ATTACHMENT D - SUPPLEMENTAL SPECIFICATIONS

TABLE OF CONTENTS

SPECIFICATIONS ADDED TO ARLINGTON COUNTY CONSTRUCTION STANDARDS AND SPECIFICATIONS MANUAL:

SECTION 13180 – MAINTENANCE AND CONTROL OF TRAFFIC

PART 1 - GENERAL

This work shall consist of maintaining and protecting workers, vehicular and pedestrian traffic through areas of construction within the limits of the project and over the approved traffic detours. All work shall be in accordance with the latest Arlington County Construction Standards and Specifications, Virginia Department of Transportation (VDOT) Road and Bridge Specifications, the Manual on Uniform Traffic Control Devices (MUTCD), and the Virginia Work Area Protection Manual (WAPM), the standard drawings, and the Contract, as directed by the Engineer.

1.1 DESCRIPTION OF WORK

A. Provide all plant, labor, supervision, materials, and equipment to install, maintain, relocate, and remove all temporary traffic control devices.

1.2 RELATED WORK SPECIFIED ELSEWHERE

1.3 APPLICABLE SPECIFICATIONS

A. Virginia Department of Transportation (VDOT)

B. VDOT Road and Bridge Specifications

C. Manual on Uniform Traffic Control Devices (MUTCD)

D. Virginia Work Area Protection Manual (WAPM)

E. VDOT Work Zone Pedestrian and Bicycle Guidance Manual (January 2016 Edition)

F. Occupational Safety and Health Act, State & Federal (OSHA)

1.4 QUALITY ASSURANCE

A. Work Zone Traffic Control Certification

1. The Contractor shall have at least one (1) employee who is certified by VDOT in Basic Work Zone Traffic Control; and who will be responsible for the placement, maintenance, and removal of work zone traffic control devices within the project limits in compliance with the permit requirements and conditions, the approved plan, specifications, the Virginia Work Protection Manual and the Manual of Uniform Traffic Control Devices. An Employee certified by VDOT in the Intermediate Work Zone Traffic control shall be on-site to provide supervision during work zone adjustments or changes to traffic control due to field conditions. This employee shall provide evidence of this certification upon request from Arlington County personnel.

PART 2 - MATERIALS

2.1 GENERAL

A. Material shall conform to the requirements of the applicable VDOT specification.

2.2 SIGNALIZATION, BARRICADES, CHANNELIZING DEVICES, SAFETY DEVICES, AND PAVEMENT MARKINGS

A. Signalization, barricades, channelizing devices, safety devices, and pavement markings shall conform to the requirements of Division VII of the latest VDOT specifications and the MUTCD.

2.3 TEMPORARY PAVEMENT MARKERS

A. Temporary pavement markers shall conform to the requirements of VDOT Road and Bridge Specifications Section 235, Retroreflectors.

2.4 CONSTRUCTION PAVEMENT MARKINGS

A. Construction pavement markings shall conform to the requirements of the VDOT Road and Bridge Specifications Section 231 (Paint), and Section 246 (Pavement Marking).

2.5 PORTABLE CHANGEABLE MESSAGE SIGNS

A. Portable changeable message signs shall meet the requirements of Section 512.03 subsection S of the VDOT Road and Bridge Specifications.

PART 3 - EXECUTION

This section shall conform to the VDOT Specification Section 512.03.

PART 4 - MEASUREMENT AND PAYMENT

Payment for MOT shall be based on the bid form. The payment will be a multiplier, expressed as a percentage, to be added to the total amount of the project assignment cost (applied only to the amount being invoiced). There will be no escalation for MOT percentage multiplier for the initial contract term and the extensions thereafter.

The Contractor shall not be entitled to any additional payment for changes to MOT which are the result of the Contractor’s work schedule or resource allocation, weather delays, or other factors not controlled by the County.

Payment for maintenance of traffic is full compensation for providing the proper pedestrian and vehicular traffic controls during all stages of construction and includes furnishing, preparing, fabricating, installing,

maintaining, removing, relocating, repairing, or replacing pedestrian and vehicular traffic control devices and signs as necessary, and all other materials, labor, hardware, equipment, tools, supplies, and incidentals. Contractor shall be responsible for acquiring VDOT permit for any revision during construction and/or as required by the project contract to the approved traffic control plan.

Payment for maintenance of traffic for each site will be made as partial payments. The first installment of 50 percent of the unit price for maintenance of traffic will be made on the first progress estimate following partial mobilization and initiation of construction work for the particular site. The remaining 50% of the contract lump sum price bid will be paid on each subsequent estimate based on the percent of work completed at the site all the way through Final Acceptance of work. The Engineer shall have the authority to decide on the appropriate payment for each subsequent estimate.

END OF SECTION 13180

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SECTION 330130.16 - TV INSPECTION OF SEWER PIPELINES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Assess the condition of the indicated sanitary sewer pipes.
2. Closed-circuit television (CCTV) of selected gravity sewer pipes using the National Association of Sewer Service Companies (NASSCO) industry standard Pipeline Assessment and Certification Program (PACP) forms and coding.
3. Creation of a digital submission of sewer inspection data, videos, photos, and reports on portable external hard drives.
4. Provide a visual and written record of internal pipeline features including, general information, overall condition, wastewater depth, structural integrity and significant defects.

B. Related Requirements:

1. Section 330130.41 “Cleaning of Sewers.”
2. Section 330130.72 “Cured-in-Place Pipe Lining.”

1.3 PAYMENT

A. Payment for CCTV work is included in the CIPP installation.

B. TV Inspection of Sewer Pipelines:

1. Basis of Payment: TV inspection, data compiling according to NASSCO PACP standards, and audio-video recording of pipeline.

1.4 COORDINATION

A. Coordinate Work of this Section with County.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Contractor to conduct conference at Project site.

B. Contractor shall convene minimum one week prior to commencing Work of this Section.

1.6 SCHEDULING

A. Schedule Work of this Section to coincide with temporary flow control, traffic control, sewer cleaning, and pipe rehabilitation.

1.7 ACTION SUBMITTALS

A. Data:

1. Database structure and file naming plan.
2. Submitted External Hard Drives become property of Arlington County (Owner/County).
3. Sewer Assessment Reports.

