and perform Anhydrous Calcium Chloride ASTM F1869.
2. 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 products recoat window: minimum cure to a tacky state; maximum cure of 18-hrs at 72°F substrate temperature. Additional surface preparation procedures will be required if this recoat window is exceeded including inspection for and removal of amine blush and/or other potential contaminants.
 5. Holiday Testing: The protective lining/coating protection system shall be cured in accordance with the manufacturer's recommendations prior to holiday testing at a minimum of 12,500 volts.
- F. **SC-5: Spectrashield Multicomponent Liner System.** Spectrashield multi-component stress panel liner system composed of moisture barrier (modified polymer), surfaces (polyurethane/polymeric blend foam) and final barrier coat (modified polymer). The system is applied in three-steps and the applicator/installer shall be certified by the Manufacturer.
1. Application
 - a. Moisture barrier: Silicone Modified Polyurea Minimum 40-mils DFT
 - b. Surfacer: Polyurethane/Polymeric blend foam
 - c. Final corrosion barrier: Silicone Modified Polyurea Minimum 60-mils DFT
 2. Film Thickness: Final installation shall be a minimum of 500-mils. A permanent identification and date of work performed shall be affixed to the structure in a readily visible location.
 3. Holiday Testing: The protective lining/coating protection system shall be cured in accordance with the manufacturer's recommendations prior to holiday testing at a minimum of 50,000 volts.

PART 3 - EXECUTION

3.01 QUALITY ASSURANCE

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

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

3.02 INSPECTION FOR ACCEPTANCE

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

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

END OF SECTION

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 adheres 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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APPENDIX C

ORANGE COUNTY UTILITIES

PERMITS OBTAINED BY COUNTY

APPENDIX D

ORANGE COUNTY UTILITIES Standards and Construction Specification Manual

LIST OF APPROVED PRODUCTS

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		

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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	

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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	

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Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Joint Restraints	PVC Bell Joint Restraints (16" & Greater)	PVC Bell Joint Restraints: (16" & Greater) PVC pipe Split Serrated on Bell End and Spigot End. Water & Reclaimed Water Existing pipe only. Wastewater shall be new and existing pipe.						
		Ford / Uni-Flange	Series 1390	Existing Only	Series 1390	Existing Only	Series 1390	
		JCM	Sur-Grip Series 621	Existing Only	Sur-Grip Series 621	Existing Only	Sur-Grip Series 621	
		Sigma	PV-Lok PWP	Existing Only	PV-Lok PWP	Existing Only	PV-Lok PWP	
		Smith Blair	Bell-Lock Series 165	Existing Only	Bell-Lock Series 165	Existing Only	Bell-Lock Series 165	
		Star	Series 1100C	Existing Only	Series 1100C	Existing Only	Series 1100C	
Pipe	PVC C900 DR 18 Bell & Spigot (4" - 12")	C900 Bell & Spigot PVC Pipe: 4 to 12-inch - AWWA C-900, Minimum DR18 for Water, Reclaimed and Wastewater. DR14 for Fire Lines. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.						
		Certaanteed 4" to 12"	Certa-Lok C900/RJ	Blue	Certa-Lok C900/RJ	Pantone Purple	Certa-Lok C900/RJ	Green
		Diamond Plastics Corp	C-900	Blue	C-900	Pantone Purple	Diamond C900	Green
		Ipex Inc	C-900 Blue Brute	Blue	C-900	Pantone Purple	C900 Blue Brute	Green
		JM Eagle	C-900	Blue	C-900	Pantone Purple	C-900	Green
		National Pipe & Plastics Inc	C-900 Dura- Blue	Blue	C-900	Pantone Purple	C-900 Pipe	Green
		North American Pipe Corp (NAPCO)	C-900	Blue	C-900	Pantone Purple	C-900	Green
		Sanderson Pipe Corp	C-900	Blue	C-900	Pantone Purple	C-900	Green
	PVC C905 DR 18 Bell & Spigot 16" and Larger	C905 Bell & Spigot PVC Pipe 16" and Larger: AWWA C-905, Minimum DR18 for all Force Mains up to 24". Minimum DR21/DR25 for 30" and greater. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.						
		Certaanteed 16"	NA	NA	NA	NA	Certa-Lok C905/RJ	NA
		Diamond Plastics Corp	NA	NA	NA	NA	Trans-21 DR18	Green
		Ipex Inc	NA	NA	NA	NA	IPEX Centurion	Green
		JM Eagle	NA	NA	NA	NA	C905 Big Blue	Green
National Pipe & Plastics Inc		NA	NA	NA	NA	C905	Green	
HDPE C906 DR11	HDPE Pipe DR11 AWWA C906 shall be Ductile Iron Pipe Size, PE 3408/3608/4710 DIPS manufactured in accordance with ASTM F-714 and listed with NSF. Pipe shall be marked in accordance with either AWWA C901,AWWA C906. Compression type connections are not acceptable in new installations. Pipe joints shall be butt fusion or electro-fusion with flange or adapter. All HDPE shall be color coded to the Utility. Color identifications are in accordance with the APWA/ULCC Uniform Color Code. Manufacturers shall be members in good standing with PPI to maintain approval status.							
	JM Eagle	HDPE	DR11 Blue	HDPE	DR11 Pantone	HDPE	DR11Green	
	Performance Pipe(Chevron)	Driscoplex 4000	DR11 Blue	Driscoplex 4000	DR11 Pantone	Driscoplex 4300	DR11 Green	
	PolyPipe, Inc.	EHMW Poly Pipe	DR11 Blue	EHMW	DR11 Pantone	EHMW	DR11Green	

