SUPPLEMENTAL TECHNICAL SPECIFICATIONS

FOR

IFB #15-1599BLS,
(ADDENDUM #2)
SANITARY SEWER SYSTEMS,
STORMWATER SYSTEMS,
LINE AND MANHOLE REHABILIATION SERVICES
(as required)

November 2015

INFRASTRUCTURE Engineering Standard Specifications

SECTION 01570

TRAFFIC REGULATION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

The Contractor shall be responsible for providing safe and expeditious movement of traffic through construction zones. A construction zone is defined as the immediate areas of actual construction and all abutting areas which are used by the Contractor and which interfere with the driving or walking public. The Contractor shall remove temporary equipment and facilities when no longer required, restore grounds to original or to specified conditions.

1.02 TRAFFIC CONTROL

The necessary traffic control shall include, but not be limited to, such items as proper construction warning signs, signals, lighting devices, markings, barricades, channelization and hand signaling devices. The Contractor shall be responsible for installation and maintenance of all devices and detour routes and signage for the duration of the construction period. The Contractor shall utilize the appropriate traffic plan from the FDOT Maintenance of Traffic Standards, Series 600 of the FDOT Roadway & Traffic Design Standards, Latest Edition. Should there be the necessity to close any portion of a roadway carrying vehicles or pedestrians the Contractor shall submit a Traffic Control Plan (TCP) at least 5 days before a partial or full day closure, and at least 8 days before a multi-day closure. TCP shall be submitted, along with a copy of their accreditation, by a certified IMSA or ATSA Traffic Control Specialist. At no time will more than one (1) lane of a roadway be closed to vehicles and pedestrians without an approved road closure from the County Transportation Department. With any such closings, adequate provision shall be made for the safe expeditious movement of each. All traffic control signs must be in place and inspected at least 1 day in advance of the closure. Multi-day closures notification signs shall be in place at least 3 days in advance of the closure. All signs must be covered when no in effect, and checked twice a day by the Worksite Traffic Supervisor when they are in effect. The Contractor shall be responsible for removal, relocation, or replacement of any traffic control device in the construction area which exists as part of the normal preconstruction traffic control scheme. Any such actions shall be performed by the Contractor under the supervision and in accordance with the instructions of the applicable highway department unless otherwise specified. The Contractor will consult with the County immediately on any vehicular or pedestrian safety or efficiency problem incurred as a result of construction of the project. The Contractor shall provide ready access to businesses and homes in the project area during construction. The Contractor shall be responsible for coordinating this work with affected homeowners.

When conditions require the temporary installation of signs, pavement markings and traffic MLS 1M Spec 10.01.2014.docx 41 / 73 barriers for the protection or workers and traffic, the entire array of such devices shall be depicted on working drawings for each separate stage of work. These drawings shall be submitted to the County for review and approval prior to commencement of work on the site. Precast concrete traffic barriers shall be placed adjacent to trenches and other excavations deeper than six inches below the adjacent pavement surface.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 02626

SANITARY SEWER LATERAL REHABILITATION

1.01 GENERAL

This section describes the material requirements, installation practices, and test methods for the rehabilitation of sanitary sewer service lateral lines and connection to the sanitary sewer main line, without excavation. The pipe renovation shall be accomplished by providing and installing a one piece resin impregnated lateral and main connection cured-in-place pipe (CIPP) liner installed into the existing lateral connection by a pressure apparatus. When cured, the liner shall have a watertight connection seal at the mainline and extend over the length of the service lateral providing a continuous one piece structural pipe within a pipe. All such work shall comply with these Specifications, the requirements of ASTM F1216 or ASTM F2561-11, and the specific product manufacturer's recommendations. Any conflict between the product manufacturer's recommendations and any portion of the Contract Documents shall be resolved prior to beginning the work. The Contractor shall utilize the products of one manufacturer which meet the requirements of these Specifications when relining sections of existing sewer which are straight or have minor offsets. It shall be the Contractor's sole responsibility to insure that materials provided by the liner manufacturer will function as intended when installed in curved or offset sections of existing pipe.

1.02 DESIGN CRITERIA

The fabrication and installation of the CIPP lateral liner system shall be done in accordance with ASTM F1216 or ASTM F2561.

The CIPP thickness shall be designed per ASTM F1216, Appendix X1.

The CIPP design for the lateral tube and mainline connection shall assume no bonding to the original pipe.

The resin saturated lateral tube and the main sheet must place the resin in full contact with the host pipe.

This specification references ASTM test methods which are made a part hereof by such reference and shall be the latest edition and revision thereof:

ASTM F-1216 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.

ASTM F-2561 - 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.

ASTM D-790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

ASTM D-792 - Standard Test Methods for Density and Specific Gravity of Plastics by displacement.

ASTM D-2990 - Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics

ASTM D-5813 - Standard Specification for Cured-in Place Thermosetting Resin Sewer Pipe.

1.03 QUALIFICATIONS

All sewer products are intended to have a minimum 50 year design life, in order to minimize the owner's long term risk of failure, only proven products and installers with substantial successful long term track records will be considered. The manufacturer of the CIPP lateral lining system shall have a minimum of five (5) year documented history of satisfactory performance with a minimum of 10,000 CIPP lateral installations for the product that is being supplied in this Invitation for Bids. Additionally, the manufacturer's CIPP lateral lining product shall have a minimum of 2,500 CIPP lateral installations that have been in service for a minimum of five (5) years. The Contractor performing the work shall be employees of the company manufacturing the CIPP lateral lining system, or shall be licensed as

an authorized installer of the system by the manufacturer. The Contractor shall have a minimum of three (3) years of continuous service experience installing CIPP lateral lining in pipe of similar size, length and configuration as proposed in this project. Additionally, the Contractor shall have successfully installed a minimum of 5,000 CIPP lateral liners in a wastewater collection system, of which a minimum of 2,500 were installed in Florida.

1.04 SUBMITTALS

Submit submittals in accordance with Section 01340, Shop Drawings, Project Data, and Samples and the following:

With the Bid, provide the following documentation to demonstrate that the proposed CIPP lateral lining system meets the qualifications listed above in subsection 1.03.A:

1. Resin

i. Long term test creep data confirming the resin system's 50 year design life in accordance with ASTM D2990.

ii. Chemical Resistance per ASTM F 1216

iii. Certificate of Compliance with ASTM F 1216

2. Tube

Certificate of Compliance with ASTM F1216

If glass fiber reinforcement is used, CIPP strain Corrosion testing data in accordance with ASTM D3681 with the Bid, provide documentation that the manufacturer of the proposed CIPP lateral lining system meets the qualifications listed above in subsection 1.03.B. Provide contact information for at least three (3) similar projects referenced in subsection 1.03.B as part of the Bid Submittal. With the Bid, provide documentation that the CIPP Contractor meets the qualifications listed above in subsections 1.03.C and 1.03.D. Provide contact information for at least three (3) similar projects referenced in subsection 1.03.D as part of the Bid Submittal.

Submit the following to the Project Manager prior to Mobilization:

Contractor shall provide to the Project Manager for review, complete design calculations for the liner thickness per ASTM F1216. The design shall be signed and sealed by a professional engineer in the State of Florida and certified by the manufacturer as to compliance of his material to the values used in the calculation. Approval of the calculations shall not relieve the Contractor of any contractual obligations. The Contractor shall provide a typical schedule for "wet out" of the connection seal and lateral liner in the method statement together with a typical insertion and curing schedule/plan at the pre-construction meeting.

Certified copies of the test reports for the resin material used for this project.

Proposed testing laboratory with qualifications, experience history and references.

Installation Plan/Diversion Pumping Plan (including Emergency Plans) as required. E. Submit the following to the Project Manager after completion of each service:

The Contractor shall submit the installation and curing process control sheets including information as described under Section 3.E, GENERAL INSTALLATION PROCEDURES of this specification.

Pre and Post CCTV inspection tapes.

Manufacturer's certification of proper installation.

Physical samples: for every ten laterals lined, two flat plate samples shall be processed and tested. The flat plate sample preparations shall be as described under Section 3.7-A.1 of this specification.

Samples removed for testing shall be individually labeled and logged to record the following:

County's project number and title.

Sample number

Segment number of line as noted on supplements. iv. Date and time of sample

Name of Contractor Location and by whom tested

Street name and address

Results of test. Samples shall be numbered as follows:

a. Sample No.1: Flat plate sample.

PART 2 PRODUCTS

2.01 MATERIALS

CIPP Sectional Liner and Lateral Lining Tube:

The liner assembly shall be continuous in length and consist of one or more layers of flexible needled felt or an equivalent non-woven material that meet the requirements of ASTM F1216 and ASTM D5813. The liner tube shall be fabricated to a size that when installed will neatly fit the circumference of the lateral pipe, shall have uniform wall thickness, and shall create a watertight seal at the mainline interface. No intermediate or encapsulated elastomeric layers shall be in the textile that may cause de-lamination in the CIPP. The textile tube and sheet shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe segments, and flexibility to fit irregular pipe sections. The resin saturated textile tube and sheet shall meet ASTM F 1216, 7.2 as applicable, and the tube shall have 5% to 10% excess resin distribution (full resin contact with the host pipe) that when compressed and cured will meet or exceed the design thickness.

Resin System

The resin/liner system shall conform to ASTM D5813 Section 8.2.2. The resin shall be a corrosion resistant polyester, vinyl, epoxy or silicate resin and catalyst system that when properly cured within the composite liner assembly, meets the requirements of ASTM F1216, the physical properties herein, and those which are to be utilized in the design of the CIPP, for this project. The resin shall have proven resistance to ultraviolet light (sunlight) at any stage prior to installation. The resin system shall be manufactured by a company selected by the CIPP supplier which shall produce a CIPP that will comply with the structural and chemical resistance requirements of ASTM F1216:

Table 1 CIPP INITIAL STRUCTURAL PROPERTIES

Property	ASTM Test PSI	Minimum Value (MPa)
Flexural Strength	D 790	4,500 (31)
Flexural Modulus	D 790	250,000 (1,724)

Interface Seal

The interface seal shall have structural properties in accordance with ASTM F1216 and as referenced in Table 1 - CIPP Initial Structural Properties. The interface seal shall meet the 50 year design life of the CIPP lateral liner. The interface seal shall meet the conditions above and shall be a full-circle integrally manufactured to the lateral liner providing a seamless connection between the mainline liner and the lateral liner. Fabrication of the interface seal shall be in accordance with ASTM F1216 or ASTM F2561. Interface seals shall be designed for either a "T" or "Y" fining and I or shall be able to accommodate either condition without wrinkles or folds when installed. The interface seal shall provide a watertight connection between the service connection and the mainline. The interface seal between the lateral liner and the mainline sewer pipe shall be compatible with the mainline liner.

2.02 DELIVERY, STORAGE AND HANDLING

If the flexible tube is impregnated with resin at the factory, it shall be transported, installed, and cured before expiration of the shelf life. Impregnated tube shall be stored and transported under refrigerated, ultraviolet light free conditions. Each liner shall be accompanied with the appropriate documentation indicating time and date of liner manufacturing, felt thickness, number of layers, length of liner, resin type and name, hardener type and name, batch numbers, mixing ratios, etc. No cuts, tears, or abrasions shall occur during handling. The Contractor shall not place the tube into the host pipe before the Project Manager inspects the tube.

PART 3 EXECUTION

3.01 CONSTRUCTION (ALL METHODS)

General:

Unless otherwise noted, the lateral lining methods listed below are acceptable to the County. Should the Contractor desire to use different methods than described in these Specifications, written permission must be obtained from the County. The finished product is to be of highest quality and shall eliminate any infiltration or corrosion problems which may exist in the system.

Pre-Installation Procedures:

The Contractor shall notify all the 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 at all times during the rehabilitation of lateral lines. By-passing as outlined in the following section is permitted. Alternate methods shall be submitted to the County for approval.

By-Passing Existing Flows: The Contractor shall furnish equipment, materials, supplies, labor and all incidentals required to by-pass the sanitary sewer flow such that the lateral lining process may be completed. The Contractor shall plug the upstream line and pump the flow to the nearest downstream manhole (or, when approved by the County, to another system all together) per Section 02720. Dumping the existing flow onto private property or streets shall not be allowed. At the end of each day, the Contractor shall make temporary tie-ins such that no service is interrupted overnight. By-passing of existing flows shall be considered an incidental part of this Contract and will not be paid for directly. All requisite pre-installation submittals shall be approved, including traffic management measures, safe pedestrian passage, and provision of vehicular access to property, bypass/diversion pumping and emergency measures prior to the commencement of any work. The Contractor shall use CCTV to inspect the lateral line immediately prior to reconstruction and determine the overall structural condition of the lateral. Both the mainline in the vicinity of the lateral and the lateral shall be surveyed. The location of any conditions which may prevent proper installation of the connection seal or lateral liner shall be noted and provided to the Project Manager so that these conditions can be corrected. The Contractor shall pre-condition the lateral line and the mainline in the vicinity of the lateral for acceptance of the CIPP by thoroughly cleaning and removing any roots, grease build- up, or any other obstruction that may interfere with lining operations by mechanical means or high pressure flush and vacuum. No interface seal shall be installed in the presence of active infiltration. Infiltration at the lateral interface shall be controlled by chemical grout sealing per the lateral liner manufacturer's guidelines. It is the responsibility of the Contractor to clear the main and the lateral of all obstructions in the area to be lined. All debris removed from the sewer during cleaning shall be transported in watertight containers and disposed of in accordance with all local, state and federal regulations.

General Installation Procedures

The CIPP lateral liner system installation will be accomplished remotely using air or water for inversion and curing. The cured-in-place pipe shall provide a smooth interior surface and shall conform to the existing pipe and eliminate any groundwater infiltration or connection to the outside of the host pipe/service. The CIPP lateral liner system shall be installed from the mainline sewer and shall extend a minimum of 3 feet and up to 25 feet to effectively span the distance from the lateral connection at the main to the desired termination location in the service lateral pipe. For the purpose of this specification, the termination point shall be a distance within 18 inches of the intersection of a clean out or property line. No cleanout is, or should be, required for the installation of the CIPP lateral liner system. If necessary, the CIPP lateral liner system may be installed utilizing existing cleanouts installed at the property line or launched from the sewer main. It is the intent of these specifications that all lateral lining/ work be accomplished utilizing existing cleanouts. In the event a lateral has been identified to be repaired by means of a CIPP lateral liner installation, and no cleanout exists where a cleanout is required to complete the lining of the lateral, the Contractor shall obtain authorization from the County's Project Manager to install a new clean out. When required, an overlap method is performed with a pull-in-process installation from a cleanout or access point back to the main. In either case, the lateral liner must provide a watertight seal at the mainline and a structural repair of the lateral

over the specified length. The Installer shall verify the lengths in the field before impregnation of the resin.