B. Assessment Procedures Plan:

1. Pipeline inspection work plan.
2. List of equipment to be used on the project, including product literature for all video equipment (including cabling, camera, footage counter, tilting device, and recorder).

C. Proposed door hanger for public notification.

D. Qualification Statements.

1.8 INFORMATIONAL SUBMITTALS

A. Informational Submittals: Prior to beginning assessment work, submit the following to the Engineer in accordance with Section 01330 “Submittal Procedures.”

1. Qualifications statement in accordance with Section 330130.72 “Cured-in-Place Pipe Lining.”

B. Traffic Control plan for work in areas of vehicular travel.

C. List of Project staff, including qualifications of Crew Chief and CCTV operator.

D. Spill plan to address any spills that might occur.

E. Two copies of the NASSCO-issued “certified PACP user” identification card showing certification number for each CCTV operator that will be performing assessment work on the Project. Work shall not commence until such certification is provided.

F. Confined Space entry and hazardous atmosphere training certifications for all staff that will be involved in work located within or near manholes.

1.9 QUALITY ASSURANCE

A. Perform Work according to NASSCO PACP standards, latest version.

1.10 QUALIFICATIONS

A. Contractor: Successfully performed work on at least ten other projects within the last five years that cumulatively include at least 10,000 linear feet of sewer rehabilitation sanitary sewers 30-inches in diameter or greater. Have completed at least one (1) similar recently completed project involving the same material, 30" sewer diameter and greater in size, comparable length, and meets the minimum installation requirements as stated in the Specifications.

B. CCTV Operator: Successfully performed work on at least three other projects within the last five years that includes at least 100,000 linear feet of CCTV video experience in sanitary sewers using NASSCO PACP format.

PART 2 - PRODUCTS

2.1 EXTERNAL HARD DRIVES

A. Description: A portable storage device that can be attached to a computer through a USB connection.

B. Solid state data storage devices are preferred.

2.2 CCTV SOFTWARE

A. Capable of providing complete survey reports in compliance with the most recent version of NASSCO PACP.

B. The PACP defect and construction codes shall be pre-programmed in the CCTV software and shall be grouped by PACP Groups.

C. Software and Databases:

1. Fully compliant with PACP.
2. Capable of customization with the ability to modify or add to the pipeline condition and group them for ease of use.
3. Assessment and reporting software program shall be menu-driven and shall have a complete on-screen help file.
4. NASSCO PACP mandatory fields and any additional available field requested by the County or Engineer shall be setup in the software prior to the assessment, and all of these fields shall be populated with information collected during the assessment. Any general and pipe segment information that is already known prior to the assessment shall be entered into the appropriate fields in advance of performing the physical assessment.
5. Maintain a database of underground pipe and manhole assets. Structure the asset database similar to the one referencing pipe usage (i.e., sanitary, storm, drainage, etc.) sections (i.e., projects, areas, quadrants).

6. Surveys include using the existing pipe segment numbering/naming convention and a chronological survey set-up numbering system.
7. Capacity to import and export survey results in the most recent NASSCO PACP exchange format.

D. The footage reading from the camera equipment shall be automatically entered into the survey log and shall directly correspond to the noted observation location throughout the pipe graphical and tabular reports generated.

2.3 SEWER ASSESSMENT REPORTS

A. File Naming Conventions: Name all files in accordance with the requirements of the County and Engineer to allow direct linking of files to pipe assets using a common unique identifier.

1. Each manhole has been given a unique manhole identification (Asset ID) the file name for each pipeline assessed shall be that unique upstream manhole Asset ID followed by an underscore followed by the unique downstream manhole such as "0123S0456_0123S0457.pdf."
2. If an unnamed manhole is found, the letter "A" shall be added to the end of the upstream manhole's Asset ID to form a new Asset ID. The data/video files shall then be renamed to include the new Asset ID and a new CCTV assessment shall be started from the new Asset ID.
3. If more than one unnamed manhole is found between two named manholes, subsequent new manhole Asset IDs shall be formed using the letters "B", "C", etc.
4. If an unnamed manhole is found, provide documentation showing the location of the unnamed manhole to the County and Engineer depicting the change in connectivity found in the field.
5. If the contractor performs a reverse setup and televises an individual pipe segment from more than one direction (i.e. the camera is only able to televise a portion of the entire segment heading downstream, and the remaining portion of the pipe segment was televised heading upstream) then two or more separate video files are allowable. The name of the additional database files etc. (i.e. unique manhole Asset ID followed by an underscore followed by the unique downstream Asset ID) followed by "_1", "_2" etc. at the end of the filename so that it is clear there are multiple files and videos for the same pipe segment. If unnamed manhole(s) is (are) found the procedure previously described shall also apply. Examples:

    a. Initial filename: 0015S0001_0015S0002.
    b. Additional filenames: 0015S0001_0015S0002_1.

6. Base the name of each digital still photo on the video/data filename of the specific sewer in which the photo was taken. Record the name as the video/data filename followed by the PACP code for the item pictured followed by the footage at which the observation was encountered. Examples:

    a. (Filename)_(PACP Coded)@(footage).jpg.
    b. 0015S0001_0015S0002_HSV@37_2.jpg.
    c. 0015S0001_0015S0002_1_MCU@113_6.jpg.

B. Format all data files to facilitate upload into a NASSCO PACP exchange database.

C. Digital Video: CCTV assessments shall be captured at a minimum video bit rate of 4,500 kbps.

D. Indicate individual survey results in tabular form and provide a sortable list of surveys based on a user-defined description field. Include the starting and ending manhole Asset IDs depths, pipe material, total survey length, and pipe diameter. All reports and and/or submittals shall comply with the most recent version of NASSCO PACP standards.

E. Create separate folders for each inspection. Within each inspection folder include the video file, digital photos, evaluation reports, supporting documentation etc.

1. Label each portable external hard drive clearly to indicate the date range of the assessments included on the hard drive, the name of the project, the County's project number, Contactor's name, and the index number of the hard drive. The index number for each hard drive shall be the sequential number followed by the area number.
2. Each portable external hard drive submitted shall contain all sewer assessment data obtained to date. The database shall be comprehensive for the entire project and additional data shall be added to the database each week.
3. On each hard drive, new data collected since the previous hard drive submittal shall be indicated as such to facilitate separation of the new data from the previously submitted data.
4. A typewritten summary in pdf format shall be provided for each portable external hard drive that lists the files contained on that hard drive.