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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
	Services	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
Services	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

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Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater		
			Model #	Comments	Model #	Comments	Model #	Comments	
Services	Curb Stops	Curb Stops - Straight Valves: Ball type compression 2" cts O.D. tubing by 2" FIP							
		Ford	B41-777W		B41-777W		NA	NA	
		AY McDonald	6102W-22		6102W-22		NA	NA	
		Mueller	P25172		P25172		NA	NA	
	Curb Stops	Curb Stops - Straight Valves: ball type compression x compression							
		Ford	B44-444W		B44-444W		NA	NA	
		AY McDonald	6100W-22		6100W-22		NA	NA	
		Mueller	P25146		P25146		NA	NA	
	PE tubing	Polyethylene tubing: AWWA C901. UV protection (SDR-9) 1-inch and 2-inch only. PE 3408 / PE 4710							
		Charter Plastics	Blue Ice		Lav Ice		NA	NA	
		Endot	Endopure Blue		Endocore Lavender		NA	NA	
		JM Eagle	Pure-Core		NA	NA	NA	NA	
Line Stops	Line Stops								
	JCM								
	Romac								
	Smith Blair								
Tapping Sleeves and Valves	Tapping Sleeves	Tapping Sleeves: (Mechanical joint for taps on cast iron, ductile iron, PVC & AC pipe, including size on size) with stainless steel nuts and bolts.							
		American Flow Control	Series 2800		Series 2800		Series 2800		
			Series 1004		Series 1004		Series 1004		
		Clow	Series F-5205	DIP/PVC	Series F-5205	DIP/PVC	Series F-5205	DIP/PVC	
			Series F-5207	A/C Pipe	Series F-5207	A/C Pipe	Series F-5207	A/C Pipe	
		JCM	Series 414	FBE	Series 414	FBE	Series 414	FBE	
		Mueller	Series H-615	DIP/PVC	Series H-615	DIP/PVC	Series H-615	DIP/PVC	
			Series H-619	A/C Pipe	Series H-619	A/C Pipe	Series H-619	A/C Pipe	
Smith Blair	Style 623	FBE	Style 623	FBE	Style 623	FBE			
Tapping Valves: 12" and smaller	Tapping Valves: 12" and smaller - Tapping Valves shall be furnished with an alignment lip and installed in the vertical position for Water and Reclaim Water. Wastewater shall be installed horizontally and abandoned in the open position. Tapping valves shall be resilient seated only and meet the requirements of AWWA C509 or C515								
	American Flow Control	Series 2500	Alignment Lip	Series 2500	Alignment Lip	Series 2500	Alignment Lip		
	Clow	Series F-6114	Alignment Lip	Series F-6114	Alignment Lip	Series F-6114	Alignment Lip		
	Mueller	Series T2360 (4"-12")	Alignment Lip	Series T2360 (4"-12")	Alignment Lip	Series T2360 (4"-12")	Alignment Lip		