Wet Out:

Thoroughly saturate lining system prior to installation. Catalyst system or additives compatible with the resin and liner shall be as recommended by the manufacturer. Handle the resin impregnated lining system to retard or prevent resin setting until it is ready for insertion.

Insertion:

CIPP shall be installed in accordance with the manufacturer's instructions and the practices outlined in ASTM F1216 or ASTM F2561 for direct inversion installations. The Contractor shall document the placement of the CIPP lateral liner by internal video inspection. The installer shall be capable of viewing the lateral liner contacting the lateral pipe from the beginning to the end of the repair. Video documentation of the lateral liner contracting the lateral pipe, prior to curing shall be provided to the Project Manager. Lubricant shall be used, as recommended by the manufacturer, to reduce friction between the host pipe and the liner during the inversion or pull-in process. No resin shall be lost by contact with the manhole walls or the pipe during the pull-in process. The lubricant used shall be a non-toxic product with no detrimental effects on the liner and shall not be detrimental to wastewater treatment plant operations. Any cured liner/resin composite pipe left protruding from the main line or service connection shall be trimmed back using a hydraulic-powered robotic cutting device specifically designed for cutting cured-in-place pipe. All materials shall be removed from the sewer system and not allowed to float downstream. The Contractor will be held responsible for the cost of all repairs or maintenance resulting from materials accumulating in downstream pump stations. The addition of pressure shall be adjusted to cause the impregnated flexible tube to invert from the mainline to lateral clean-out, holding the tube tight against the host sewer pipe. If water is used to accomplish the inversion process, the Contractor shall complete an installation process control sheet for every lining completed. The control sheets shall provide the following information:

Liner length
Hydrostatic head at the point of inversion
Hydrostatic head at the termination point
Time when inversion process starts V.
Time start cutting ends.

Finish: The finished CIPP shall be continuous and free from visual defects such as foreign inclusions dry spots, pinholes, de-lamination, and wrinkles greater in length than 1 % of the pipe ID. Any section of lining with such defects shall be removed and replaced at no additional cost to the County. If the defective liner cannot be repaired or removed, the Contractor will be responsible for all costs associated with replacement of the service.

Clean Up: After liner installation has been completed and accepted, the Contractor shall clean up the entire project area and restore the site to its original condition prior to the commencement of work. All excess material and debris not incorporated into the permanent installation shall be disposed of by the CONTRACTOR. Any materials used in the installation other than the cured lube/resin composite are to be removed from the pipe.

Post Televising of Completed Work

Following completion of CIPP liner installation, a CCTV inspection shall be completed. Submit to the County color DVD's or approved electronic files showing completed work. Correction of failed CIPP or CIPP deemed defective from post-installation television inspection or test reports for structural values, thickness, etc., shall be repaired as determined by Project Manager at no extra cost to the County. Method of repair, which may require field or workshop demonstration, shall be approved by Project Manager.

Testing

Laboratory Testing:

Flat plate samples shall be tested as requested by the Engineer. However, as a minimum a frequency of two flat plate samples shall be processed and tested for every 10 laterals lined. The time and location will be selected by the Project Manager. The Contractor shall prepare the flat plate samples on site using the actual CIPP liner being installed. Once the liner is applied to the clamped mold, the sample shall be placed in either the upstream or downstream manhole, to simulate the environmental conditions that the lateral liner being installed will experience during the curing process. After the curing process has been completed, the sample shall be removed, labeled and sent to the laboratory facility for physical properties testing. Samples shall be tested for modulus of elasticity and flexural strength in accordance with ASTM 0790. Preparation and testing samples shall be performed in accordance with the approved submittals. Failure of either the modulus or flexural strength tests on either sample shall be grounds for the rejection of all CIPP liners installed since the last successful test. Testing shall be completed by accredited laboratory at the Contractor's expense. The Contractor shall submit the chosen laboratory with appropriate accreditation documentation for approval by the Project Manager prior to testing. Testing results shall be provided to the Project Manager within seven days of receipt.

Hydrostatic Testing - Low Pressure Air Test

Random low pressure air tests shall be performed as directed by the Project Manager. I. On ten percent (10%) of the laterals repaired under this contract.

If more than ten percent (10%) of the air tests fail, an additional 10% of the laterals will be selected by the Project Manager to be tested at no additional cost.

If more than twenty-five percent (25%) of the air tests fail, the Project Manager may direct the Contractor to test all of the repaired laterals at no additional cost.

Low Pressure Air Test Procedure

Place test balls no more than 5 inches inside the CIPP lateral liner at the upper point of the repair.

Place test balls in the mainline a minimum of 12 inches from and centered on the lateral opening.

Introduce air into the sealed line until an internal pressure of 4.0 psig is achieved.

Allow the pressure to stabilize for 2 minutes, but in no case let the pressure drop to less than 3.5 psig.

If the pressure drops 1.0 psig in less than 4 minutes, the test will be considered to have failed.

If the lined lateral fails the air test, the Contractor shall locate the leak and perform corrective measures including:

Re-inspection of the lateral by CCTV

Repair using materials and methods contained in this specification. III. Repeat the air test

END OF SECTION

SECTION 02720

SANITARY SEWER BYPASS PUMPING

PART 1 GENERAL

1.01 SCOPE

The Contractor shall furnish all labor, materials, equipment and incidentals required to maintain existing and anticipated flows within the affected portion of the collection system throughout the construction period.

1.02 PUBLIC IMPACTS

The contractor shall not create a public nuisance due to excessive noise or dust, nor impact the public with flooding of adjacent lands, discharge of raw sewage, or release of other potential hazards, nor shall he encroach on or limit access to adjacent lands. No extra charge may be made for increased costs to the contractor due to any of the above.

1.03 SUBMITTALS

A. The Contractor shall, within 30 days of the date of the Notice to Proceed, submit to the Project Manager a detailed Pumping Plan for each site by-pass pumping will be needed. The Pumping Plan shall address all measures and systems to prevent a sanitary sewer overflow (SSO) as defined by the EPA. The Plan shall include as a minimum:

Working drawings and sketches showing work location, pump location, piping layout & routing. Show all proposed encroachment and access impacts on adjacent properties or facilities.

Pump, control, alarm and pipe specifications or catalog cuts. Detailed sketch of controls and alarm system.

Power requirements and details on methods to provide by-pass power or fueling.

Calculation and determination of response times to prevent an SSO after a high water alarm. If anticipated peak flows are 750 G.P.M. or greater, an operator is required on site at all times pump is in service. If the anticipated peak flows are less than 750 G.P.M. an operator may not be required to be on site at all times; show operator on-site schedule.

Procedures to be taken in case of power, pump, or piping failures; including contact names and numbers for emergency notifications.

Frequency and specific responsibility for monitoring pump operation, fuel levels, pump maintenance and entire length of piping.

PART 2 PRODUCTS

2.01 EQUIPMENT

Pumps: By-pass pumping system shall consist of at least a primary pump and a backup pump. Each pump shall have a minimum pumping capacity of 150% of the anticipated peak flows. If a lift station by-pass, 150% of the lift station capacity (G.P.M. & T.D.H) for the lift station being by-passed.

Pumps shall be low noise or sound attenuated. The noise level at any operating condition, in any direction, shall not exceed 70dBA at a distance of twenty three (23) feet (7 meters) from the pump and/or power source.

Controls:

The by-pass pump system shall be equipped with automatic controls and an alarm system. The automatic controls will automatically start the backup pump in the event of a high water condition or failure of the primary pump. The alarm system will immediately notify the Contractor of a pump failure or high water condition.

Pipe:

Pipe shall be of adequate size and capacity to match the pumps. Pipe type and materials will depend on the particulars of the site conditions, and shall be detailed in the Pumping Plan. Contractor will provide all connections.

PART 3 EXECUTION

SITE CONDITIONS

Site conditions will vary by site. Contractor is responsible to determine and address requirements such as traffic control, excavation, connections & fittings, impacts on access to adjacent properties, routing and support of by-pass piping, etc., in the Pumping Plan.

ON-SITE MONITORING

All by-pass operations where the anticipated flow rates are 750 G.P.M or greater shall require an employee on-site at all times (full-time on-site monitoring attended by personnel experienced with the pumps and controls, with demonstrated ability to monitor, turn on & off, and switch between pumps while the by-pass pump system is in service.

By-pass operations where the anticipated flow rates are less than 750 G.P.M may not require an employee on-site at all times while the by-pass pump system is in operation. The Contractor shall have personnel experienced with the pumps and controls on site within the calculated response time to prevent an SSO after a high water alarm.

During by-pass operations, the Contractor shall have posted on site with the permit, a copy of the approved Plan and the name and 24 hour contact number of the primary response person, the job site superintendent, and the construction company owner.

3.03 OPERATIONS

The Contractor is responsible for securing and providing power, fuel, site security, traffic control and all other supplies, materials and permits required for the by-pass pumping. Contractor shall demonstrate automatic pump switching and alarm system to the satisfaction of: the County inspector, Project Manager, or Lift Stations Superintendent prior to beginning by-pass pumping. Satisfactory demonstration shall be documented by the inspector's, PM's or Lift Station Superintendent's dated signature on the posted copy of the approved Pumping Plan.

3.04 DAMAGE RESTORATION & REMEDIATION

The Contractor shall be responsible for any pre-pump notifications, all restoration of pre-pump conditions and any damage caused by by-pass operations.

Should there be an SSO caused by or as a direct result of the by-pass pumping, the contractor is responsible for all immediate & long term response, notifications, clean up, mitigation, etc. Copies of all written response plans, notifications, documentation, mitigation plans, etc., shall be submitted to the County Project Manager.

END OF SECTION

SECTION 02730

PREPATORY CLEANING AND ROOT REMOVAL

PART 1 – GENERAL

1.01 WORK INCLUDED

A. This Section covers the preparatory cleaning of sewer lines and manholes as needed prior to the internal survey of the sewer lines by closed-circuit television. It also covers the preparatory cleaning and root removal of sewer lines and the cleaning of manholes prior to rehabilitation. The CONTRACTOR shall furnish all necessary material, labor, equipment and services required for cleaning the specific sewer lines.

1.02 GENERAL

Sewer Line Cleaning: Removal of foreign materials from sewer lines to restore the sewer to a minimum of 95% of the original carrying capacity, for proper seating of pipe lining, or as required by other specified rehabilitation. It is recognized that there are some conditions such as broken pipe and major blockages that prevent cleaning from being accomplished or where additional damage would result if cleaning were attempted or continued. Should such conditions be encountered, the CONTRACTOR will not be required to clean those specific sewer sections. If, in the course of normal cleaning operations, damage does result from preexisting and unforeseen conditions such as broken pipe, the CONTRACTOR will not be held responsible.

Manhole Cleaning: All concrete and masonry surfaces must be cleaned prior to repair. Removal of grease, laitance, loose bricks, mortar, unsound concrete, and other materials from manholes. Water blasting (minimum 1,200 psi), utilizing 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. Surfaces on which these other methods are used shall be thoroughly rinsed, scrubbed, and neutralized to remove cleaning Managers and their reactant products.

Television Inspection: Operation necessary to complete an internal inspection for verification of existing conditions prior to performing rehabilitation and to verify for approval of rehabilitated sewer segments. CONTRACTOR shall furnish all labor, materials, equipment, tools, and other incidental services for closed circuit television inspection or work.

Light Cleaning: The removal of sand and/or debris occupying up to 25% of the diameter of the pipe.

Medium Cleaning: The removal of sand and/or debris occupying between 25% and 50% of the diameter of the pipe.

Heavy Cleaning: The removal of sand and/or debris occupying more than 50% of the diameter of the pipe.

Specialty Cleaning: The removal of grease, roots, and tuberculation in cast iron pipe; the use of special equipment such as bucket machines; root cutters or internal protruding tap remover or high pressure water blasting.

Cleaning and Preparation for Cementitious Liner Rehabilitation

The manhole or chamber surface shall be clean, structurally sound and free from oil, grease, loose mortar, paints, protective coatings, efflorescence, laitance and airing compounds. The conditions of the manhole or chamber may require the use of an environmentally safe degreasing compound; if so, the surface shall be thoroughly rinsed to eliminate any residue.

Place covers over invert to prevent extraneous material from entering the sewer lines.

All foreign material shall be removed from the manhole wall and bench using a high pressure water spray (minimum 4,000). Loose and protruding brick, mortar, and concrete shall be removed using a mason's hammer, chisel and/scraper. Fill any large voids with quick setting patching material.

If the 4,000 psi high water pressure water spray is not successful in removing all grease and contaminants, then a chemical wash shall be used to clean and degrease the interior of the manhole

or chamber. The entire structure shall be thoroughly water- and/or sand-blasted to remove any loose or deteriorated material. The CONTRACTOR shall clean all accumulations of debris, such as dirt and grease, loose mortar, bricks and concrete, and dispose of properly. Care shall be taken to prevent any loose material from entering outlet sewer lines by inserting a 2-inch or smaller mesh protective screen into the manhole's outlet.

Any existing manhole steps shall be removed prior to sealing (waterproofing) the structure walls, and installing liners.

PART 2 - PRODUCTS

2.01 CLEANING EQUIPMENT

High-Velocity Jet (Hydrocleaning) Equipment: All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floors and produce at least 4,000-psi pressure. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel.

Mechanically Powered Equipment or Bucket machines used by the CONTRACTOR 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 allowed. The 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 specifically heat-treated steel. To ensure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.

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 to insure removal of grease. If sewer cleaning balls or other equipment which cannot be collapsed is used, special precautions to prevent flooding of the sewers and public or private property shall be taken.

2.02 TELEVISION INSPECTION EQUIPMENT

A. Television inspection equipment used by the Contractor shall conform to the requirements of Section 02752 – Television Survey.

PART 3 - EXECUTION

3.01 SANITARY SEWER SYSTEM CLEANING

The CONTRACTOR shall notify the local fire department and the OWNER to obtain approval and water meter, if required, before using fire hydrants.

During sewer cleaning operations, satisfactory precautions shall be taken by the CONTRACTOR 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 owner. When possible, the flow of wastewater in the sewer shall be utilized to provide the necessary pressure for hydraulic cleaning devices. When additional water from fire hydrants is necessary to avoid delay in normal work procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.