PART 3 - EXECUTION

3.1 PREPARATION

A. Sewer Flow Control:

1. Evaluate each segment of sewer to be assessed with respect to diameter, flowrate, velocity, upstream/downstream manhole diameter, debris levels, extent of pipe wall corrosion, and accessibility. Select and provide the most appropriate equipment and methods based on the condition of the specific sewer line segment and its access manhole(s) at the time the work commences.
2. At all times during the assessment, the flow in the sewer line segment(s) being assessed shall be suitably controlled as needed to perform the assessment.
3. When flow in a sewer line is plugged, blocked, or bypassed, take precautions:

    a. To protect the sewer lines from damage that might result from sewer surcharging.
    b. To ensure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewer involved.

B. Confirm equipment and methods used for each sewer pipe and the setup location to the submitted and reviewed plan.

C. Perform sewer line cleaning in accordance with Section 330130.41 "Cleaning of Sewers" to provide a thorough assessment of the sewer condition.

3.2 APPLICATION

A. CCTV Equipment:

1. Provide a mobile vehicle large enough to accommodate at least three people with video monitoring equipment specifically compatible with the camera equipment being used. County and Engineer shall have unrestricted access to observe the television screen and all other operations.
2. CCTV Camera:

    a. Adjustable light source generates an even distribution of lighting for the camera that results in a clear color picture of the entire periphery of the pipe.
    b. Operable in 100 percent humidity conditions and in a hazardous and corrosive environment.
    c. Provide a backup (spare) camera either on the Project site or at a nearby location so performance of the Work is not delayed.
    d. Capable of panning 360 degrees and tilting 270 degrees and with minimum optical zoom ratio of 10:1 plus a minimum digital zoom ration of 4:1 to facilitate the assessment of defects with optimum picture quality provided by focus and iris adjustment.
    e. Capable of accurately measuring distance from manhole or other structure to an accuracy of plus or minus 6 inches.

3. CCTV Equipment:

    a. Camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction pf the County and/or Engineer. Picture resolution shall be a minimum of 620x480.
    b. Provide a lighting system adequate for quality pictures. A reflector in front of the camera may be required to enhance the lighting in black pipe.
    c. Accurate footage counter to display on the monitor the exact distance, in $1/10^{th}$ of a foot increments, of the camera from the centerline of the starting manhole.
    d. The CCTV equipment shall limit travel speed to 25 feet per minute.
    e. Compatible with the version of NASSCO PACP used by the CCTV software and the reports and submittals generated from the software.

3.3 FIELD QUALITY CONTROL

A. The following measurements shall be collected for each accessible manhole and included in the PACP exchange database:

1. Utilize GPS equipment to obtain X and Y state plane coordinates with a submeter accuracy.
2. Field-measure the vertical distance from the top of the manhole frame to the invert in accordance to NASSCO PACP standards.

B. Pipeline Assessment:

1. Each sewer section shall be assessed from the upstream manhole to the downstream manhole if possible.
2. For the upstream and downstream manholes on each segment of pipe that is assessed, pan and tilt from the invert and take digital still photos that clearly depict the entirety of the manhole interior, including cone section.
3. Assess the full length of each sewer between access points in accordance with PACP standards. When the camera is unable to pass an obstruction even though flow is continuing, perform a reverse setup of the CCTV equipment from the opposite access point.
4. Perform all CCTV assessments using personnel who are trained and certified (current standing) in the use of NASSCO's PACP.
5. Multiple upstream and/or downstream sewer segments can be televised from a single manhole setup location as long as each manhole-to-manhole video section restarts its footage counter at zero and a separate video file for each assessment is submitted.
6. The CCTV camera shall travel through the lines using its own power unless a tethered floating unit is used. The pictures taken of the entire inside periphery of the pipe shall be clear and visible. Picture quality and definition shall be to the satisfaction of the Engineer.
7. Stop the camera at all service laterals, if any, and pan at such an angle that an internal view of the service lateral is available to determine if the lateral is active, inactive, or plugged. Take photos:

    a. Include a brief description of the subject of the photo directly on the photo.
    b. Catalogue and link in the CCTV database so the photos correspond with the length along the sewer line where the photo of the recorded observation was taken.
    c. JPEG format and at least 50 kilobytes in size.

8. Adjust the camera height such that the camera lens is always centered in the pipe being televised.
9. Retrieve camera equipment that becomes stuck within a sewer.
10. Submit CCTV inspection videos, where reversal setups are not required, in one continuous video section from manhole to the immediately adjacent manhole and not in multiple files. If a reverse setup is required, two complete inspections and video are acceptable.

C. Calibrate camera footage on a weekly basis in the presence of the County or Engineer with an above ground tape measure and simultaneous CCTV footage counter.

D. Project Notifications: Notify the Engineer and the County immediately if:

1. A collapsed pipe or other significant pipe failure is discovered.
2. The conditions for CCTV assessment are found to be unsafe or impractical.
3. A manhole is buried, cannot be found, or cannot be accessed. Include a diagram in PDF file format that clearly indicates the location of the manhole, identifies its Asset ID, and lists the procedures that were used to attempt to locate the manhole.
4. Any defects that pose immediate danger to the public are observed (i.e. missing or broken manhole covers, sinkholes, etc.).
5. Any major pipe blockages, manhole surcharging, or potential overflow conditions are observed.

6. The pipe configuration in the field is different than shown on the Drawings. Include a diagram in PDF file format that clearly indicates the location of structures in relation to immediately adjacent structures.
7. Any significant obstructions are found within permanent sewer easement, even if these obstructions do not impact the Work.

E. Public Notifications: Provide 48-hour notice prior to the assessment of any pipe segment, distribute door-to-door a door hanger, approved by the County and Engineer, describing the work to be performed to notify the owner of every property, including residences and businesses, that may be affected. Door hangers shall be double-sided with the notification information in the English language on one side and in the Spanish language on the reverse side. Affected properties shall include, but not be limed to, properties on which:

1. A sewer to be accessed is located.
2. A manhole for accessing a sewer to be assessed is located.
3. An existing sewer easement that could be used to access the sewer is located.
4. A temporary right-of-entry agreement with the property owner and the contractor for accessing a sewer or manhole on the property.