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Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Tapping Sleeves and Valves	Tapping Valves: 16" and Larger	Tapping Valves: 16" and Larger - Tapping valves shall be furnished with an alignment lip and be installed in the vertical position for Water and Reclaimed Water. No tapping valve shall be installed horizontally for Water and Reclaim Water unless approved by the engineer. Tapping Valves 16" and larger AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a spur gear actuator unless noted by the engineer. All tapping valves above 24" shall be furnished with NPT pipe plugs for flushing the tracks when valves are installed horizontally. Tapping valves for Wastewater shall be installed horizontally and abandoned in open position.						
		American Flow Control	Series 2500	Alignment Lip & flushing port	Series 2500	Alignment Lip & flushing port	Series 2500	Alignment Lip & flushing port
		Clow	Series F-6114	Alignment Lip & flushing port	Series F-6114	Alignment Lip & flushing port	Series F-6114	Alignment Lip & flushing port
		Mueller	Series T2361 (14"&up)	Alignment Lip & flushing port	Series T2361 (14"&up)	Alignment Lip & flushing port	Series T2361 (14"&up)	Alignment Lip & flushing port
Valves	Butterfly Valve 42" and Above	Butterfly Valves 42"and above. AWWA C504. Actuators input torques based on 150 psi valve pressure and 16 fps velocity with a maximum input of 80 ft-lb on 2" nuts and shall withstand 250 ft-lbs. Valve seats shall be leak-tight in both directions at 150 psi.						
		Clow	Style #1450		Style #1450		NA	NA
		Dezurik	BAW		BAW		NA	NA
		Mueller / Pratt	LINSEAL III / Groundhog		LINSEAL III / Groundhog		NA	NA
	Check Valves	Valves (Check) 4-inch and Larger (8 mil epoxy lined)						
		American Flow Control	NA		NA		Series 600 or 50 line	
		Clow / M&H / Kennedy	NA		NA		106	
	Gate Valves 4" - 12"	Gate Valves 12" and smaller - resilient seated only AWWA C509 or C515. Valve seat shall be leak-tight in both directions at 150 psi.						
		American Flow Control	Series 2500		Series 2500		NA	NA
		Clow	Series F-6100		Series F-6100		NA	NA
Mueller		Series A-2360		Series A-2360		NA	NA	
Gate Valves (Vertical) 16" and Up	Gate Valves 16" and larger (Vertical Installation) AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a gear actuator unless noted by the engineer. Valve seat shall be leak-tight in both directions at 150 psi.							
	American Flow Control	Series 2500		Series 2500		NA	NA	
	Clow	Series F-6100		Series F-6100				
	Mueller	Series A-2361		Series A-2361		NA	NA	

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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		