The designated sewer manhole sections shall be cleaned by the CONTRACTOR using hydraulically propelled, high-velocity jet, or mechanically powered equipment. 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 OWNER. The equipment shall be capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the sewer lines and manholes. 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. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole section, it will be assumed that a major blockage exists and the cleaning effort shall be repeated with other types of equipment.

ALL sludge, dirt, sand, rocks, grease, and other solid or semi-solid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing material from manhole section to manhole section, which could cause line stoppages, accumulations of sand in wet wells, or damage pumping equipment, shall not be permitted.

Under no circumstances shall sludge or other debris removed during these operations be dumped or spilled into the streets, ditches, storm drains or other sanitary sewers. The CONTRACTOR shall remove from the site and properly dispose of all solids or semi-solids recovered during the cleaning operation. The CONTRACTOR shall obtain permits and make arrangements as required to properly dispose of solids.

The CONTRACTOR is advised that he shall not dispose of this material by legal or illegal dumping on private or public property, by sale to others, or any means other than those given above.

The CONTRACTOR shall keep his haul route and work area(s) neat and clean and reasonably free of odor, and shall bear all responsibility for the cleanup of any spill which occurs during the transport of cleaning/surface preparation by-products and the cleanup of any such material which is authorized by or pursuant to this contract and in accord with applicable law and regulations. The CONTRACTOR shall immediately cleanup any such spill, or waste. If the CONTRACTOR fails to cleanup such spill or waste immediately, the OWNER shall have the right to cleanup or arrange for its cleanup and may charge to the CONTRACTOR all costs, including administrative costs and overhead, incurred by the OWNER in connection with such cleanup. The OWNER may also charge to the CONTRACTOR any costs incurred or penalties imposed on the OWNER as a result of any spill, dump or discard. Under no circumstances is this material to be discharged into the waterways or any place other than where authorized to do so by the appropriate authority. The term "CONTRACTOR" as used in this section shall include the CONTRACTOR'S subcontractors and other Contractors.

The general requirements for vehicles hauling such waste materials are as follows: Transport vehicles must be of type(s) approved for this application by the political jurisdictions involved. General requirements are that the vehicles have watertight bodies, that they be properly equipped and fitted with seals and covers to prohibit material spillage of drainage, and that they be cleaned as often as is necessary to prevent deposit of material on roadways. Vehicles must be loaded within legal weight limits and operated safely within all traffic and speed regulations.

The routes used by the CONTRACTOR for the conveyance of this material on a regular basis shall be subject to approval by the governing authority having jurisdiction over such routes.

3.02 ROOT REMOVAL

A. Roots shall be removed by the CONTRACTOR from sections designated to be relined. Special attention shall be used during the cleaning operation to ensure complete removal of roots from the joints. Any roots which could prevent the traveling of the packer or could prevent the proper application of chemical sealants, or could prevent the proper seating and application of cured-in-place, fold-and-formed or sectional cured-in-place liners, shall be removed. Procedures may include the use of mechanical equipment such as rodding machines, bucket machines and winches using root cutters and porcupines, and equipment such as high-velocity jet cleaner. When specifically directed, chemical root treatment shall be used before the root removal operation, and grouting will take place after root removal in accordance with Section 02763 – Chemical Grouting. CONTRACTOR shall capture and remove all roots form the line.

3.03 DISPOSAL OF MATERIALS

A. All solids or semi-solids resulting from the cleaning operations shall be removed from the site and disposed of in accordance with applicable regulations. All materials shall be removed from the site no less often than at the end of each workday. Under no circumstances shall the CONTRACTOR be allowed to accumulate, debris etc., on the site beyond the stated time, except in totally enclosed containers and

as approved by the OWNER. The CONTRACTOR shall submit a plan for disposal of solids to the OWNER.

3.04 TELEVISION INSPECTION

A. Television inspection shall be performed by the CONTRACTOR in accordance with requirements of Section 02752 - Television Survey.

3.05 FINAL ACCEPTANCE

Acceptance of sewer line cleaning shall be made upon the successful completion of the television inspection by the CONTRACTOR and shall be to the satisfaction of the ENGINEER. If a TV inspection shows the cleaning to be unsatisfactory, the CONTRACTOR shall be required to re-clean and re-inspect the sewer line until the cleaning is shown to be satisfactory. In areas where television inspection is not performed, the OWNER may require the CONTRACTOR to pull a double squeegee (with each squeegee the same diameter as the sewer) through each manhole section as evidence of adequate cleaning. If lining is to follow the television inspection, particular attention shall be given to the adequacy of the cleaning to ensure that proper seating of the liner can be achieved. It is the CONTRACTOR's responsibility to assure that the lines are properly cleaned to accept the liner.

In addition, on all those lines which have sags or dips, to an extent that the television camera lens becomes submerged for three (3) or more feet during the television inspection, the CONTRACTOR shall pull double squeegee and/or sponges through the line in order to remove the water from those dips or sags, or draft the water by means of high-velocity jet cleaners. Water removal shall be performed until the television camera lens will no longer be submerged. This requirement may be waived by the OWNER if the water in which the camera lens is submerged is clear enough to allow the identification of pipe defects, cracks, holes and location of service taps.

END OF SECTION

SECTION 02752

TELEVISION SURVEY

PART 1 - GENERAL

1.01 WORK INCLUDED

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 survey to inspect the entire barrel of sewers up to 36 inches in diameter and sewer service laterals. The survey shall show all defects and determine amount of infiltration entering the sewer system. Prior to any testing, all lines and laterals shall be cleaned of debris, cleaned of tuberculations through mechanical removal and flushed clean. Debris shall be caught and removed from the lines and laterals and shall not be flushed into existing live sanitary sewers.

1.02 GENERAL

After cleaning as specified in Section 02730 – Preparatory Cleaning and Root Removal, and before and after rehabilitation operation/replacement work, the pipe sections and laterals shall be visually surveyed by means of closed-circuit television in the presence of the OWNER. The survey shall be performed one manhole-to-manhole section or one lateral at a time and the flow in the section being surveyed shall be suitably controlled as described in Section 02750 – Wastewater Flow Control.

Pre and post-construction survey video on CD-ROM shall be delivered to the OWNER on a "one line per CD-ROM" basis with the pre-construction video immediately preceding the post-construction video, accompanied with the corresponding work orders, and pre- and post-TV logs, for each sewer line and lateral surveyed. The video on CD-ROM shall be direct from a live video source into video file, format MPEG1.

1.03 EQUIPMENT

A. Sewer Main

The television camera used for the survey shall be one specifically designed and constructed for such survey and shall be of the pan and tilt type. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. Then 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 camera in clear focus at all times. Picture quality and definition shall be to the satisfaction of the OWNER; and if unsatisfactory, equipment shall be removed and replaced with adequate equipment at no additional cost to the OWNER.

The video camera shall include a titled feature capable of showing on the tape the following information:

City and State
Date/Time
CONTRACTOR's Name
Line Size, Material, and Depth
Manhole Identification (both manholes) and direction of video
Lateral identification.
On-going Footage Counter

B. Service Lateral

The television camera used for the lateral survey shall be one specifically designed and constructed for such survey. A Sonde locating device shall be attached to the camera. 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 camera in clear focus at all times. Picture quality and definition shall

be to the satisfaction of the OWNER; and if unsatisfactory, equipment shall be removed and replaced with adequate equipment at no additional cost to the OWNER. The camera system shall be able to inspect 3-, 4-, and 6- inch lateral connections up to 70 feet from the sewer mainline. The launcher shall be mounted on a tread tractor that moves through main sewers and positions the inspection camera launcher opposite the lateral line connection. The camera system shall have mini black and white or color, fixed position, "positioning" camera to observe and place the mini color, push, "inspection" camera at the lateral. The inspection camera shall be attached to an 80-foot long push cable with a fiberglass rod core for cable rigidity. The camera head shall point forward while traveling through the sewer mainline. 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.

The video camera shall include a titler feature capable of showing on the tape the following information:

City and State
Date/Time
CONTRACTOR's Name
Pipe size and material hole Number & Distance to Lateral
On-going Footage Counter

6. A Sonde shall be provided for locating unmarked sewer laterals. A sonde is a transmitter tied on a line and moved through a sewer or duct. A receiver on the surface follows its movement, documenting the line location. The pipe position is then marked on the ground. The sonde is pushed farther into the pipe, the receiver relocates the sonde and the pipe position is marked again. This process is repeated until the desired section of pipe is traced. It is pulled out on completion of the locate.

1.04 SUBMITTALS

A. The CONTRACTOR shall submit shop drawings and other information in accordance with Section 01300 – Submittals. 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.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION SURVEY

A. Procedure for Sewer Main

Prior to any repair work, the entire sewer line (from manhole to manhole) shall be televised. The camera shall be placed at the center of the manholes and videotaping shall commence prior to entering the pipe. The CONTRACTOR shall show the inside of the manhole walls and the pipe connection to the wall at both the upstream and downstream manhole. The camera shall be moved through the lines in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case shall the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, powered rewinds and tractors 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 the camera is being pulled through the sewer line by a hydraulic cleaning unit hose, the cleaning nozzle shall be located a minimum of eight (8) feet away from the camera to allow a clear, unobstructed view. Jet nozzle shall be used in front of camera while televising through a dip to draft out water. If, during the survey operation, the television camera will not pass through the entire manhole section, the CONTRACTOR shall set up his equipment so that the survey can be performed from the opposite manhole. In addition the CONTRACTOR shall stop camera at all point repairs, sectional repairs, and reinstated laterals, and inspect entire repaired pipe section.

Whenever non-remote powered and controlled winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two

manholes of the section being surveyed to insure good communications between each member of the crew. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Measurement meters shall be accurate to tenths of a foot over the length of the section being surveyed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, electronic distance meter or other suitable device. Manhole numbers and linear footage shall be shown on screen during taping. Movement of the television camera shall be temporarily halted for a minimum of ten seconds at each visible point source of infiltration and/or inflow until the leakage rate from that source is quantified. The camera shall be stopped at all service connections and the service lateral shall be inspected with the pan and tilt camera. The camera shall also be stopped at active service connections where flow is discharging. If the discharge persists, the property involved shall be checked to determine whether or not the discharge is sewage. If no flows are being discharged from the building, it shall be considered that the observed flow is infiltration/inflow.

Procedure for Service Lateral

Prior to any repair work, the entire service lateral (from mainline to property line/cleanout, whichever is farther from the mainline) shall be televised.

Measurement for location of defects shall be above ground by means of a meter device. Measurement meters shall be accurate to tenths of a foot over the length of the section being surveyed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device. Linear footage shall be shown on screen during recording.

Movement of the television camera shall be temporarily halted for a minimum of ten seconds at each visible point source of infiltration and/or inflow until the source and flow rate from that point are determined.

The inspection shall be performed from either the main sewer or the cleanout with proper equipment specified. If the CONTRACTOR chooses to perform the inspection from the cleanout and the cleanout is either inaccessible or does not exist, he shall install a cleanout to facilitate the inspection. All costs of material equipment, labor, and other costs due to unspecified field conditions shall be borne by the CONTRACTOR. Payment for cleanout installation shall be made by the OWNER as indicated in Section 01025, Measurement and Payment.

Above ground horizontal location of lateral shall be marked every (5) feet utilizing surveyor's paint on an asphalt or concrete surface and surveyor's flags in grass. Approximate depth of laterals at these locations shall be recorded on the TV logs.

Field Documentation

1. Television Inspection Forms (Survey Logs).

Sewer Main: Printed and electronically stored 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 survey. Upstream footage at face of manhole (0) and downstream footage at face of manhole (e.g. 250 shall be shown on the log. The television inspection forms to be utilized by the CONTRACTOR shall be those mandated by NASSCO's (National Association of Sewer Survey Companies) PACP (Pipe Line Assessment and Certification Program). Both the "Header" and "Details" information of the form shall be entered as indicated in the PACP standards. The survey logs shall include, but not be limited to the following information:

Correct pipe segment/manhole numbers/lateral identification
Correct address of manhole/lateral location
Pipe/Lateral size, length and material
Manhole depth (up and downstream)
Lift station service area number
CD number and index

Footage locations, descriptions and estimated leak rates for visible point sources of infiltration inflow. Footage locations and descriptions of structural defects such as obstructions, any remaining root intrusion, offset joints, cracked pipe, fractured pipe, holes, collapses, sags, protruding service connections and/or blockages in the pipe. The terminology to be used shall follow NASSCO's PACP standards. All information will be recorded and a copy of such electronic records and a hard copy will be supplied to the OWNER.

Service Laterals: Location of the lateral by indicating 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. Printed and electrically 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 OWNER.

Photographs. Digital photographs of the television picture of problems shall be taken by the CONTRACTOR upon request of the OWNER.

Video Recordings. The purpose of video (CD-ROM) recording shall be to supply a visual and audio record of problem areas of the lines that may be replayed. CD-ROM recording playback shall be at the same speed that it was recorded. Slow motion or stop motion playback features shall be supplied by the CONTRACTOR. Once recorded, the CD-ROM becomes property of the OWNER. The CONTRACTOR shall have all CD-ROM and necessary playback equipment readily accessible for review by the OWNER during the Project. Audio. All CD-ROM shall have audio record. State date, time, operator's name, area, upstream manhole number to downstream manhole number, pipe size and material, upstream manhole depth, and TV survey will be from up- to downstream, or down- to upstream. The CONTRACTOR shall verbally state station and position of all laterals and defects.

3.02 POST-CONSTRUCTION SURVEY

A. Procedure

The same procedures shall be used as indicated in Section 3.01 PRE-CONSTRUCTION SURVEY. In addition, the CONTRACTOR shall stop camera at all point repairs, sectional repairs, and reinstated laterals, and inspect entire repaired pipe section. The CONTRACTOR shall invert white foreground to black as needed in the line section with light background.

B. Documentation

1. The same documentation shall be provided as indicated in Section 3.01 PRECONSTRUCTION SURVEY.

3.03 LOCATION OF A LATERAL FROM RESIDENCE

A. Procedure

1. Run a sonde through a roof vent to locate cleanout as well as unmarked sewer lateral. A sonde is a transmitter tied on a line and moved through a sewer or duct. A receiver on the surface follows its movement, documenting the line location. The pipe position is then marked on the ground. The sonde is pushed farther into the pipe, the receiver relocates the sonde and the pipe position is marked again. This process is repeated until the desired section of pipe is traced. It is pulled out on completion of the locate.