3.4 DATA QUALITY CONTROL

A. Review quality and accuracy of each submittal of CCTV assessment data and revise as needed to correct any inaccuracies prior to providing submittal to the Engineer.

B. Quality Review:

1. Engineer requires a 30-day period to review sewer assessment data/videos after each submittal has been received.
2. Payment applications will not be processed until the sewer assessment data/videos have successfully passed the quality review and have been accepted by the Engineer.
3. Additional 30-day review periods apply to each resubmittal of data/videos determined to be unacceptable by the Engineer.
4. Re-inspection is required when digital videos are inaccurate or of such poor quality that the Engineer is unable to evaluate the condition of the sewer or locate sewer service connections.
5. Provide CCTV assessment data contained on each portable external hard drive in the most recent version of PACP exchange format. Include video indexing for all observations. CCTV assessment data to be submitted:

    a. Database file.
    b. Still photos in JPEG file format for each observation.
    c. Video for each inspection in MPEG1 file format.
    d. Summary report for each pipe segment in PDF format.

END OF SECTION 330130.16

SECTION 330130.41 - CLEANING OF SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cleaning of sewer pipe and fittings installed and/or rehabilitated, complete as shown on the Drawings and as specified herein.

B. Cleaning includes proper high-pressure water jetting, rodding, bucketing, brushing, and flushing of sewers and manholes prior to inspection by closed circuit television, pipeline rehabilitation or replacement, point repairs, manhole preparation, and testing operations.

C. Clean all sewers to remove debris, roots, intruding services, deposits, and other blockages to a minimum of 95 percent open. Perform sewer cleaning work to an acceptable level as necessary to perform a thorough television inspection of sewer. If pipe condition is such that cleaning may cause a potential collapse, then pipe shall be televised without attempting to clean it to 95 percent condition, pending approval by Engineer.

D. Related Requirements:

1. Section 330130.16 “TV Inspection of Sewer Pipelines.”
2. Section 330130.72 “Cured-in-Place Pipe Lining.”

1.3 DEFINITIONS

A. Sewer Main Cleaning: Cleaning to remove large deposits of debris or heavy root growth existing within sewer line and where sewer reaches require debris removal of depths up to 25 percent of pipe height.

B. Heavy Cleaning: Large deposits of debris or heavy root growth existing within sewer line and where sewer reaches require debris removal exceeding the definition of Sewer Main Cleaning.

1.4 PAYMENT

A. Sewer Main Cleaning: Clean sewer using standard industry procedures of high-pressure water jetting equipment or other approved equipment. Costs related to cleaning of such sewers shall be included in Contractor’s unit prices for CIPP.

1. Use suitable equipment and hydraulic pressure jetting with special aggressive root cutting nozzles, or tools and augers.

2. Cleaning shall include up to six (6) passes with hydraulic cleaning equipment.
3. Cleaning shall remove all settled deposits and debris.
4. Cleaning shall remove all obstructions along the sewer main, including but not limited to scale, tuberculation, grease buildup and roots.
5. Submittal: PACP reports, and audio-video recording of pipeline.
6. A Daily Cleaning Log shall be maintained by the Contractor, it shall be made available to the Owner's representative on request for verification and signature.

B. Heavy Cleaning: Pipes that contain excessive blockages will be paid on a per linear foot basis for length required to be cleaned, upon approval by Engineer. Provide direct water source as required. Engineer or County may determine any individual pipe be cleaned using Heavy Cleaning.

1.5 INFORMATIONAL SUBMITTALS

A. Submit a safety plan prior to performing any on-site work that includes the following as a minimum:

1. Confined Space Entry.
2. Personal Protective Equipment.

B. Qualifications Statements.

1.6 CLOSEOUT SUBMITTALS

A. Section 01330 "Submittal Procedures" for requirements for submittals.

B. Submit one complete set of documentation regarding inspections and work performed. Based on work scope, submit written reports, photographs and External Hard Drives that incorporate color video and data per Specification 330130.16 "TV Inspection of Sewer Pipelines."

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Contractor shall have a minimum of five years' experience in sewer line and underground structure cleaning. Submit a list of at least three customers who have had similar work complete. Furnish trained and qualified technicians with proper experience operating equipment that is being used on this project.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Hydraulic Sewer Cleaning Equipment:

1. Equipment: Movable dam type constructed so that a portion of the dam may be collapsed at any time during cleaning operation to protect against flooding of sewer.

a. Movable dam shall be same diameter as pipe being cleaned and shall provide flexible scraper around outer periphery to ensure total removal of grease. If sewer cleaning balls or other such equipment which cannot be collapsed instantly are used, take special precautions against flooding of sewers and public or private property.

B. High Velocity Jet (Hydrocleaning) Equipment:

1. Have a minimum of 500 feet of high-pressure hose.
2. Have a selection of two or more velocity nozzles that are capable of producing a scouring action from 15 to 45 degrees in all size lines to be cleaned. Also include a high velocity gun for washing and scouring manhole walls and floor.
3. Be capable of producing a minimum of 80 gallons per minute flows from a fine spray to a long-distance solid stream and delivering up to 1000 psi. Be able to carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel. Locate controls so equipment can be operated above ground. Select flowrates and pressures as required for each size of sewer, type of debris, and amount of debris, and as recommended by nozzle manufacturers.
4. Have a water tank, auxiliary engines and pumps, and a hydraulically driven hose reel.
5. Have root cutting blades that are hydraulically spun.

C. Mechanical Cleaning Equipment:

1. Bucket machines shall be in pairs and 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 shall not be acceptable.
2. Power rodding machines shall be either sectional or continuous type capable of holding a minimum of 750 feet of rod. Rod shall be specifically treated steel. To ensure safe operation, machine shall have a fully enclosed body and an automatic safety release clutch or relief valve

2.2 APPLICATION

A. Provide appropriate screening to stop passing of materials into downstream sewers. Sludge, dirt, sand, rocks, grease, and other solid or semisolid residue, debris, and material resulting from cleaning operations shall be removed at downstream manhole of section of sewer being cleaned. Passing material from manhole section to manhole section which could cause line stoppages, accumulations of sand in wet wells, or damage to pumping equipment shall not be permitted.