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LIST OF APPROVED PRODUCTS - GRAVITY SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Coatings	Anti-Graffiti Paint	Block Walls-Anti-Graffiti Paint per Section 3119 Coatings & Linings						
		American Building Restoration Products	NA	NA	NA	NA	Polyshield Graffiti Preventer for Unpainted Masonry Type B	Super Bio Strip or Strip it all
		Tnemec / Chemprobe	NA	NA	NA	NA	626 DUR A PEL	680 Mark A Way
		Professional Products of Kansas, Inc	NA	NA	NA	NA	Professional Water Seal & Anti-Graffiti (PWS-15 Super Strength)	Professional Phase II Cleaner
	Coatings for Existing Manholes	Rehabilitation corrosion protection system per Section 3119 Coatings & Linings. Interior coating for force main connections to existing concrete manholes only. New precast structures and existing pump stations shall be lined.						
		CCI Spectrum, Inc	NA	NA	NA	NA	Spectrashield	min of 500 mils
		Kerneos Aluminate Technologies	NA	NA	NA	NA	Sewpercoat	1" (1000mil)
		Raven Lining System	NA	NA	NA	NA	Raven 155 Primer Raven 405	min 8 mils min 125 mils
		Sauereisen	NA	NA	NA	NA	210 Series Topcoat Glaze 210G	min 125 mils min 20 mils
		Tnemec	NA	NA	NA	NA	Series 434 Topcoat Glaze 435	min 125 mils 15-20 mils
PVC Pipe and fittings	Pipe SDR 35 Gravity Mains	PVC Pipe for Gravity SDR26/SDR 35 (Green in color) ASTM-D034. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.						
		Certainteed	NA	NA	NA	NA	Gravity Sewer Pipe	
		Diamond Plastics Corp	NA	NA	NA	NA	Sani-21 SDR-35	
		JM Eagle	NA	NA	NA	NA	Gravity Sewer	
		National Pipe & Plastics, Inc.	NA	NA	NA	NA	Ever-Green Sewer Pipe	
		North American Pipe Corp (NAPCO)	NA	NA	NA	NA	Gravity Sewer	
		Sanderson Pipe Corp	NA	NA	NA	NA	Gravity Sewer	
	Locate Balls	Locating Marker Systems - Wastewater Locator balls placed at all sanitary sewer cleanouts						
		3M	NA	NA	NA	NA	3M™ EMS 4" Extended Range 5' Ball Marker 1404-XR	
	Fittings SDR 35	Fittings, Adapters and Plugs - Gravity PVC ASTM-D3034, Min SDR26/ SDR 35						
		GPK Products, Inc.	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Harrington Corporation (HARCO)	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Multi Fittings Corp.	NA	NA	NA	NA	SDR26/SDR 35 Trench Tough Sewer Fittings	
JM Eagle		NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings		
Plastic Trends Inc		NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings		
	TIGRE USA, Inc.	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings		