B. Documentation

1. Above ground horizontal location of lateral shall be marked every (5) feet utilizing surveyor's paint on an asphalt or concrete surface and surveyor's flags in grass. Approximate depth of laterals at these locations shall be recorded on the TV logs. Location of buried cleanouts, or location for the purposes of installing a new cleanout shall be marked by two measured distances to permanent recoverable objects. CONTRACTOR shall furnish a schematic of these locations with sufficient detail to be able to relocate from above ground, at a later date. **END OF SECTION**

SECTION 02760

PREPARATORY CLEANING AND ROOT REMOVAL

PART 1 GENERAL

1.01 Scope

This Section covers the preparatory cleaning and root removal from sanitary sewer mains prior to the internal inspection of the sewer lines by closed-circuit television and rehabilitation. This section also addresses the cleaning of the receiving lift station wet well prior to the start of cleaning operations and again after all liner installations served by that lift station have been installed and trimmed out. The Contractor shall furnish all necessary materials, labor, equipment, and services required for cleaning the sanitary mains and lift stations, including the removal of roots and debris.

1.02 General

Sewer Line Cleaning – The intent of sewer line cleaning is to remove dirt, grease, rocks, tuberculation, sand, and other foreign materials from the lines and restore the sewer to a minimum of 95% of the original carrying capacity. Since the success of other phases of work depends on the cleanliness of the lines, the importance of this phase of the operation is emphasized. It is recognized that there are some conditions such as broken pipe and major blockages that prevent cleaning from being accomplished or where additional damage would result if cleaning were attempted or continued. Should such conditions be encountered, the Contractor will not be required to clean those specific segments of the sewer line. If, in the course of normal cleaning operations, damage does result from preexisting and unforeseen conditions such as broken pipe, the Contractor will not be held responsible. However, the Contractor is required to provide flow transfer and may be directed to assist the County in the repair.

Lift Station Cleaning – The purpose of cleaning the lift station wet well(s) prior to the start of line cleaning operations is to ensure the wet well is free of debris and other objects which may be dislodged by the additional flows entering the wet well(s) as a result of the cleaning and lining operations. The lift station wet wells shall be cleaned as work in the area served by the lift station is finished and prior to starting work in another area.

1.03 Hydraulic Cleaning Equipment

Hydraulically Propelled Equipment – The equipment used shall be of a removable 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 in the sewer. The moveable dam shall be equal in diameter to the pipe being cleaned and shall provide a flexible scraper around the outer periphery to insure removal of the grease. If sewer cleaning balls or other equipment, which cannot be collapsed, are used, special precautions to prevent flooding of the sewers and public or private property shall be taken.

High-Velocity Jet (Hydro-Cleaning) Equipment – All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all line sizes designated to be cleaned. The equipment shall carry its own water tank, auxiliary engines, pumps and hydraulically driven hose reel.

The wet well shall be pumped down by County personnel. The equipment used for cleaning lift station wet wells shall not damage the wet well and shall carry its own water tank, auxiliary engines, pumps, hoses, and nozzles. The vac-truck shall be used to remove any materials and debris from the wet wells. County personnel shall be present during all phases of the wet well cleaning to manage/operate the lift station pumps. **All wet well cleaning operations shall be completed and the lift station**

returned to normal operation prior to 3:30 PM. The Contractor shall coordinate the cleaning operations with the County five (5) business days in advance.

PART 2 PRODUCTS (Not Used)
PART 3 EXECUTION

3.01 General

The cleaning equipment shall be capable of removing dirt, grease, rocks, tuberculation, sand, and other materials and obstructions from the sewer lines and lift stations. When cleaning the sanitary mains, if an entire segment of the main cannot be successfully performed from one manhole, the equipment shall be set up in the opposing manhole and cleaning attempted again. If after reversing the setup, successful cleaning cannot be performed or the equipment fails to traverse the entire length of the main segment, it will be assumed that a major blockage exists and the cleaning effort shall be abandoned. The Contractor shall document the cause of the blockage if possible.

3.02 Cleaning Precautions

During the cleaning and preparation operations all necessary precautions shall be taken to protect the sanitary system from damage. During these operations, precautions shall also be taken to insure that no damage is caused to the lift station or to public or private property adjacent to, or served by, the sewer or its branches. 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 of the sewer line are used, precautions shall be taken to insure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. When possible, the flow of sewage in the sewer shall be utilized to provide the necessary pressure for hydraulic cleaning devices. When additional water from fire hydrants is necessary to avoid delay in normal work procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant. If a source of water is needed, the Contractor shall obtain one or more hydrant water meter(s) from the County. A refundable deposit and service charge is required for each meter. The most current information and fee schedule may be obtained by contacting the Customer Service Department at (813) 272-5977.

3.03 Material Removal

All sludge, dirt, sand, rocks, grease, roots and other solid or semisolid material shall be removed from the wet wells prior to and after the cleaning and lining operations. Additionally, 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 segment being cleaned. Passing material from segment to segment (or into the wet wells) which could cause line stoppages, accumulations of sand in wet wells, or damage pumping equipment, shall not be permitted. Under no circumstances shall sludge or other debris removed during these operations be dumped or spilled into the streets, ditches, storm drains or other sanitary sewers.

3.04 Disposal of Materials

All solids or semisolids resulting from the cleaning operations shall be removed from the site and disposed of by the Contractor in a legal and sanitary manner as approved by appropriate authorities, at the Contractor's cost. At the pre-construction conference, the Contractor shall identify the facility which will be accepting the materials removed from the sanitary system. The Contractor shall submit a letter to the Project Manager identifying the facility, the cost per unit, and the method for quantifying the amount disposed of (e.g. cost/ton, cost/cubic yard, etc.). The Contractor's letter shall be accompanied by a letter from the facility which will accept the materials removed from the sanitary sewers, acknowledging the material will be originating in Hillsborough County and will be removed by the Contractor under contract with the County. The facility letter shall be on company letterhead and bear the signature and title of an authorized facility representative.

3.05 Root Removal

Special attention should be used during the cleaning operation to assure complete removal of roots from the joints. Any roots which could prevent the proper application of chemical sealant, or could prevent the proper seating and application of the liners shall be removed. All roots shall be captured and removed from the line segments.

3.06 Protruding Service Taps

Protruding taps shall be trimmed to allow the insertion of the liner and the restoration of the full capacity of the line segment.

3.07 Acceptance of Cleaning Operations

Acceptance of sewer line cleaning shall be made upon the successful completion of the CCTV inspection. If the CCTV inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to re-clean and re-inspect the sewer line until the cleaning is shown to be satisfactory. If the Contractor proceeds with lining a segment which is determined to be unsatisfactorily cleaned, the liner shall be removed and replaced at no additional cost to the County. In addition, for those lines which have sags or dips, to an extent that the television camera lens becomes submerged for three (3) or more feet during the television inspection, the Contractor shall pull a double squeegee and/or sponge through the line in order to remove the water from the dips or sags. Water removal through squeegees and/or sponges shall be performed until the television camera lens is no longer submerged. This requirement may be waived by the Project Manager/Inspector if the water in which the camera lens is submerged, is clear enough to allow the identification of pipe defects, cracks, holes and location of service taps.

END OF SECTION

SECTION 02763

CHEMICAL GROUTING

PART 1 - GENERAL

1.01 SCOPE

A. The work specified in the Section includes all labor, materials, accessories, equipment and tools necessary for chemical grouting, sealing, and air testing sanitary sewer pipe joints, pursuant to ASTM F2304-03.

1.02 GENERAL

Chemical Root Treatment

When so directed by the ENGINEER, the CONTRACTOR shall perform chemical root treatment. The CONTRACTOR shall schedule his work to perform chemical root treatment a minimum of 8 weeks prior to performing the work specified under this Section. When so directed by the ENGINEER, prior to performing chemical grouting, the CONTRACTOR shall remove roots and clean the sewer in accordance with Section 02730 – Preparatory Cleaning and Root Removal.

Leak Testing

Sewer line joint testing shall be accomplished by applying air pressure to each sewer joint, and monitoring the pressure in the void over a one-minute period. The intent of joint testing is to identify defective joint prior to the joint sealing process and check the effectiveness of the seal. Testing cannot be performed and shall not be required on cracked, structurally unsound, or broken pipe, severely corroded or out-of round pipe, or on visibly leaking joints.

Leak Sealing

Sources, or possible sources, of infiltration within the sewer system, are to be sealed to eliminate infiltration. The application of the sealing grout within the pipe shall be by means of remote-controlled equipment designed to be positioned at the specific joint or crack to be sealed and to apply the grout under sufficient pressure for the grout to pass through the opening and fill voids outside the pipe as well as the opening in the pipe wall. Control of the device and review of the results shall be by operating the closed-circuit television camera and van-mounted monitor conforming to the requirements of Section 02752 – Television Survey. The method of sealing used shall not damage the pipe or change pipe alignment, and the original cross sectional area shall not be permanently reduced or changed.

1.03 QUALIFICATIONS

A. The qualifications of the Grouting CONTRACTOR shall be submitted. These Qualifications shall include detailed descriptions of the following:

Name, business address and telephone number of the CONTRACTOR. Name(s) of all supervisory personnel to be directly involved with Grouting for 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 ENGINEER. Specialty technicians shall be certified by the equipment manufacturer and/or its authorized representative. Certifications shall be submitted to the ENGINEER. The CONTRACTOR shall provide his references of previous project lists going back three (3) years including his customers' names, addresses, and telephone numbers. To be qualified, the CONTRACTOR shall have a minimum of three (3) years previous experience in grouting.

PART 2 - PRODUCTS

2.01 CHEMICAL JOINT SEALING MATERIALS

A. Chemical joint sealing materials used on this project shall be AV-118 Duriflex, or AV-100 plus activators, initiators and inhibitors recommended by the manufacturer, Avanti International, or an approved equal.

In those lines which had root removal performed, a chemical root inhibitor shall be added to the grout prior to sealing the joints. CONTRACTOR shall submit the chemical to be used for ENGINEER's approval prior to utilization.

PART 3 - EXECUTION

3.01 LEAK TESTING EQUIPMENT

The basic equipment used shall consist of a television camera, joint testing device such as a packer, and test monitoring equipment. In combinations, the equipment shall be constructed in such a way as to provide means for introducing a test medium under pressure, into the Void area created by the expanding ends of the joint testing device. The testing equipment shall also have the means for regulating the flow rate of the test medium Void area in conjunction with the means for continuously measuring the actual static pressure of the test medium at and within the Void area only. The packer device shall be constructed in such a manner as to allow some flow to pass through its center annulus. Void pressure data shall be transmitted electrically and without the use of the test medium or hoses. All test monitoring shall be above ground and in a location to allow for simultaneous continued observation of the television monitor and test monitoring equipment by the CONTRACTOR. The ENGINEER shall witness the testing operation. Sewer line joint testing shall be accomplished before and after the grouting operation by applying a positive pressure to each sewer joint and monitoring the pressure in the Void. The intent of joint testing is to identify defective joints prior to the joint sealing process and determine the effectiveness of the seal repaired.

3.02 CONTROL TEST PROCEDURES

A. Prior to and during the joint testing phases of the work, the CONTRACTOR shall perform Control, Intermediate, and Final testing in accordance with the latest edition of ASTM F2304.

3.03 JOINT TESTING PROCEDURE

A. Sewer line joints shall be individually tested at a test pressure equal to ½ psi per vertical foot of pipe depth, but in no case exceeding a pressure of 10 psi and in accordance with the following procedures:

The packer or testing device shall be positioned within the line in such a manner as to straddle the joint to be tested.

The packer ends or testing device ends shall be expanded so as to isolate the joint from the remainder of the line and create a Void area between the packer or testing device and the pipe joint. The ends of the testing device shall be expanded against the pipe with sufficient inflation pressure to contain the test medium within the Void without leakage past the expanded end. The test medium shall be introduced into the Void area until a pressure or flow rate equal or greater that the required test pressure is observed with the Void pressure monitoring equipment.

Air Test – After the void pressure is observed to be equal to or greater than the required test pressure, the airflow shall be stopped and the air test supply line vented. The operator will observe this void pressure for a period of 15 s, if the pressure is maintained, with a pressure drop of less than 1 psi (7 kPa), then the joint will be considered as having passed the test. If the pressure shows additional decay during the recommended time period, it will be considered as having failed and shall be sealed. Upon completion of the sealing, the joint will be retested at the established test criteria (posttest).

Water Test – A liquid (water) shall be introduced into the void area until a pressure equal to or greater than the required test pressure is observed with the void pressure monitoring equipment. If the required test pressure cannot be developed (due to joint leakage), the joint will have failed the test and shall be sealed as specified. The flow rate of the test liquid shall then be regulated to a rate at which the void pressure is observed to be the required test pressure for a period of 30 seconds. A reading of the test liquid flow meter shall then be taken. If the flow rate exceeds ¼ gallon per minute (due to joint leakage), the joint will have failed the test and shall be sealed as specified.

4. The test medium shall be air or liquid.

3.04 TEST RECORDS

A. During the joint testing procedure, complete records shall be kept, to include the following data:

Identification of the manhole section tested.
Type of pipe.
Diameter of pipe.
Length of pipe sections between joints.
Depth of pipe to surface.
Test pressure used and duration of test.
Statement indicating the pass/fail test results for each joint tested, Location (stationing) of each joint tested and location of any joints not tested with an explanation for not testing. B. In the case of "passing" joint, a single pressure reading may be recorded. In the case of a "failing" joint requiring grout, three pressures shall be recorded: the initial "failing" pressure; the zero pressure after grout has been injected and the packer deflated; and the final pressure after the grout has been injected and the packer reinflated.

3.05 JOINT SEALING EQUIPMENT

The basic equipment shall consist of a closed circuit television system, necessary chemical sealant containers, pumps, regulators, valves, hoses, etc., and joint sealing packers for the various sizes of sewer pipe. The 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. Generally, the equipment shall be capable of performing the specified operations in lines where flows do not exceed the maximum line flows as specified in Section 02750-Wastewater Flow Control. When the packer is inflated, two widely spaced annular bladders shall be formed, each having an elongated shape and producing an annular void around the center portion of the packer. Before starting the work, a performance test demonstration verifying the accuracy and repeatability of the void pressure meter and fluid pumping equipment should be performed. If these test demonstrations fail to show that the readings are accurate, ± 0.5 psi (3kPa) for void pressure repeatability, and ± 0.1 gal (0.4 L) of chemical pumped into a measured container, the CONTRACTOR shall be required to make the required repair or adjustments to the equipment and gages and retest until the results are satisfactory to the OWNER's representative. The test demonstration may be required at each work shift during the sealing operation.