B. Remove debris, residue, and other materials resulting from cleaning operations from site at end of each workday and shall be disposed of in an approved and lawful manner. Under no circumstances will accumulation of debris, residue, and other matter be permitted on site beyond stated time, unless prior written authorization is given for storage in totally enclosed containers.

C. Specifics regarding the scheduling, monitoring, disposal fees (if any) and approved methods and procedures for disposal must be arranged with the COUNTY/ENGINEER.

D. Flushing of sanitary sewers to facilitate cleaning activities without the capture of solids and debris is expressly prohibited.

E. Retrieval of equipment lodged in pipes or a wet well is Contractor's responsibility and shall be performed at Contractor's expense.

F. Cleaning Precautions: During sewer cleaning operations, satisfactory precautions shall be taken in use of cleaning equipment. When hydraulically propelled cleaning tools (which depend upon water pressure to provide their cleaning force) or tools which retard flow in sewer line are used, precautions shall be taken to ensure that water pressure created does not damage or cause flooding of public or private property being served by sewer. When possible, flow of sewage in sewer shall be utilized to provide necessary pressure for hydraulic cleaning devices. When additional water from fire hydrants is necessary to avoid delay in normal work procedures, water shall be conserved and not used unnecessarily.

G. No sewer cleaning shall take place in a particular sewer segment until upstream pipe segments have been cleaned. If cleaning is done in a downstream pipe segment in order to facilitate overall cleaning operations, segment shall be re-cleaned at no additional cost to County, after pipes upstream of that segment have been cleaned.

H. Sewer line walls shall be cleaned adequately to provide for proper operation of joint testing and sealing equipment or internal inspection to discern structural defects, misalignment, and infiltration/inflow sources. Cleaning shall be performed immediately prior to joint testing and sealing and internal inspection to preclude build-up of debris from infiltration/inflow sources and discharges from upstream pipeline sections.

I. Designated sewer manhole sections shall be cleaned using hydraulically propelled, high velocity jet, or mechanically powered equipment. If cleaning of an entire section cannot be successfully performed from one manhole, equipment shall be set up on other manhole and cleaning again attempted. If, again, successful cleaning cannot be performed or equipment fails to traverse entire manhole section, it will be assumed that a major blockage exists, and cleaning effort shall be repeated with other types of equipment. Immediately report any blockages to Engineer

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove debris, roots, intruding services, deposits, and other blockages to a minimum of 95 percent open as necessary to perform a thorough television inspection of sewer. If pipe condition is such that cleaning may cause a potential collapse, televise pipe without attempting to clean it to 95 percent condition, pending approval by Engineer.

B. Select, based on pre-construction CCTV inspection, cleaning equipment to address conditions of manhole and sewer lines at the time the work commences to adequately remove dirt, grease, rocks, sand, and other materials and obstructions from sewer lines and manholes to allow performance of other work.

C. Take satisfactory precautions to protect sewer lines from damage that might be caused by improper use of cleaning equipment. Whenever using hydraulically propelled cleaning tools that depend upon water pressure to provide their cleaning force, or any tools that retard flow of water in sewer line, take precautions to ensure that water does not cause damage or flooding to public or private property.

D. No fire hydrant shall be obstructed in case of a fire in area served by hydrant.

E. Remove water meters, piping, and related equipment from fire hydrants at end of each workday.

3.2 FIELD QUALITY CONTROL

A. Acceptance of sewer line cleaning is contingent on satisfactory completion of television inspection. If television inspection shows cleaning to be unsatisfactory, re-clean sewer line and re-inspect until cleaning is shown to be satisfactory.

B. If internal joint testing and sealing is to follow cleaning, give particular attention to adequacy of cleaning to ensure that proper seating of sealing packer can be achieved.

C. Inspection of cleaning operations will be made on a daily basis by Engineer.

3.3 FINAL CLEANING

A. Upon cleaning of underground sewer lines or structures, removal debris from finish grade and clean work areas so conditions at conclusion of the work are equal to or better than areas prior to work of this Section.

END OF SECTION 330130.41

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SECTION 330130.72 - CURED-IN-PLACE PIPE LINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cured-in-place pipe lining.
2. Pre-rehabilitation and post-rehabilitation closed camera television inspection of piping to be rehabilitated.
3. Removal of obstructions and protruding service connections, if any, to complete pipe lining rehabilitation.
4. Related activities to perform the work, including traffic control.

B. Related Requirements:

1. Section 330130.16 “TV Inspection of Sewer Pipelines.”
2. Section 330130.41 “Cleaning of Sewers”.
3. Section 331113.26 “Grouting.”
4. Section 331210 “Temporary Bypass Pumping Systems.”

1.3 ABBREVIATIONS AND DEFINITIONS

A. CIPP: Cured-in-place pipe.

B. CCTV: Closed-circuit television.

C. Groundwater Depth - Used in Calculations: From estimated maximum groundwater level at surface to invert of interior pipe or at elevation in Contract Documents specified for bidding purposes. Measured groundwater elevations in the vicinity of the project area, are included in Attachment F of this specification set.

D. Run: Length of existing host pipe measured from interior walls of manholes or from pipe ends if pipe extends into the manholes.

1.4 UNIT PRICES

A. Measurement: Make measurement for CIPP pipe liner at Contract unit price per total linear feet for each size as stated on Bid Form, complete in place, in accordance with Contract Documents. Measurement will be based on actual number of feet installed, with preliners, as necessary, as

measured by Engineer. Pipe will be measured horizontally, on surface, from center-to-center of manholes to nearest 0.1 foot, unless another method is approved by County or Engineer.

B. Payment: Price paid per linear foot for pipe liner includes full compensation for labor, materials, tools, equipment, and incidentals necessary to provide CIPP liner, end seals, control of water, manhole connections, preconstruction CCTV inspection, sewer cleaning, disposal of sewer cleaning materials, final inspection, perform leakage testing of the CIPP pipe liner, post-construction CCTV inspection, protection of existing utilities and adjacent property, any associated manhole modifications and manhole restoration, required surface restoration work complete in place, as shown in Contract Documents.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Contractor shall conduct conference at the Project site. Discuss following as a preliminary meeting agenda:

1. Preparatory activities before installing CIPP materials, including submittals, delegated design, notification to property owners, material storage, videos, and other specified actions.
2. Installation and testing procedures.
3. Post installation activities, including videos, cleanup, and repairs.