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LIST OF APPROVED PRODUCTS - GRAVITY SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
PVC Pipe a	Flexible Pipe Connectors	Flexible Pipe Connectors and Transitions						
		Fernco	NA	NA	NA	NA	1002, 1051, 1056 Series	
		Indiana Seal	NA	NA	NA	NA	102, 151, 156 Series	
		Mission Rubber	NA	NA	NA	NA	MR02, MR51, MR 56 Series	
Precast Concrete Structures	MH Lids	Frame and Cover						
		USF Fabrication Inc.	NA	NA	NA	NA	USF 225-AS	
	Adj Ring	Top Adjusting Rings - HDPE with heavy duty loading (H-20)						
		Ladtech, Inc	NA	NA	NA	NA	24R, 24S with Rope Sealant CS2455	
	Hatches	Wet Well and Valve Vault Access Frames and Covers (Include the term "Confined Space" etched or cast into the cover with recessed lock & hasp. Frames and covers per manufacturers specifications.						
		Halliday Products	NA	NA	NA	NA	S1R or S2R Series	
		USF Fabrication Inc.	NA	NA	NA	NA	APS or APD Series	
	Precast Concrete Structures	Precast Manhole and Wetwell Structures ASTM C478. Precast concrete shall be batched with concrete dyed crystalline waterproofing admixture with corrosion protection. Concrete without admixture or without color tint /tracer shall be rejected.						
		Allied Precast	NA	NA	NA	NA	Dyed Admix	
		Atlantic Concrete Products, Inc.	NA	NA	NA	NA	Dyed Admix	
		Delzotto Products, Inc.	NA	NA	NA	NA	Dyed Admix	
		Dura Stress Underground Inc.	NA	NA	NA	NA	Dyed Admix	
		Hanson Pipe & Product	NA	NA	NA	NA	Dyed Admix	
		Mack Concrete	NA	NA	NA	NA	Dyed Admix	
		Oldcastle Precast	NA	NA	NA	NA	Dyed Admix	
Standard Precast Inc.	NA	NA	NA	NA	Dyed Admix			
Concrete Admix	Crystalline Waterproofing Concrete Admix with color dye shall be added to all concrete structures (precast and cast-in-place) to provide waterproofing and corrosion resistance. Concrete without admixture or without color tint / tracer shall be rejected. % concentration of admix with colored dye added to the mix shall be based on weight of cement.							
	Kryton International	NA	NA	NA	NA	KIM K-301R (with red dye)	2%	
	Xypex Chemical Corp	NA	NA	NA	NA	Xypex Admix C-1000Red (with red dye)	3.0 - 3.5%	
Liners	Interior Liner for New or existing Precast Manhole and Precast Wetwell Structures per Section 3119 Coatings & Linings							
	AFE	NA	NA	NA	NA	Fiberglass Liner		
	AGRU Liner	NA	NA	NA	NA	HDPE Liner (Min 2 mm for Manhole / Min 5 mm for Pump Station)		
	Containment Solutions Inc. (Flowtite)	NA	NA	NA	NA	Fiberglass Liner		
	GSE Studliner	NA	NA	NA	NA	HDPE Liner (Min 2 mm for Manhole / Min 5 mm for Pump Station)		
	GU Liner	NA	NA	NA	NA	Reinforced Plastic Liner		
		L & F Manufacturing	NA	NA	NA	NA	Fiberglass Liner	

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LIST OF APPROVED PRODUCTS - GRAVITY SYSTEMS

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		

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LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Generator	Gen	Generator Systems, Fixed Shall be UL 2200 Certified.						
		Caterpillar	NA	NA	NA	NA	CAT Diesel Generator Set	
		Cummins Power Generation	NA	NA	NA	NA	Diesel Generator Set	
	Fuel Tanks	Generator Fuel Tanks. Shall be UL2085 certified.						
		Convault	NA	NA	NA	NA	CVT-3SF or CVT-3FF	
		Phoenix	NA	NA	NA	NA	Envirovault	
	GR	Generator Receptacle (GR)						
		Cooper Crouse-Hinds	NA	NA	NA	NA	AR2042 (230V, 200A, 3P, 4W) With AJA1 Angle Adaptor	
		Cooper Crouse-Hinds	NA	NA	NA	NA	AR2042-S22 (460V, 200A, 3P, 4W) With AJA1 Angle Adaptor	
		Pyle National	NA	NA	NA	NA	JRE-4100 (230V, 100A, 3P, 4W)	
ATS	Generator Transfer Switch							
	Russelectric	NA	NA	NA	NA	RMTD Series with model 2000 controller	NEMA 12/3R 316SS Enclosure	
Odor Control Units	Biotrickling Filters	Biotrickling filters						
		BioAir	NA	NA	NA	NA		
		Bioem	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			