3.06 JOINT SEALING PROCEDURE

In the preparation and application of the sealing grout, the recommendations of the manufacturer of the grout materials shall be followed. Before joint sealing, chemical grout gel times should be measured and recorded. Gel times should also be measured and recorded. Gel times should also be measured and recorded whenever a new batch is made and at the end of the shift these gel times' measurements are a very effective and meaningful quality assurance procedure. Joint sealing shall be accomplished by forcing chemical sealing materials into or through infiltration points be a system of pumps, hoses, and sealing packers. Jetting or driving pipes from the surface that could damage or cause undermining of the pipe lines, will not be allowed. Excavating the pipe, which would disrupt traffic, undermine adjacent utilities and structures, will not be allowed. The packer shall be positioned over the area of infiltration by means of a metering device and the closed circuit television in the line. It is important that the procedure used by the CONTRACTOR for positioning the packer be accurate to avoid over-pulling the packer and thus not effectively sealing the point of infiltration. The packer sleeves shall then be expanded using precisely controlled pressures. The pneumatically expanded sleeve or elements shall seal against the inside periphery of the pipe to form a void area at eh point of infiltration, now completely isolated from the remainder of the pipe line. Into this isolated area, sealant materials shall be pumped through the hose system at controlled pressures, which are in excess of groundwater pressures. The pumping, metering, and packer device shall be integrated so that the proportions and quantities of materials can be regulated in accordance with the type and size of the leak being sealed. The grout must be injected beyond the joint interface into the soil surrounding the pipe joint.

A color additive (dye) should be added to the grout so that a visual residual layer of grout rings the joint providing confirmation the packer was located over the joint and the void was filled during the sealing operation. No joint shall be considered sealed unless, while under continual pressure, an attempt is made to pump grout to "refusal" (up to ½ gallon per inch diameter pipe size). This is to insure that sufficient chemical has been dispersed into the soil surrounding the joint and that a temporary seal has not been made by applying a minimum amount of chemical grout to the void and the joint area inside the pipe. When chemical grout cannot be pumped to "refusal" within a volume less than or equal to ½ gallon per inch diameter pipe size due to latent physical conditions, no additional work shall be undertaken until authorization to proceed has been given by the OWNER/OWNER's representative. Upon completing the sealing of each individual joint, the packer shall be deflated; moved at least one packer length in either direction, and then repositioned over the joint; with the void pressure meter reading zero pressure, then reinflated and tested as specified in subsection 3.03 – Joint Test Procedure. Should the void pressure meter not read zero, the CONTRACTOR shall clean his equipment of residual grout material or make the necessary equipment repairs to provide for an accurate void pressure reading. Joints that fail to meet the specified test criteria shall be resealed and retested until the test criteria can be met in order to receive payment.

All testing shall be performed by the CONTRACTOR in the presence of the ENGINEER. It shall be the responsibility of the CONTRACTOR to completely seal every leak authorized for sealing to the extent determined by the ENGINEER. If, in the ENGINEER's opinion, it is not necessary to continue with a particular leak, the crew shall move to the next joint or leak. The CONTRACTOR shall remove any small excess sealing grout inside the sewer line. CONTRACTOR shall operate his equipment with care and shall be responsible for any damage to the sewer system or other facilities caused by his operations, and shall repair such damage at his expense and without delay as instructed by the ENGINEER.

3.07 JOINT SEALING RECORDS

A. Included in the records for joint sealing shall be:

The test pressure before and after sealing and the duration of the test.

The volume of grout material used to seal each joint.

The volume of grout placed per section.

The gel set time used.

The barrel test results.

The grouting material used including additives and their respective quantities.

3.08 LATERAL SEALING PROCEDURE

A. The following shall apply to the sealing of all reinstalled laterals after the main has been lines. The total batch shall be no more than 50 gallons. That means reducing the water in each tank by 5 gallons. This will increase the strength of the "gel" by increasing the solids to 12 percent. The "gel" time shall be 10 seconds longer than the time required by the pumps to fill the inside packer void at no time shall the "gel" time be less than 20 seconds.

3.09 TELEVISION SURVEY

A. Television survey, including Preconstruction Survey, Post Construction Survey, and Warranty Survey, as indicated in Section 02752 – Television Survey, is required for all grouted lines.

3.10 WARRANTY

A. All chemical grouting work described herein shall be guaranteed against faulty workmanship and/or materials for a period of 3 years after the completion of the work.

END OF SECTION

SECTION 02764

CURED-IN-PLACE SECTIONAL PIPE LINING

PART 1- GENERAL

1.03 SCOPE

B. The work specified in this section consists of rehabilitating existing sanitary sewer pipe by installing a resin impregnated fiberglass/polyester felt tube into an existing pipe to restore its structural and hydraulic integrity.

1.04 GENERAL

B. The finished sectional pipeliner in place shall be fabricated from materials which, when installed, will be chemically resistant to withstand internal exposure to domestic sewage.

1.04 SUBMITTALS

A. The Contractor shall submit shop drawings and other information to the Engineer for review in accordance with Section 01300, "Submittals". Included shall be design calculations for the work.

1.05 QUALIFICATIONS

A. The Qualifications of the CONTRACTOR shall be submitted. These Qualifications shall include detailed descriptions of the following:
Name, business address and telephone number of the CONTRACTOR. Name(s) of all supervisory personnel 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 ENGINEER. Specialty technicians shall be certified by the equipment manufacturer and/or its authorized representative. Certifications shall be submitted to the ENGINEER. The CONTRACTOR shall provide his references of previous project lists going back three (3) years including his customers' names, addresses, and telephone numbers. To be acceptable, a minimum of 200 sectional liner installations must be documented. To be acceptable, the installer must have had a minimum of three (3) years active experience in the commercial installation of the product.

PART 2- PRODUCTS

2.02 GENERAL

The finished liner shall be fabricated from material as specified in this section which when cured will be chemically resistant to the corrosive effects of the raw sewage and hydrogen sulfide. The cured-in-place sectional pipe shall be the New Life System as manufactured by Stephen's Technologies, Inc. or approved equal. The CONTRACTOR shall submit shop drawings, samples of materials, and design calculations to the ENGINEER for review.

2.03 LINER SIZING

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 ENGINEER. The length and number of liners shall be that deemed necessary by the ENGINEER to effectively carry out the repairs. The CONTRACTOR shall verify the lengths in the field before cutting liner to length. In general, the minimum length shall be 6 feet for 8- to 12-inch diameter of pipe, and cover a minimum of 6 inches on either side of the pipe joint. For 15- to 21-inch diameter of pipe, a longer sectional liner may be required.

2.04 LINER MATERIAL

The lining material shall be fiberglass matting material and fully impregnated with an epoxy resin as specified. The mixed components of the epoxy resin shall have the following properties:

Item		Criteria
1.	Solids Content	100% by weight
2.	Pot Life	90 minutes at 70 degrees F
3.	Shelf Life	at least 1 year (sealed)
4.	Viscosity	18,000 cps (average at 70 degrees F)
5.	Density	12 pounds per gallon (max.)

The cured epoxy resin material shall have the following properties:

Item	Test Value	Reference Standard
Flexural Strength	5,000 psi	ASTM D 790
Flexural Modulus	400,000 psi	ASTM D 790

2.05 LINER DESIGN

The required structural CIPP wall thickness shall be based at a minimum, 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 Safety Factor	2.0
Retention Factor for Long-Term Flexural Modulus to be used in Design	50%
Ovality*	5%
Groundwater Depth = Pipe Depth (above invert)*	ft.
Soil Depth (above crown)*	ft.
Soil Modulus	700 psi
Soil Density	120 pcf
Live Load	Two H20 passing trucks
Design Condition	Fully deteriorated
**Denotes information which can be provided here or in inspection video tapes or project construction plans. Multiple line segments may require a table of values.*	

The lining manufacturer shall submit to the ENGINEER for review complete design calculations for the liner, 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. A safety factor of 2 shall be applied in the design calculation. The host pipe shall be

considered fully deteriorated. The liner shall be designed to withstand a live load equivalent to two H-20 passing trucks plus all pertinent dead loads, hydrostatic pressure and grout pressure (if any). For design purposes, the water table shall be considered at grade elevation. The liner shall be designed in accordance with ASTM F 1216. The buckling analysis shall account for the combination of dead load, live load, hydrostatic pressure and grout pressure (if any). The liner side support shall be considered as if provided by soil pressure against the liner. The existing pipe shall not be considered as providing any structural support. Modulus of soil reaction shall be 700, corresponding to a moderate degree of compaction of bedding and a fine-grained soil as shown in AWWA Manual M45, Fiberglass Pipe Design. Liner shall be neither accepted nor installed until design calculations are acceptable to the ENGINEER.

PART 3- EXECUTION

3.11 CLEANING SEWER LINES

A. Prior to any lining of a pipe so designated, it shall be the responsibility of the CONTRACTOR to remove internal deposits from the pipeline in accordance with Section 02730 – Preparatory Cleaning and Root Removal.

3.12 TELEVISION SURVEY

Television survey shall be performed in accordance with Section 02752 – Television Survey, including Preconstruction and Post Construction Surveys. The interior of the pipeline shall be carefully surveyed to determine the location and extent of any structural failures. The location of any conditions which may prevent proper installation of lining materials into the pipelines shall be noted so that these conditions can be corrected. A video tape and suitable log shall be kept and turned over to the ENGINEER. For the sewer line with sectional cured-in-place liner installed, a variance for post-TV and tapes shall be allowed as follows:

The post-TV shall commence at the upstream manhole
(downstream for reverse setups) and shall proceed at a maximum speed of 30 feet per minute until the repair is reached. No panning of defects or laterals needs to be done. Upon reaching the sectional liner, the CONTRACTOR shall stop and carefully pan the beginning and the end of the liner to show that the repair has been successfully completed. If a lateral connection has been lined over and reopened, the CONTRACTOR shall pan this opening and the lateral. The rest of the line shall be televised without stopping until the downstream manhole has been reached.

One log (pre-TV log) shall be furnished with a statement under the comments line as to the linear footage of the beginning of the sectional liner, the length of the liner, and the number of laterals reinstated (if any), and their location.

3.13 FLOW BYPASSING

A. The CONTRACTOR, when required, shall provide for the transfer of flow, through or around a section or sections of pipe that are to be repaired. The proposed bypassing system shall be acceptable in advance by the ENGINEER. The acceptance of the bypassing system in advance by the ENGINEER shall in no way relieve the CONTRACTOR of his responsibility and/or public liability. The flow bypassing shall be done in accordance with Section 02750 – Wastewater Flow Control.

Note: If the repair can be made in a few hours, bypass pumping may not be required. The placement carriage shall be equipped with a bypass section to allow flow once liner is pressed into place.

3.14 LINE OBSTRUCTIONS

A. It shall be the responsibility of the CONTRACTOR to clear the line of obstruction. If survey reveals an obstruction that cannot be removed by conventional cleaning equipment, the CONTRACTOR shall make a point repair excavation in accordance with Section 02757 – Point Repair of Sanitary Sewers, to uncover and remove or repair the obstruction. Such excavation shall be accepted in writing by the ENGINEER prior to the commencement of the work.

3.15 LINER INSTALLATION

Prior to liner installation, all active severe leaks which may affect the success of the liner installation shall be stopped using chemical grout. The CONTRACTOR shall impregnate the liner with the 100

percent solids epoxy. Drop cloths, tarpaulins, and etc. shall be used to prevent epoxy material from contacting the adjacent ground. Place the liner on the placement carriage and maneuver carriage and liner into position with the use of a video camera. Force the liner against the inside wall of the damaged host pipe allowing epoxy resin to permeate into any cracks in the host pipe. Allow lines to cure for approximately 2 hours in accordance with the manufacturer's recommendations. Heat may be introduced to speed up curing time. Retract the placement carriage and remove from pipe. After the sectional liner has been cured in place, the CONTRACTOR shall reconnect the service connections. Cutting of the liner pipe shall be done from the interior of the pipeline using a robotic cutter. Where holes are cut through the liner, they shall be neat and smooth in order to prevent blockage at the service connections. Cut-in-service connections shall be opened to a minimum of 95 percent of the flow capacity of the building sewer. Cuts shall be wire-brushed to remove jagged edges. All coupons shall be recovered at the downstream manhole and removed. All reinstated service lateral connections (between the liner and the existing pipe) shall be grouted. The CONTRACTOR should not reactivate any line sections until accepted by the ENGINEER.

3.16 ACCEPTANCE

A. The finished liner shall be continuous over the entire length of the installation. The liner shall be free from visual defects, damage, deflection, holes, delamination, uncured resin, and the like. There shall be no visible infiltration through the liner or from behind the liner.

3.17 CLEANUP

A. After the liner installation has been completed and accepted, the CONTRACTOR shall clean up the entire project area and return the ground cover to grade. All excess material and debris not incorporated into the permanent installation shall be disposed of by the CONTRACTOR.

3.18 WARRANTY

A. The liner shall be 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 one 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 mutually agreed by the OWNER and the CONTRACTOR.

END OF SECTION

SECTION 02765

CURED-IN-PLACE PIPE LINER

PART 1 - GENERAL

1.01 WORK INCLUDED

It is the intent of this specification to provide for the reconstruction of pipelines and conduits by the installation of a resin-impregnated flexible tube which is formed to the original conduit by use of a hydrostatic head. The resin is cured using hot water under hydrostatic pressure within the tube. The Cured-In-Place Pipe (CIPP) will be continuous and tight fitting. The work specified in this Section includes all labor, materials, accessories, equipment and tools necessary to install and test cured-in-place pipe lining in main lines and in service laterals.

1.02 GENERAL

The finished pipe in place shall be fabricated from materials which when cured will be chemically resistant to withstand internal exposure to domestic sewage. This specification references ASTM F1216 (Rehabilitation of pipelines by the inversion and curing of a resin-impregnated tube). ASTM F1743 (Rehabilitation of pipelines by pulled-in-place installation of a cured-in-place thermosetting resin pipe) and ASTM D790 (Test methods for flexural properties of unreinforced plastics) which are made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.

1.03 SUBMITTALS

The CONTRACTOR shall submit manufacturer's Certificate of Compliance certifying compliance with the applicable specifications and standards.

The CONTRACTOR shall submit certified copies of test reports of factory tests required by the applicable standards and this Section.

The CONTRACTOR shall submit Manufacturer's installation instructions and procedures and insertion runs.

The CONTRACTOR shall submit procedures and materials for service reinstatement including time and duration of sewer service unavailability.

The CONTRACTOR shall submit liner sizing and wall thickness calculation data.

1.04 DELIVERY, STORAGE, AND HANDLING

The CONTRACTOR shall be responsible for delivery, storage, and handling of products. Products shall be kept safe from damage. Damaged products shall be removed from the job site promptly. Damaged products shall be replaced with undamaged products.