1.6 ACTION SUBMITTALS

A. Submit a detailed public notification plan including detailed staged notification to residences affected by CIPP installation and associated work. Include following as a minimum:

1. Initial letter describing the work to be done.
2. Door hangers are to be placed 48 hours prior to any lining work to be performed.

B. Safety Plan: Provide a Safety Plan identifying persons, a description of a daily safety program for job site and emergency procedures to be implemented in the event of a safety incident. Conduct work in accordance with submitted Safety Plan.

C. Quality Control Plan: Provide a detailed quality control plan (QCP) that fully represents and conforms to following as a minimum:

1. A detailed discussion of proposed quality controls to be performed.
2. Defined responsibilities to specific personnel for assuring that quality requirements for this Contract are met.
3. Define proposed procedures for quality control including those pertaining to fit and finish, and product sampling and testing.
4. Proposed methods for product performance controls, including method of and frequency of product sampling and testing both in raw material form and cured product form.
5. A schedule for performance and product test result reviews between Contractor and County/Engineer at a regularly scheduled job meeting.
6. Prepare inspection forms and guidelines for quality control inspections in accordance with specified standards and submitted with QCP.

D. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.

1.7 DELEGATED-DESIGN SUBMITTAL

A. CIPP Design:

1. Data on maximum allowable stresses and elongation of the tube during installation and the means for monitoring stress and elongation, such as ideal inversion head and maximum cold head, minimum inversion head, maximum hot head.
2. A complete description of the proposed wet-out procedure for specified technology.

B. Design and Specification Data Sheets:

1. List parameters used in CIPP liner design and thickness calculations based on ASTM F1216 for fully deteriorated gravity pipe conditions
2. Prepare calculations under supervision of and stamped by a professional engineer registered in State of Virginia.

C. Delegated-Design Submittal:

1. CIPP Installation Procedures: Provide detailed information on CIPP installation procedures, tools, and equipment required for a complete installation. Identify which tools and equipment will be redundant on job site in the event of equipment breakdown. Clearly describe equipment and proposed back-up equipment to be furnished.
2. Outline mitigation procedure to be implemented in the event of key equipment failure during installation process.
3. CIPP Lining Schedules: Provide CIPP lining schedules including field-verified lengths and diameters of required CIPP lining and appurtenances. Include maps that show insertion points for all CIPP installations on plans.
4. Shop Drawings: Identify work scope locations, construction details, pipe diameters, traffic control measures, and related activities.
5. Product Data: Identify construction materials including resins, catalysts, felt, and other system components. Identify manufacturer and their location for felt, wet-out facility, and flexible membrane or coating material, including recommended repair and patching procedures, if applicable.
6. Manufacturers' shipping, storage and handling recommendations for CIPP system components.
7. Detailed sample collection, laboratory testing, and quality control procedures, including schedule, shipping, and storage requirements.
8. Written description and plan for odor control ensuring that project specific odors such as styrene will be minimized at project site and surrounding area.

D. Submittals Before CIPP Installation:

1. Prior to each CIPP lining shipment, submit certified test reports that CIPP lining was manufactured and tested in accordance with specified ASTM Standards.
2. CIPP lining schedules including field-verified lengths and diameters of CIPP lining and appurtenances to show that each pipe to be rehabilitated was physically measured.

Include plans and maps showing insertion points.

3. Detailed installation procedures and manufacturer's recommended cure method for each diameter and thickness of CIPP liner, including CIPP lining production schedule, acceptable inversion heads and pressures, inversion or winching procedures, curing and cool-down procedures detailing the curing rate of temperature increases and cool down, and application method and times for each stage of the process.
4. Pre-rehabilitation (CCTV) inspection data.
5. Samples of installed liners for testing to be performed by a certified independent testing laboratory.
6. Information on grouts, epoxy, or cements proposed to use for sealing manholes or other uses.
7. Some installations may result in the need to repair or replace a defective CIPP. Submit in writing specific repair or replacement procedures for potential defects that may occur in the installed CIPP. Include repair and replacement procedures as recommended by CIPP system manufacturer, as well as the following:

    a. Identify and define defects in installed CIPP that will not affect operation and long-term life of the product.
    b. Repairable Defects: Include a detailed step-by-step repair procedure, resulting in a finished product that addresses blisters, wrinkles, fins, pinholes, over- or under-cut lateral connections, voids found between liner and host pipe, and similar conditions.
    c. Unrepairable Defects: Include a recommended procedure for removal and replacement of CIPP that may include thickness below required minimum thickness, structural strength below required limits, lifts, shrinkage, folds, bulges, delamination, and similar conditions.

E. Submittals During CIPP Installation:

1. Wet-out forms or reports for each CIPP segment with detailed information including but not limited to: date and time of wet-out, wet-out facility address, volumes and/or weights of resin, length and diameter of CIPP liner (both wet-tube and dry-tube), roller gap settings, start times, finish times, resin used (product name and batch/shipment number) and quantity, gel times, resin injection locations, thickness of CIPP liner (dry and wet), catalyst(s) name and quantity used, and other pertinent data documenting wet-out for each section of CIPP liner manufactured.

    a. Submit wet-out forms prior to CIPP liner installation and without delay or claim to confidentiality.
    b. Submit to County and Engineer's field representative on the day of delivery.

2. CIPP liner field curing reports documenting liner installations for sewer segments. Document details of liner installation, including manhole numbers, street names, sewer location, project number, date, time, ambient temperature, heads used during the inversion process, pressures and/or heads (minimum inversion pressure, ideal head, maximum hot head and maximum cold head) used during curing, curing temperature, curing time, rate of cool down, and CIPP liner thickness.

    a. Submit a sample report to County and Engineer for approval prior to installation of any CIPP lining. Submit reports prior to requesting payment and without delay or claim to confidentiality.

b. Submit daily production reports to Engineer or field representative at end of each workday.