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LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Pumps	Floats	Float Regulator (FR) - Duplex and Triplex Pump Stations						
		Atlantic Scientific	NA	NA	NA	NA	Roto-Float	
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 Srvc Disconnect	Main Service Disconnect Breaker						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
	Surge Protector Device	Surge Protector - UL 1449, 3rd Edition listed and labeled, minimum 10 year warranty, NEMA LS-1 and IEEE C62, 41/45 tested with NEMA 4X enclosure, internal fusing, voltage and phase to match service. Rated 80,000 amps per mode for Duplex & Triplex stations and 150,000 Amperes per mode for Master Stations. All devices shall be provided with a NEMA 4X Plastic enclosure which is approved in lieu of stainless steel.						
		Current Technology (Power & Systems)	NA	NA	NA	NA	XN-80, TG-150 or CurrentGuard 150 Plus Series	
		Joslyn AKA (Total Protection Solutions)	NA	NA	NA	NA	TSS-ST 160 Series, ST 300 Series or JSP-300 Series	
		Surge Suppressors, Inc	NA	NA	NA	NA	LSE Series or SHL Series	
Sub Panel	Sub Panel	Sub-Panel Enclosure - NEMA 12/3R Enclosure 316SS, white polyester Powder coated finish inside and out, With 3 Point Pad lockable Handle, and Door Stop						
		Hoffman	NA	NA	NA	NA		
		Schaefer	NA	NA	NA	NA		
		Universal enclosure systems	NA	NA	NA	NA		
Pump Station Control Panel	Control Panel	Control Panel Supplier						
		ECS	NA	NA	NA	NA		
		Sta-Con Inc	NA	NA	NA	NA		
	Enclosure	Enclosure - NEMA 12/3R Enclosure 316SS, white polyester Powder coated finish inside and out, With 3 Point Pad lockable Handle, and Door Stop						
		Hoffman	NA	NA	NA	NA		
		Schaefer	NA	NA	NA	NA		
		Universal enclosure systems	NA	NA	NA	NA		
	Mnts	Mounting Channel for Enclosures						
		Unistrut Stainless Steel	NA	NA	NA	NA	1" 5/8 x 1" 5/8 316 SS	
	Seal-off	Explosion-Proof Sealoff						
	Cooper Crouse-Hinds	NA	NA	NA	NA	EYSR - 2 Inch Min.		
FL	Flasher (FL)							
		MPE	NA	NA	NA	NA	025-120-105	
		SSAC	NA	NA	NA	NA	FS-126	

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LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Pump Station Control Panel		Alarm Light / With Base and Globe (AL)						
	AL	American Electric	NA	NA	NA	NA	F32552	
		Red Dot Globe	NA	NA	NA	NA	VGLR-01	
		Red Dot Base					VA-01	
		Alarm Horn (AH)						
	AH	Wheelock	NA	NA	NA	NA	3IT-115-R	
		Fuses (F)						
	Fuse	Bussmann	NA	NA	NA	NA	FNQ-R or KTK-R	
		Hand-Auto-Off Selector (HOA)						
	HOA	Square D	NA	NA	NA	NA	9001-SKS43B	
		Horn Silence Button (HSS)						
	HSS	Square D	NA	NA	NA	NA	9001-SKR1RH5	
		Mechanical Interlock						
	Inter-lock	Square D	NA	NA	NA	NA	S29354	
		Control Panel Main Circuit Breaker (MCB) With S29450 Circuit Breaker Auxiliary Switch						
	Breakers	Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Emergency Circuit Breaker (ECB) With S29450 Circuit Breaker Auxiliary Switch						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Motor Circuit Breaker (MB)						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Control Circuit Breaker/ GFCI Receptacle Breaker/ SCADA Breaker						
	Square D	NA	NA	NA	NA	QOU120		
	Motor Starter (MS)							
MS	Square D	NA	NA	NA	NA	Type S Class 8536		
	Overload Heater(OL)							
OL	Square D	NA	NA	NA	NA	Part number will vary with size needed		
	Overload Reset							
OR	Square D	NA	NA	NA	NA	9066-RA1		
	Control Circuit Transformer (XMFR)							
Transformer	Square D	NA	NA	NA	NA	9070TF75D23	120/24 Volt .075 KVA	
	Main Circuit Transformer (MCT)							
	Square D	NA	NA	NA	NA	9070T2000D1	480/120 2KVA	
	Supplemental Protector Breaker - 3 pole, 1-amp for Phase Monitor							
SPB	Square D	NA	NA	NA	NA	MG24532		

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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		

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LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Pump Station Control 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			