1.05 PRODUCT AND INSTALLER ACCEPTABILITY

Since sewer products are intended to have a 50 year design life, and in order to minimize the OWNER's risk, only proven products with substantial successful long term track records will be approved. Products seeking approval must meet all of the following criteria to be deemed commercially acceptable: For a product to be considered commercially proven, a minimum of 1,000,000 linear feet or 4,000 manhole-to-manhole line sections of successful wastewater collection system installations in the U.S must be documented to the satisfaction of the OWNER to assure commercial viability. In addition, at least 250,000 linear feet of the product shall have been in successful service within the State of Florida for a minimum of five years. For an installer to be considered as commercially proven, the installer must satisfy all insurance, financial, and bonding requirements of the OWNER, and must have had at least three (3) years active experience in the commercial installation of the product. In addition, the installer must have successfully installed at least 150,000 feet of the product in wastewater collection systems in Florida. Acceptable documentation of these minimum installations must be submitted to the OWNER.

Sewer rehabilitation products submitted for approval must provide third party test results supporting the long term performance and structural strength of the product and such data shall be satisfactory to the OWNER. Test samples shall be prepared so as to simulate installation methods and trauma of the product. No product will be approved without independent third party testing verification. Documentation for products and installers must be satisfactory to the OWNER and must be submitted with the bid.

PART 2 - PRODUCTS

2.01 MATERIALS FOR MAIN LINES

The sewn tube shall consist of one or more layers of absorbent nonwoven felt fabric and meet the requirements of ASTM F1216 or ASTM F1743, Section 5. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe, and stretch to fit irregular pipe sections.

The wetout tube shall have a uniform thickness that when compressed at installation pressures will meet or exceed the Design thickness.

The tube shall be sewn to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential stretching during inversion. Overlapped layers of felt in longitudinal seams that cause lumps in the final product shall not be utilized.

The outside layer of the tube (before wetout) shall be coated with an impermeable, flexible membrane that will contain the resin and facilitate monitoring of resin saturation during the resin impregnation (wetout) procedure.

The tube shall be homogeneous across the entire wall thickness containing 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.

The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.

Seams in the tube shall be stronger than the unseamed felt.

The outside of the tube shall be marked for distance at regular intervals along its entire length, not to exceed 5 ft. Such markings shall include the Manufacturers name or identifying symbol. The tubes must be manufactured in the USA.

The resin system shall be a corrosion resistant polyester, vinyl ester, or epoxy and catalyst system that when properly cured within the tube composite meets the requirements of ASTM F1216 and ASTM F1743, the physical properties herein, and those which are to be utilized in the Design of the CIPP for this project. The resin shall produce CIPP which will comply with the structural and chemical resistance requirements of this specification.

The finished pipe liner in place shall be chemically resistant to and shall withstand internal exposure to domestic wastewater having a pH range of 5 to 11 and temperature of 150□F.

2.02 STRUCTURAL REQUIREMNTS

The CIPP shall be designed as per ASTM F1216, Appendix X1. The CIPP design shall assume no bonding to the original pipe wall. 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. This is a performance test of the materials (tube and resin) and general workmanship of the installation and curing. A percentage of the instantaneous flexural modulus value (as measured by ASTM D-790 testing) will be used in design calculations for external buckling. The percentage, or the long-term creep retention value utilized, will be verified by this testing. Values in excess of 50% will not be applied unless substantiated by qualified third party test data. 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 design.

The layers of the cured 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 the probe or knife blade moves freely between the layers. If separation of the layers occur during testing of field samples, new samples will be cut from the work. Any reoccurrence may cause rejection of the work.

Cured pipe shall conform to the following initial minimum structural properties:

PROPERTY	TEST METHOD	RESULTS
Flexural Stress	ASTM D-790 (short term)	4,500 psi
Modulus of Elasticity	ASTM D-790	250,000 psi

The required structural CIPP wall thickness shall be based at a minimum, on the physical properties described above and in accordance with the design equations in the appendix of ASTM F1216, and the following design parameters:

Design Safety Factor	2.0
Retention Factor for Long-Term Flexural Modulus to be used in Design (as determined by Long-Term tests described in paragraph 2.02 B)	50%
*Ovality	5%
Groundwater Depth = Pipe Depth (above invert)*	ft.
Soil Depth (above crown)	ft.
Soil Modulus	700 psi
Soil Density	120 pcf
Live Load	Two H-20 passing trucks
Design Condition	Fully deteriorated
*Denotes information which can be provided here or in inspection video tapes or project construction plans. Multiple line segments may require a table of values.	

The lining manufacturer shall submit to the OWNER for review complete design calculations for the liner, signed and sealed by a Professional ENGINEER registered in the State of Florida and certified by the manufacturer as to the compliance of his material to the values used in the calculations. A safety factor of 2 shall be applied in the design calculation. The host pipe shall be considered fully deteriorated. The liner shall be designed to withstand a live load equivalent to two H-20 passing trucks plus all pertinent dead loads, hydrostatic pressure and grout pressure (if any). For design purposes, the water table shall be considered at grade elevation. The liner shall be designed in accordance with

ASTM F1216. The buckling analysis shall account for the combination of dead load, live load, hydrostatic pressure and grout pressure (if any). The liner side support shall be considered as if provided by soil pressure against the liner. The existing pipe shall not be considered as providing any structural support. Modulus of soil reaction shall be 700, corresponding to a moderate degree of compaction bedding and a fine-grained sole as shown in AWWA Manual M45, Fiberglass Pipe Design. Because of the nature of the calculations and constants utilized, the minimum liner thicknesses shall be 5 percent greater than the amount specified. 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 a five degree Fahrenheit increments ranging from 70 degrees F to 100 degrees F. This 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 the preconstruction conference so that the OWNER may set procedures for dealing with such an instance caused by construction delays. The minimum liner thickness is for material with characteristics as shown. Liner shall neither be accepted nor installed until design calculations are acceptable to the OWNER. Liner shall be as manufactured by Insituform Technologies, Inc., 702 Spirit 40 Avenue, Chesterfield, MO 63005, Phone No. 800-325-1159, or approved equal.

2.03 MATERIALS FOR SERVICE LATERALS

Chemical Resistance – The CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical testing requirements.

Hydraulic Capacity – Overall, the hydraulic profile shall be maintained as large as possible. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.

CIPP Field Samples – When requested by the OWNER, the CONTRACTOR shall submit test results from field installations in the USA of the same resin system and tube materials as proposed for the actual installation. These test results must verify that the CIPP physical properties specified in Section 2.02 D have been achieved in previous field applications.

2.04 MATERIALS FOR SERVICE LATERALS

Intent: It is the intent of this portion of this specification to provide for the reconstruction of lateral sanitary sewer pipelines with the installation of resin impregnated, flexible felt tubes. They shall be installed into the existing service using a pull rope or a push rod. Curing shall be accomplished with hot water or other methods approved by the OWNER, the curing method shall be suitable for the selected resin, such that the resin produces a hard, impermeable pipe wall. The cured-in-place pipe (CIPP) should extend throughout the service lateral in a jointless, continuous, tight-fitting, watertight pipe-within-a-pipe.

Structural Requirements: The structural performance of the finished pipe must be adequate to accommodate all anticipated loads throughout its design life. No CIPP reconstruction technology will be allowed that requires bonding to the existing pipe for any part of its structural strength. Since the pipe strength is related to the uniformity and density of the pipe wall, only resin vacuum impregnation will be allowed. Resin impregnation without vacuum entraps air and creates voids which weaken the pipe wall. If reinforcing materials (fiberglass, etc.) are used, the reinforcing material must be fully encapsulated within the resin to assure that the reinforcement is not exposed, either to the inside of the pipe or at the interface of the CIPP and the existing pipe.

Structural Design Methods: design methods are to be derived from traditionally accepted pipe formulae for various loading parameters and modes of failure. All equations will be modified to include ovality as a design parameter. The design method shall be submitted to the OWNER for review.

Design calculations shall be signed and sealed by a Professional ENGINEER registered in the State of Florida.

Continuous Structure: The lateral CIPP must bridge breaks and missing sections of the existing pipe, substantially reducing or eliminating infiltration or exfiltration. The new joint less pipe-within-a-pipe must fit tightly against the old pipe wall and consolidate all disconnected sections into a single continuous conduit.
Useful Life: The lateral CIPP must have a minimum design life of fifty (50) years. The minimum design life may be documented by submitting life estimates by national and/or international authorities or specifying agencies. Otherwise, long-term testing and long-term in-service results (minimum ten (10) years) may be used, with the results extrapolated to fifty (50) years.
Materials: All constituent materials will be suitable for service in the environment intended. The final product will not deteriorate, corrode or lose structural strength that will reduce the projected product life.
Physical Strength: The design for the lateral CIPP wall thickness will be based on the following strengths as shown herein, unless otherwise submitted and approved by the OWNER.

PROPERTY	TEST METHOD	RESULTS
Flexural Stress	Modified ASTM D-790	4,500 psi
Modulus of Elasticity	Modified ASTM D-790	250,000 – 500,000 psi

H. Service lateral liner shall be neither accepted nor installed until design calculations are acceptable to the OWNER. Liner shall be as manufactured by Insituform of North America, Inc., or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

All activities shall be performed in accordance with the manufacturer's recommendations and regulations established by OSHA. Particular attention shall be drawn to those safety requirements involving working with scaffolding and entering confined spaces. The Contractor shall provide traffic control in accordance with the requirements of Section 01570 – Traffic Regulations and Maintenance of Traffic. It is the Contractors responsibility to notify in writing any property OWNER having a sewer service connection on the sewer being relined that such work is being performed. Notification shall be done 48 hours prior to performing relining work. The Contractor shall be solely responsible for any damage to private service lines or backups caused by relining operations. The Contractor shall defend, indemnify, and hold harmless the OWNER and employees, the Engineer, and the OWNERs consultants from and against any and all claims, suits, actions, damaged loss, liability, or costs of any nature or description (including, without limitation, reasonable attorney's fees) arising from, or in any way attributable to or connected with the Work performed by the Contractor.

3.02 PREPARATION

The Contractor shall clean and inspect the existing sewer in conformance with Section 02751 – Preparatory Cleaning and Root Removal. The Contractor shall perform point repairs as directed by the OWNER, for the sewer section scheduled for relining. If during pre-television inspection, the Contractor identifies sections requiring point repairs but not identified on the Plans, he shall request OWNER's approval prior to performing those point repairs. The Contractor shall provide for the diversion of wastewater entering or passing through the pipe in conformance with Section 02600 – Wastewater Flow Control. Conditions that may prevent proper installation shall be noted and brought to the attention of the OWNER, and as directed by the OWNER corrected by the Contractor. All service connections shall be noted and brought to the attention of the OWNER. The Contractor shall notify the local fire department and utility company to obtain approval and a water meter, if required, before

using fire hydrants. The Contractor shall designate a location where the reconstruction tube shall be vacuum impregnated prior to installation. The Contractor shall allow the OWNER to inspect the materials and "wet out" procedure. A catalyst system compatible with the resin and reconstruction tube shall be used. Sufficient excess resin will be provided to ensure a mechanical bond with the host pipe after curing.

3.03 LINER INSTALLLATION FOR MAIN LINES

The Contractor shall install the pipe line in accordance with the manufacturer's specifications and as approved by the OWNER. The wet out reconstruction tube shall be inserted through an existing manhole or other approved access by means of an inversion process and the application of a hydrostatic head sufficient to fully extend it to the next designated manhole or termination point. The reconstruction tube shall be inserted into the vertical inversion standpipe with the impermeable plastic membrane side out. At the lower end of the inversion standpipe, the reconstruction tube shall be turned inside out and attached to the standpipe so that a leak-proof seal is created. The inversion head will be adjusted to be of sufficient height to cause the impregnated tube to invert from manhole to manhole and hold the tube tight to the pipe wall, produce dimples at service lateral connections, and flared ends at the manholes. The use of a lubricant is recommended. Care shall be taken during the elevated curing temperature so as not to overstress the felt fiber. Care shall be taken to facilitate any resin spillage cleanup in the work area. After inversion is completed, the Contractor shall supply suitable heat and water recirculation equipment. The equipment shall be capable of delivering hot water throughout the section by means of pre-strung hose to uniformly raise the water temperature above the temperature required to affect a cure of the resin. This temperature shall be determined by the resin/catalyst system employed, as required by the manufacturer. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supply. Another such gauge shall be placed between the impregnated reconstruction tube and the pipe invert at the remote manhole to determine the temperatures during the cure period as recommended by the resin manufacturer. Initial cure shall be deemed to be completed when inspection of the exposed portions of cured pipe appears to be hard and competent 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 water and cycling of the heat exchange to maintain the temperature continues. 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 cold water into the inversion standpipe to replace water being drained from a small hole made in the downstream end. 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. The discharge water temperature shall not exceed the level allowed by state or local standards. The finished pipe shall be continuous over the entire length of an inversion run and be as free as commercially practical from visual defects, such as foreign inclusions, dry spots, pinholes, and delamination. It shall also meet the leakage requirements or pressure test specified below. If the liner fails to make a tight seal due to a broken or misaligned pipe, at the manhole wall, or any other reason the Contractor shall apply a seal at that point. The seal shall be of a resin mixture compatible with the pipe.

3.04 SEALING PIPE IN MANHOLE

A. If the installed pipe fails to make a tight seal in the manhole, the Contractor shall apply a sealant at that point by pressure injection or other means to ensure a watertight seal. The sealant shall be of a resin mixture compatible with that used in the inversion process. The repair shall be rechecked after 48 hours to ensure that the seal is holding. If the seal does not hold, the Contractor shall continue to work until a seal is made and there are no leaks. The Contractor shall seal the pipe in the manhole at no additional cost to the OWNER.

3.05 REINSTATEMENT OF SERVICE LATERALS

After the pipe has been cured-in-place, the Contractor shall reinstate the existing service connections. This shall be done from the interior of the pipe without excavation of the pavement areas and in the case of no man entry pipes, from the interior of the pipe by means of a 360□ television camera and cutting device that reestablishes at least 95 and no more than 100% of the flow capacity of the service connection. The Contractor shall brush smooth all internal cuts to facilitate service lateral rehabilitation. Only personnel experienced in the operation of cutting devices used for reinstatement of service laterals shall be allowed to operate such equipment. The OWNER reserves the right to require reinstatement of service connections by excavation when a remote cut damages the pipe.