F. Submittals After CIPP Installation:

1. Complete certified copies of report outputs of continuous temperature monitoring systems used in curing, printed and in electronic format. Submit reports prior to requesting payment and without delay or claim to confidentiality. Provide the County and Engineer with access to the website where secure reports can be obtained.
2. Post-rehabilitation CCTV inspection data. Submit post-rehabilitation CCTV inspection within one week after CIPP segment installation.
3. A list of repair or replacement of CIPP defects that were executed including identification of segment, repair location, and repair type.

1.8 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of cured-in-place pipe liner or pre-liner system.

B. Material Test Reports: For each cured-in-place pipe liner or pre-liner system, by a qualified testing agency.

C. Product Test Reports: For each cured-in-place pipe liner or pre-liner system, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranty: For manufacturer's warranty.

1.9 QUALITY ASSURANCE

A. Installer Qualifications:

1. Have successfully installed a minimum of 50,000 feet of proposed CIPP liner in pipe of a similar size, length, and configuration as specified and documented by verifiable references.

a. Number of years of Contractor’s experience in installing CIPP lining.
b. A list of a minimum of five municipal clients that CIPP Contractor has performed specified type of work for without defects or performance problems for a period of five years after installation:

1) Owner Project manager’s name, telephone number and email address.
2) A full description of the actual work performed.
3) Name of CIPP lining manufacturer and supplier for each referenced project.

B. Staffing Qualifications:

1. Site Supervisor: At least five (5) years of experience in overseeing projects of similar type and size and can clearly always communicate technical matters on-site when construction activity is occurring or when the site is not in a secure state.

2. Safety Project Officer:

   a. At least one (1) VDOT Basic Work Zone Traffic Control certified employee on-site at all times (a certified flagger in accordance with the VDOT Flagger Certification Program, the American Traffic Safety Services Association Flagger Certification Program or any other VDOT approved flagger program).

   b. At least one (1) OSHA 10 certified employee on-site at all times who has served as a Project Safety Officer on at least three (3) prior projects. If the contractor has multiple employees with these requirements, the Contractor shall clearly identify which employee shall serve as the Project Safety Officer.

3. Environmental Project Officer: At least one (1) employee that has successfully completed the VDOT Erosion & Sediment Control Contractor Certification training. The Environmental Project Officer shall be on-site during all land disturbance activities and responsible for ensuring compliance with all applicable local, State, and Federal erosion

4. Project Manager: Minimum of five (5) years' experience successfully managing projects that installed a minimum of 10,000 feet of CIPP liner in sewers 30" or larger in diameter.

5. Manufacturer Certified Project Superintendent: Minimum of two (2) years' experience successfully installing a minimum of 10,000 feet of CIPP liner for sewers 30" or larger in diameter. Superintendent shall also have at least three (3) years of experience with CIPP technology proposed and demonstrating competency and experience.

C. Manufacturer Qualifications:

1. Names and product information of CIPP felt tubes and resin materials to be utilized for this project and their suppliers.

2. A certified statement from manufacturer that Contractor is an approved installer as certified or licensed by the CIPP liner manufacturer.

3. CIPP Felt and Resin Manufacturers: Have successfully supplied a minimum of 500,000 feet of proposed liner and one million pounds of resin as documented by verifiable references.

D. Material Certifications: Five reports from projects within past two years from independent testing laboratory analysis of liner materials showing modulus of elasticity as determined by appropriate ASTM standard and flexural stress as determined by ASTM D790 standard. Lining shall be of same resin system and felt tube materials as proposed for this project.

E. County or Engineer reserves the right to approve or disapprove Contractor, Superintendent, or manufacturer based on submitted qualifications and follow-up interviews.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Take care during shipping, handling, and laying to avoid damaging CIPP liner. Replace CIPP liner damaged beyond repair in shipment as directed by County or Engineer.

B. Repair CIPP liner showing a visible split, tear, or defect, per manufacturer's recommendations and to satisfaction of Engineer. If not possible, remove at once from project site.

C. While stored, support and protect CIPP in a manner as recommended by manufacturer.

D. Maintain CIPP liner at a proper temperature in refrigerated facilities to prevent premature curing prior to installation. Protect CIPP liner from UV light. Reject CIPP liner showing evidence of premature curing and immediately remove from site.

E. Inspections of CIPP lining may also be made by Engineer or other representatives of County after delivery. CIPP lining shall be subject to rejection at any time on account of failure to meet any of the specified requirements, even though sample CIPP lining may have been accepted as satisfactory at place of manufacture. Mark CIPP lining rejected after delivery for identification and remove from the job site.

1.11 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of cured-in-place pipe liners or pre-liner systems that fail in materials or workmanship within specified warranty period.

1. During this period, serious defects discovered in CIPP lining, as determined by Engineer and which may materially affect the integrity, strength, function, or pipe operation, shall be removed and replaced as recommended by manufacturer in a satisfactory manner.
2. Remove and repair defects in a manner that is satisfactory to County and Engineer. Defects include but not limited to the following:

    a. Leakage through liner or between liner and pipe.
    b. Reduction of liner thickness of more than ten percent of thickness design. Deliver final liner thickness based on installed product physical properties and as specified in Contract Documents.
    c. Separation of liner from host pipe where an annular space is clearly noticed, shrinkages (longitudinal or circumferential), dry spots, delamination of liner, cured lifts, dry spots, bulges due to external loading, reverse curvatures, splits, cracks, lifts, breaks, folds, defined major wrinkles, flats, pinholes, crazing and other defects that in CIPP lining will compromise installed product longevity.
    d. Circumferential defects such as wrinkles, fins, and bulges in pipe invert between 4:00 and 8:00 o'clock shall not exceed three percent of host pipe diameter or 1/2 inch by visual measurement, whichever is smaller, at discretion of County.
    e. Longitudinal wrinkles or fins shall not exceed maximum allowable height of five percent of equivalent host pipe diameter or 1 inch, whichever is smaller.
    f. Structural strength below the required limits.

B. Warranty Period: Two years from date of Substantial Completion.

C. At its own expense, County may conduct an independent CCTV inspection of CIPP lining work prior to completion of warranty period. Defects replaced at that time shall be fully warranted by Contractor and manufacturer for a period of two years from date the defect was repaired.