3.06 LINER INSTALLATION FOR SERVICE LATERALS

Site Disruption: The lateral CIPP usually require an access point to be established at the reconstruction termination point remote form the mainline pipe. The authorization for the access point a required location and excavation shall be obtained and performed by the OWNER of the system. The OWNER may install a clean-out, if required. The clean-out will be constructed of a polyvinyl chloride fitting or its equivalent with a riser pipe of equal diameter to the service pipe. The riser will be extended to the existing grade elevation and capped.

Internal Mainline Connection: The lateral CIPP shall be installed to affect a bond with the mainline invert-and-cure pipe to substantially reduce or eliminate the infiltration into the mainline pipe. The mainline pipe opening shall be prepared to accept the lateral CIPP. The lateral CIPP will protrude into the mainline pipe and form a seal with inside surface of the mainline invert-and-cure pipe surface. The bonding area of the lateral CIPP and the mainline invert-and-cure pipe shall be maximized to obtain the best possible bond. The protrusion shall not inhibit the closed circuit television post video inspection of the mainline or service lateral pipes.

Flow requirements: The lateral CIPP will provide at least 100 percent of the flow capacity of the host pipe before reconstruction. In lieu of actual measurements, calculated capacities may be derived using commonly accepted equations and values of the Manning flow coefficients (designated "n" coefficients). The original pipe material and condition at the time of reconstruction will determine the Manning coefficient used in the host pipe. A Manning coefficient of 0.009 for a jointless, relatively smooth-wall cured-in-place pipe will be used for the lateral CIPP flow calculation.

Inspection: The materials and processes must be reasonably available for pre-installation, installation and post-installation inspections. Areas which require inspection include, but are not limited to, the following:

Product materials should exhibit sufficient transparency to visually verify the quality of resin impregnation.

Temperature sensing devices, such as thermocouples, shall be located between the existing pipe and the lateral CIPP to ensure the quality of the cure of the wall laminate.

Time of construction: Construction schedules will be submitted and approved by OWNER. At no time shall any service lateral remain inoperative for more than an eight hour period. Any service that will be out of service for more than eight hours will be temporarily by-passed into a mainline sanitary sewer. This will be done at the CONTRACTOR's expense.

3.07 INSPECTION

A. After the completion of the lining process and reinstatement of appropriate service connections, the installation shall be television inspected in accordance with Section 02752 – Television Survey. All service entrances shall be accounted for. No infiltration shall be apparent. The finished pipe shall be continuous over the length of the installation and be free of dry spots, lifts, and delaminations. If the pipe is not acceptable to the OWNER, remedies shall be accomplished at the Contractor's expense and to the OWNER's satisfaction.

3.08 TESTING

After the installation procedures have been performed and prior to reinstatement of service connections, the Contractor shall perform a hydrostatic test on the sewer line to determine if it is watertight. The test shall be performed using the existing hydrostatic head provided by the inversion standpipe. The test time shall be 5 minutes during which time no makeup water shall be added to the

standpipe. If at the end of the test period no significant water loss is observed in the standpipe, the water tightness of the cured-in-place pipe shall be considered satisfactory.

For installation, two liner samples shall be required: A section of cured pipe cut from the installation at an intermediate or terminal manhole and which has been inserted through a like diameter pipe held in place by a suitable heat sink (such as sandbags); and a sample fabricated from material taken from the tube and the resin/catalyst system used and cured in a clamped 'plate' mold placed in the down tube. Each sample shall be large enough to provide a minimum of three specimens. The initial tangent flexural modulus of elasticity and flexural stress shall be measured in accordance with ASTM D-790 and shall meet the requirements of this section. Pipe failing to meet these requirements is subject to rejection and replacement at the Contractor's expense. Upon acceptance of the installation work and testing, the Contractor shall reinstate service laterals in the project area affected by his operations. After the work is complete, the Contractor shall provide the OWNER with a videotape showing the after installation, including a full circumferential view of the reinstated service lateral connections.

3.09 CLEANUP

A. After the installation work has been completed and all testing acceptable, the Contractor shall clean up the entire Project area. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor. The work area shall be left in a condition equal to or better than prior condition. Disturbed grassed areas shall be seeded or sod placed as directed by the OWNER at no additional cost to the OWNER. Refer to Section 02924 – Site Restoration.

3.10 WARRANTY

A. All liner installation will be warranted to be free from defects in materials and workmanship for a period of five (5) years from the date of rehabilitation. Should a defect occur during this five (5) year period that is attributable to the liner installation or materials, then this defect shall be repaired at no additional cost to the OWNER.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 WORK INCLUDED

Reinforcing steel bars and welded steel wire fabric for cast-in-place concrete, complete with tie wire. Support chairs, bolsters, bar supports and spacers, for reinforcing.

QUALITY ASSURANCE

Perform concrete reinforcing work in accordance with ACI 318 unless specified otherwise in this Section.

REFERENCES

ACI 318 - Building Code Requirements for Reinforced Concrete.
ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
D CRSI 63 - Recommended practice for placing reinforcing bars.
CRSI 65 - Recommended practice for placing bar supports, specifications and nomenclature.
ACI 315 - American Concrete Institute - Manual of Standard Practice.

1.04 SHOP DRAWINGS

Submit shop drawings in accordance with Contract Documents. Indicate bar sizes, spacings, locations and quantities of reinforcing steel and wire fabric, bending and cutting schedules and supporting and spacing devices.

Manufacturer's Literature: Manufacturer's specifications and installation instructions for splice devices.

PART 2 PRODUCTS

2.01 REINFORCING

Reinforcing steel: Grade 60, Minimum Yield Strength 60,000 psi, deformed billet steel bars, ASTM A615; plain finish. Welded steel wire fabric: Deformed wire, ASTM A497; smooth wire ASTM A185 in flat sheets; plain finish.

2.02 ACCESSORY MATERIALS

Tie wire: Minimum 16 gauge annealed type, or patented system accepted by County. Chairs, bolsters, bar supports, spacers: Sized and shaped for strength and support of reinforcing during construction conditions. Special chairs, bolsters, bar supports, spacers (where adjacent to architectural concrete surfaces): Stainless steel type sized and shaped as required.

2.03 FABRICATION

Fabricate concrete reinforcing in accordance with ACI 315. Locate reinforcing splices, not indicated on Drawings, at points of minimum stress. Location of splices shall be reviewed by County. Where indicated, weld reinforcing bars in accordance with AWS D12.1.

PART 3 EXECUTION

3.01 PLACEMENT

Reinforcing shall be supported and secured against displacement. Do not deviate from true alignment. Before placing concrete, ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings which would reduce bond to concrete.

3.02 QUALITY ASSURANCE

Acceptable Manufacturers: Regularly engaged in manufacture of steel bar and welded wire fabric reinforcing. Installer Qualifications: Three years' experience in installation of steel bar and welded wire fabric reinforcing.

Allowable Tolerances:

1. Fabrication:
   Sheared length: +l in.
   Depth of truss bars: +0, -1/2 in.
   Stirrups, ties and spirals: ±1/4 in.
   All other bends: ±1 in.
2. Placement:
   Concrete cover to form surfaces: ±1/4 in.
   Minimum spacing between bars: 1 in.
   Top bars in slabs and beams:
   Members 8 in. deep or less: ±1/4 in.
   Members more than 8 in.: ±1/2 in.
   Crosswise of members: Spaced evenly within 2 in. of stated separation.
   Lengthwise of members: Plus or minus 2 in.
3. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items: 1 bar diameter.

3.04 PRODUCT DELIVERY, STORAGE AND HANDLING

Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length. Handle and store materials to prevent contamination.

3.05 INSTALLATION

Placement:
Bar Supports: CRSI 65.
Reinforcing Bars: CRSI 63.
Steel Adjustment:
Move within allowable tolerances to avoid interference with other reinforcing steel, conduits, or embedded items.
Do not move bars beyond allowable tolerances without concurrence of County.
Do not heat, bend, or cut bars without concurrence of County.
Splices:
Lap splices: Tie securely with wire to prevent displacement of splices during placement of concrete.
Splice devices: Install in accordance with manufacturer's written instructions. Do not splice bars without concurrency of County, except at locations shown on Drawings.
Wire Fabric:
Install in longest practicable length.
Lap adjoining pieces one full mesh minimum, and lay splices with 16 gauge wire.
Do not make end laps midway between supporting beams, or directly over beams of continuous structures.
Offset end laps in adjacent widths to prevent continuous laps.

Cleaning: Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that will reduce bond with concrete.

Protection During Concreting: Keep reinforcing steel in proper position during concrete placement.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 WORK INCLUDED

Poured-in-place concrete slabs, thrust blocks, pile caps and pipe support cradles.

1.02 QUALITY ASSURANCE

Perform cast-in-place concrete work in accordance with ACI 318, unless specified otherwise in this Section.

1.03 TESTING LABORATORY SERVICES

Inspection and testing will be performed by the testing laboratory currently under contract to Manatee County in accordance with the Contract Documents.

Provide free access to work and cooperate with appointed firm.

Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of work.

Tests of cement and aggregates may be performed to ensure conformance with requirements stated herein.

Three concrete test cylinders will be taken for every 100 cu. yds. or part thereof of each class of concrete placed each day. Smaller pours shall have cylinders taken as directed by the County.

One slump test will be taken for each set of test cylinders taken.

1.04 REFERENCES

ASTM C33 - Concrete Aggregates
ASTM C150 - Portland Cement
ACI 318 - Building Code Requirements for Reinforced Concrete
ASTM C260 - Air Entraining Admixtures for Concrete
ASTM C94 - Ready-Mixed Concrete
ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete
ACI 305 - Recommended Practice for Hot Weather Concreting

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

Cement: Moderate-Type II, High early strength-Type III, Portland type, ASTM C150.

Fine and Coarse Aggregates: ASTM C33.

Water: Clean and free from injurious amounts of oil, alkali, organic matter, or other deleterious material.

2.02 ADMIXTURES

Air Entrainment: ASTM C260.

Chemical: ASTM C494 Type A - water reducing admixture.

2.03 ACCEPTABLE MANUFACTURERS

Acceptable Products:

Pozzolith

WRDA

ACCESSORIES

Non-shrink grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2400 psi in 2 days and 7000 psi in 28 days.

CONCRETE MIXES

Mix concrete in accordance with ASTM C94.

Provide concrete of following strength:

Required concrete strengths as determined by 28 day cylinders shall be as shown on the Drawings, but shall not be less than 3000 psi.
Select proportions for normal weight concrete in accordance with ACI 301 3.8 Method 1, Method 2, or Method 3. Add air entraining agent to concrete to entrain air as indicated in ACI 301 Table 3.4.1.
All mixes shall be in accordance with FDOT Specifications.
Use set-retarding admixtures during hot weather only when accepted by County.
Add air entraining agent to concrete mix for concrete work exposed to exterior.

2.06 FORMS

Forms shall be used for all concrete masonry, including footings. Form shall be so constructed and placed that the resulting concrete will be of the shape, lines, dimensions, appearance and to the elevations indicated on the Drawings. Forms shall be made of wood, metal, or other approved material. Wood forms shall be constructed of sound lumber or plywood of suitable dimensions, free from knotholes and loose knots; where used for expose surfaces, boards shall be dressed and matched. Plywood shall be sanded smooth and fitted with tight joints between panels. Metal forms shall be of an approved type for the class of work involved and of the thickness and design required for rigid construction. Edges of all form panels in contact with concrete shall be flush within 1/32-inch and forms for plane surfaces shall be such that the concrete will be plane within 1/16-inch in four feet. Forms shall be tight to prevent the passage of mortar and water and grout. Forms for walls shall have removable panels at the bottom for cleaning, inspection and scrubbing-in of bonding paste. Forms for walls of considerable height shall be arranged with tremies and hoppers for placing concrete in a manner that will prevent segregation and accumulation of hardened concrete on the forms or reinforcement above the fresh concrete. Molding or bevels shall be placed to produce a 3/4-inch chamfer on all exposed projecting corners, unless otherwise shown on the Drawings. Similar chamfer strips shall be provided at horizontal and vertical extremities of all wall placements to produce "clean" separation between successive placements as called for on the Plans. Forms shall be sufficiently rigid to withstand vibration, to prevent displacement or sagging between supports and constructed so the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for their adequacy. Forms, including new pre-oiled forms, shall be oiled before reinforcement is placed, with an approved non staining oil or liquid form coating having a non-paraffin base. Before form material is re-used, all surfaces in contact with concrete shall be thoroughly cleaned, all damaged places repaired, all projecting nails withdrawn, all protrusions smoothed and in the case of wood forms pre-oiled. Form ties encased in concrete shall be designed so that after removal of the projecting part, no metal shall be within 1-inch of the face of the concrete. That part of the tie to be removed shall be at least 1/2-inch diameter or be provided with a wood or metal cone at least 1/2-inch in diameter and 1-inch long. Form ties in concrete exposed to view shall be the cone-washer type equal to the Richmond "Tyscru". Through bolts or common wire shall not be used for form ties.

PART 3 EXECUTION

3.01 PLACING CONCRETE

Place concrete in accordance with ACI 304.
Notify County minimum 24 hours prior to commencement of concreting operations. Verify anchors, seats, plates and other items to be cast into concrete are placed, held securely and will not cause hardship in placing concrete. Rectify same and proceed with work. Maintain records of poured concrete items. Record date, location of pour, quantity, air temperature and test samples taken.
Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's recommendations. Pour concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur. In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack

solidly with non-shrink grout. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify County upon discovery. Conform to ACI 305 when concreting during hot weather.

SCREEDING

Screed surfaces level, maintaining flatness within a maximum deviation of 1/8" in 10 feet.

PATCHING

Allow County to inspect concrete surfaces immediately upon removal of forms. Patch imperfections as directed. All patching procedures shall be submitted to and approved by the County prior to use.

DEFECTIVE CONCRETE

Modify or replace concrete not conforming to required lines, details and elevations. Repair or replace concrete not properly placed resulting in excessive honeycomb and other defects. Do not patch, fill, touch-up, repair, or replace exposed architectural concrete except upon express direction of County for each individual area.

CONCRETE FINISHING

Provide concrete surfaces to be left exposed, columns, beams and joists with smooth rubbed finish.

CURING AND PROTECTION

Beginning immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures and mechanical injury. Maintain concrete with minimal moisture loss at relatively constant temperature for a period of 7 days or until concrete strengths reaches 75% of the 28 day design strength. Protection against moisture loss may be obtained with spray on curing compounds or plastic sheets. Protection against heat or cold may be obtained with insulated curing blankets or forms.

CONCRETE DRIVEWAY RESTORATION

Concrete driveways shall be restored with 6 inches of 3,000 psi concrete with W2.5 X W2.5, 6X6 wire mesh. Place ½ inch expansion joint between back of curb and new concrete. Area beneath restoration shall be mechanically tamped prior to placing concrete.

CONCRETE SIDEWALK RESTORATION

Concrete sidewalks across driveways shall be restored with 6 inches of 3,000 psi concrete with W2.5 X W2.5, 6X6 wire mesh. Place ½ inch expansion joint between back of curb and new concrete. Area beneath restoration shall be mechanically tamped prior to placing concrete. Concrete sidewalks outside of driveways shall be restored with 4 inches of 3,000 psi concrete per FDOT Design Standards, Sections 522 & 310

END OF SECTION

SECTION 03350

CONCRETE FINISHES

PART 1 GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required to finish cast-in-place concrete surfaces as specified herein.

1.02 SUBMITTALS

Submit to the County as provided in the Contract Documents, the proposed chemical hardener manufacturer's surface preparation and application procedures.

1.03 SCHEDULE OF FINISHES

Concrete for the Project shall be finished in the various specified manners either to remain as natural concrete or to receive an additional applied finish or material under another Section. The base concrete for the following conditions shall be finished as noted and as further specified herein:

Exterior, exposed concrete slabs and stairs - broomed finish.

Interior, exposed concrete slabs - steel trowel finish.

Concrete on which process liquids flow or in contact with sludge - steel trowel finish.

Concrete where not exposed in the finished work and not scheduled to receive an additional applied finish or material - off-form finish.

Provide concrete surfaces to be left exposed such as walls, columns, beams and joists with smooth rubbed finish.

1.04 RESPONSIBILITY FOR CHANGING FINISHES

The surface finishes specified for concrete to receive additional applied finishes or materials are the finishes required for the proper application of the actual products specified under other Sections. Where different products are approved for use, it shall be the Contractor's responsibility to determine if changes in finishes are required and to provide the proper finishes to receive these products.

Changes in finishes made to accommodate product different from those specified shall be performed at no additional cost to the County. Submit the proposed new finishes and their construction methods to the County for approval.

PART 2 PRODUCTS

2.01 MATERIALS

Portland cement and component materials required for finishing the concrete surfaces shall be as specified in the Contract Documents.

Hardener shall be Lapidolith as manufactured by Sonneborn Building Products or approved equal. Hardener shall be used on all floors, stair treads and platforms.

PART 3 EXECUTION

3.01 FORMED SURFACES

Forms shall not be stripped before the concrete has attained a strength of at least 50 percent of the ultimate design strength. This is equivalent to approximately five "100 day degrees" of moist curing.

Care shall be exercised to prevent damaging edges or obliterating the lines of chamfers, rustications, or corners when removing the forms or doing any work adjacent thereto.

Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to the satisfaction of the County.

Off-form finish. Fins and other projections shall be removed as approved. Tie cone holes and other minor defects shall be filled with non-shrink grout specified under the Contract Documents.

3.02 FLOORS AND SLABS

Floors and slabs shall be screeded to the established grades and shall be level with a tolerance of 1/8-inch when checked with a 10 foot straight edge, except where drains occur, in which case floors

shall be pitched to drains as indicated. Failure to meet either of above shall be cause for removal, grinding, or other correction as approved by the County.
Following screeding as specified above, power steel trowel as follows:

Immediately after final screeding, a dry cement/sand shake in the proportion of 2 sacks of portland cement to 350-pounds of coarse natural concrete sand shall be sprinkled evenly over the surface at the rate of approximately 500 pounds per 1,000 square feet of floor. Neat, dry cement shall not be sprinkled on the surface. This shake shall be thoroughly floated into the surface with an approved disc type power compacting machine weighing at least 200 pounds if a 20-inch disc is used or 300 pounds if a 24-inch disc is used (such as a "Kelly Float" as manufactured by the Weisner-Rapp Corporation of Buffalo, New York). A mechanical blade-type float or trowel is not acceptable for this work.
NOTE: This operation (application of the cement/sand shake) may be eliminated at the discretion of the County if the base slab concrete exhibits adequate fattiness and homogeneity. In lieu of power steel troweling, small areas as defined by the County shall be compacted by hand steel troweling with the dry cement/sand shake as ordered. The floor or slab shall be compacted to a smooth surface and the floating operation continued until sufficient mortar is brought to the surface to fill all voids. The surfaces shall be tested with a straight edge to detect high and low spots which shall be eliminated. Compaction shall be continued only until thorough densification is achieved and a small amount of mortar is brought to the surface. Excessive floating shall be avoided.

After Paragraph 3.02 A and B procedures are accomplished, floors and slabs for particular conditions shall be completed as scheduled in one of the following finishes:
Wood float finish. Hand wood float, maintaining the surface tolerance to provide a grained, nonslip finish as approved.
Broomed finish. Hand wood float maintaining the surface tolerance and then broom with a stiff bristle broom in the direction of drainage to provide a nonslip finish as approved.
Steel trowel finish. Hand steel trowel to a perfectly smooth, hard even finish free from high or low spots or other defects as approved.
Floors, stair treads and platforms shall be given a floor hardener. Application shall be according to manufacturer's instructions.

3.03 APPROVAL OF FINISHES

All concrete surfaces will be inspected during the finishing process by the County.
Surfaces which, in the opinion of the County, are unsatisfactory shall be refinished or reworked until approved by the County.

END OF SECTION

SECTION 09970

SURFACE PROTECTION SPRAY SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials, equipment and incidentals required to install and test the coating system complete and ready for operation for the structures listed in the specifications and as shown on the Drawings. The work includes coating of all surfaces as shown and specified on the Drawings. This includes, but is not limited to stairs, walls, floors, concrete divider, concrete slabs, manholes wet wells, and all other work obviously required to be coated unless otherwise specified herein or on the Drawings. The omission of minor items in the Schedule of Work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of the Specification as stated herein.

1.02 RELATED WORK

Bypass pumping is the responsibility of the General Contractor.
Concrete surface cleaning in each lift station is the responsibility of the General contractor.
Removal and offsite disposal of rubble is the responsibility of the General Contractor.

1.03 SUBMITTALS

Submit to the County shop drawings and schedules of all surfacing systems and appurtenances required. Submit design data and specification data sheets listing all parameters used in the surfacing system design and thickness calculations based on applicable provisions of ASTM. Submit to the County the name of the surfacing supplier, a list of materials to be furnished, and the qualification (per 1.05 A) of the application contractor.

1.04 REFERENCE STANDARDS

American Society for Testing and Materials (ASTM)
ASTM D-638
ASTM D-790
Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALIFICATIONS

The Contractor performing the surfacing work shall be fully qualified, experienced a minimum of seven years and equipped to complete this work expeditiously and in a satisfactory manner. The Contractor shall submit the following information to the County for review and approval before any surfacing work is performed. The number of years of experience in performing this type of specialized work must be seven years minimum. Name of the surfacing manufacturer and supplier for this work and previous work listed below. The Contractor shall be an approved installer as certified and licensed by the surfacing manufacturer and equipment supplier. A list of clients that the Contractor has performed this type of work. The list shall contain names and telephone numbers of persons who can be called to verify previous satisfactory performance. Installation dates and a description of the actual work performed. The surfacing manufacturer shall provide an installation list of his product used for similar sewer rehabilitation projects. The list shall provide the same information as required in paragraphs 3.a and 3.b above.

The County reserves the right to approve or disapprove the Contractor, based on the submitted qualifications.

GUARANTEE

All surfacing shall be guaranteed by the Contractor for a period of five years from the date of acceptance. During this period, all defects discovered in the surfacing, as determined by the County, shall be repaired or replaced in a satisfactory manner at no cost to the County, this shall include, but

is not limited to, all work and costs associated with the shutdown of any pump stations and all bypass operations needed for the proper repairs to be made.

QUALITY ASSURANCE

All surfacing products shall be from a single manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in ASTM Standards D-638 and D-790 as applicable. The Contractor shall employ specialty workers who have proven ability to perform the Work included herein. This will consist of a minimum of two years or two project experiences installing this product. This is a requirement for each and every employee.

1.08 DELIVERY, STORAGE AND HANDLING

Care shall be taken in shipping, handling and placing to avoid damaging. Any material damaged in shipment shall be replaced as directed by the County. Any material showing deterioration, or which has been exposed to any other adverse storage condition that may have caused damage, even though no such damage can be seen, shall be marked as rejected and removed at once from the work.

PART 2 PRODUCTS

2.01 GENERAL

The material sprayed onto the surface shall be a urethane resin system formulated for the application within a sanitary sewer environment. The urethane will exhibit suitable corrosion resistance to corrosive gases and fluids found within domestic sanitary sewage. Unless dictated by varying effluent, the spray system shall be a urethane and exhibit the cured physical strengths specified herein. When cured, the surface coating shall form a continuous, tight-fitting, hard, impermeable surfacing data which is suitable for sewer system service and chemically resistant to any chemicals or vapors normally found in domestic sewage. The surface shall be an integral part of the structure being rehabilitated after being placed and cured. The surface shall cover the complete interior of the existing structure. The surface shall provide a continuous watertight seal or barrier. The surface shall effectively seal the interior surfaces of the structure and prevent any penetration or leakage of groundwater infiltration. Provide water resistance data on surface based on ASTM Standards. The surface shall be compatible with the thermal conditions of existing sewer lift stations and manholes. Surface temperature will range from 30 to 80 degrees F. Provide test data on thermal compatibility based on ASTM Standards.

2.02 MATERIALS

Approved materials include:

Raven 405 epoxy
Green Monster
Spraywall Urethane by Sprayroq

Polyurethane spray application shall comply with the following specifications:
The cured urethane system shall conform to the minimum physical standards, as listed below. The long-term data is for a 50-year design life of the process.

Cured Urethane	Standard	Long-Term Data
Tensile Stress	ASTM D-638	5,000 psi
Flexural Stress	ASTM D-790	10,000 psi
Flexural Modulus	ASTM D-790	550,000 psi

Epoxy spray application shall be 100% VOC free / 100% solids.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

The contractor shall clean each structure and shall dispose of any resulting material. All contaminants including: oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed. All concrete or mortar that is not sound or has been damaged by chemical exposure shall be removed to a sound concrete surface or replaced. Surface preparation method(s) should be based upon the conditions of the substrate, service environment and the requirements of the protective coating to be applied. Surfaces to receive protective coating shall be cleaned and abraded to produce a sound surface with adequate profile and porosity to provide a strong bond between the protective coating and the substrate. Generally, this can be achieved with a high pressure water cleaning using equipment capable of 5,000 psi at 4gpm. Other methods such as abrasive blasting, shot blasting, grinding, scarifying or acid etching may also be used. Detergent water cleaning and hot water blasting may be necessary to remove oils, grease or other hydrocarbon residues from the concrete. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound clean neutralized surface that is not excessively damaged. Infiltration shall be stopped by using a material which is compatible with and is suitable for top coating with the specified protective coating. The area between the manhole and the manhole ring and any other area that might exhibit movement or cracking due to expansion and contraction, shall be grouted with a flexible grout or gel before surface coating spray application. All surfaces should be inspected by the Inspector during and after preparation and before the repair material is applied. No separate payment shall be made for any preparatory work required prior to application of the surface coating.

3.02 INSTALLATION

The Contractor shall notify the Project Manager at least 48 hours in advance, giving the date, start time and estimated completion time for the work being conducted. The Contractor shall provide bypass pumping of sewage flows (as required) where and when the rehabilitation work is being performed. No flows will be permitted in the structure until the spray coating has properly cured to the manufactures specifications. The installation of the surface coating shall be in complete accordance with the applicable provisions of ASTM and the manufacturer's specifications. A representative of the manufacturer shall be present during the actual installation. Prior to placing the surface coating, the manufacturer's representative must approve the surface preparation work and installation conditions including temperatures. All surfaces shall be sufficiently smooth and even, to ensure good flow handling characteristics when complete. All surfaces shall have the surface coating applied to the required thickness by spray application. Application procedures shall conform to the recommendations of the protective coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment. The spray equipment shall be specifically designed to accurately ratio and apply the specified protective coating materials and shall be regularly maintained and in proper working order. The protective coating material must be spray applied by a Certified Applicator of the protective coating manufacturer. Polyurethane spray application shall be applied such that all surfaces shall be coated in accordance with the manufactures recommended thickness but not be less than 125 mils. Epoxy spray application shall be applied such that all surfaces shall be coated in accordance with the following:

Specified surfaces shall be coated by spray application of a moisture tolerant, solvent-free, 100% solids, epoxy protective coating as further described herein. Spray application shall be to a minimum wet film thickness in accordance with the following table:

Concrete, New/Smooth 80-100 mils for immersion, 60-80 mils for atmospheric, splash and spill exposure

Concrete, Rough 100-125+ mils

Masonry/Brick 125-150+ mils

Steel 16-80 mils for immersion, 16-40 mils for atmospheric, splash and spill exposure; also profile dependent

Fiberglass Systems 40-60 mils tack coat, 9 oz/yd2 fabric, 40-60 mils top coat. Varies with circumstances

Airless spray application equipment approved by the coating manufacturer shall be used to apply each coat of the protective coating. Air assisted spray application equipment may be acceptable, especially for thinner coats (<10 mils), only if the air source is filtered to completely remove all oil and water. If necessary, subsequent top coating or additional coats of the protective coating should occur as soon as the basecoat becomes tack free, ideally within 12 hours but no later than the recoat window for the specified products. Additional surface preparation procedures will be required if this recoat window is exceeded.

3.03 FIELD TESTING AND ACCEPTANCE

Field acceptance of surface coatings shall be based on the County's evaluation of the proper surfacing of the structure and the appropriate installation and curing test data along with review of the structure inspections. The surface coatings shall provide a continuous monolithic surfacing with uniform thickness throughout the structure interior. If the thickness of the coating surface is not uniform or is less than specified, it shall be repaired or replaced at no additional cost to the County. The County will measure the surface cured thickness from a specimen retrieved by the Contractor. The Contractor shall retrieve the specimen by physically cutting through the surfacing (by drilling or coring). There will be up to three thickness measurement locations in each structure. A suitable non-destructive type of thickness measurement may also be used. All the surface coating thickness measurement locations shall be repaired by the Contractor in accordance with the manufacturer's recommendations. These repairs shall be included in the five year surface coating guarantee. All pipe connections shall be open and clear. There shall be no cracks, voids, pinholes, uncured spots, dry spots, lifts, delaminations or other type defects. If any defective surface coating is discovered after it has been installed, it shall be repaired or replaced in a satisfactory manner within 72 hours and at no additional cost to the County. This requirement shall apply for the entire five year guarantee period.

END OF SECTION