1. Repair or replace wrinkles in flow stream, blisters that may affect the longevity of CIPP liner, dry spots where liner tube has no resin saturation, or other defects that may affect the integrity or strength of the CIPP or the flow capacity of the pipe.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:

1. Inliner by Layne Inliner, Inc.
2. Insituform by Insituform Technologies, Inc.
3. SAK Liner by SAK Construction LLC.
4. Premier-Pipe USA by AM Liner East
5. CIPP Corporation Liners

B. Source Limitations: Obtain all components and accessories for CIPP system from single manufacturer or products from a secondary manufacturer as approved by primary manufacturer.

C. Identify designated wet-out facility where CIPP liners will be manufactured. Use this facility for the entirety of the project, unless specifically approved otherwise by Engineer in writing. Multiple wet-out facilities will not be allowed.

2.2 SYSTEM REQUIREMENTS

A. In addition to various system requirement identified in following Paragraphs of this Article, comply with other requirements specified within this Section. CIPP lining and appurtenances generally include, but are not limited to:

1. Services necessary for traffic control, bypass pumping or diversion of sewage flows, cleaning, and television inspection of sewers to be lined, liner installation, reinstatement of service connections, quality control, providing samples for performance of required material tests, final television inspection, testing of lined pipe system and warranty work.
2. Removal of obstructions and protruding service connections to complete CIPP rehabilitation. Complete removal of pipeline obstructions and protruding service connections required for sewer rehabilitation using cured-in-place pipe lining prior to pre-rehabilitation CCTV inspection.
3. Verify neither CIPP system nor its installation causes adverse effects to any of County's processes or facilities.

a. Product use shall not result in formation or production of detrimental compounds or by-products in the system or at wastewater treatment plant.
b. Notify County and identify any by-products produced as a result of installation

operations, test and monitor levels, and comply with local waste discharge requirements.

c. Cleanup, restore existing surface conditions and structures, and repair CIPP system determined to be defective. Conduct installation operations and schedule cleanup in a manner to cause minimize inconvenience to traffic, pedestrians, businesses, and property Owners or tenants.

4. Do not change any material, design values, or procedural matters stated or approved, without informing Engineer and receiving written approval of the change. Such changes constitute a breach of contract and shall result in rejection and removal of work performed with unapproved materials or processes. Replace with new materials and specified requirements.
5. Maintenance and Protection of Traffic, confined space entry, and work site protection shall be the responsibility of the Contractor with related costs of these items included in project cost. Notify Police, Fire, Ambulance agencies, and residents/businesses in advance of road closures. Comply with applicable OSHA trench safety rules and confined space and sewer system entry.

B. Verify proposed CIPP liner thicknesses and submit associated calculations. Actual cured liner thickness shall be -5/+10 percent of approved design thickness and shall not include thickness of any non-structural membrane (inner/pre- liner). Design CIPP liner in accordance with applicable provisions of ASTM F1216 for "fully deteriorated gravity pipe conditions", unless Engineer agrees, in writing, prior to installation that "partially deteriorated gravity pipe conditions" shall apply based upon review of CCTV video. CIPP liner shall meet following design conditions, unless Engineer agrees, in writing, of their change:

1. AASHTO H-20 Live Load.
2. Constrained soil modulus of native soil in the pipe zone of 2,000 psi.
3. Soil weight of 120 pounds per cubic foot and a coefficient of friction of Ku'=0.130 for the installed depths.
4. Estimate long-term flexural modulus used in design calculations by multiplying lowest short-term flexural modulus used in design calculations by a retention factor of 0.50 (i.e., long-term retention of mechanical properties equal to 50 percent.)
5. Design safety factor of 2.0.
6. Groundwater depths (See Attachment F – Groundwater Level Monitoring Report)

    a. MH 750 – MH 749: Use highest Ground surface elevation
    b. MH 749 – MH 748: See Attached Groundwater Memo
    c. MH 748 – MH 746: See Attached Groundwater Memo
    d. MH 746 – MH 745: See Attached Groundwater Memo
    e. MH 745 – MH 742: See Attached Groundwater Memo
    f. MH 742 – MH 741: Use highest Ground surface elevation
    g. MH 741 – MH 740: Use highest Ground surface elevation

7. Service Temperature Range: 40 to 100 degrees F.
8. Minimum Ovality of Host Pipe: Two percent.
9. Long-Term Retention of Mechanical Properties: Equal to 50 percent.
10. Thickness for CIPP Liner: Largest thickness as determined by calculations for deflection, bending, buckling, and minimum stiffness.
11. CIPP Liner Thickness for Non-Round Pipes or Circular Pipes with Greater than 10 Percent Ovality: Design In accordance with WRc Sewerage Rehabilitation Manual, Type

II Design, Section 5.3.2.iii.

12. CIPP liner shall provide a minimum service life of 50 years and, for design purposes, shall have the following minimum initial and long-term properties:

    a. Flexural Strength - Initial: 4,500 psi according to ASTM D790.
    b. Flexural Strength - Long Term: 2,250 psi according to ASTM D790.
    c. Flexural Modulus of Elasticily - Initial: 350,000 psi according to ASTM D790.
    d. Flexural Modulus of Elasticily - Long Term: 175,000 psi according to ASTM D790.

13. Design CIPP to withstand imposed loads, including dead and live loads and, hydrostatic pressure. Design liner to have sufficient wall thickness to withstand anticipated external pressures and loads that may be imposed after installation.

2.3 MATERIALS

A. CIPP Liner: Composed of tubing material consisting of one or more layers of a flexible non-woven polyester felt with or without additives such as woven fiberglass or other fibers and meet the requirements of ASTM F1216, ASTM F1743, and ASTM D5813.

1. Determine felt content of CIPP liner, but do not exceed 15 percent of total impregnated liner volume.
2. Fabric Tube: Capable of absorbing and carrying resins, construct to withstand installation pressures and curing temperatures, and stretch to fit irregular pipe sections.

B. Submit certified information from felt manufacturer on normal void volume in felt fabric that will be filled with resin.

C. CIPP Liner Tube: Single or multiple layer construction, with any layer not less than 1/16 inch thick, unless the tube is made of fiberglass material. Wet-out fabric tube shall have a uniform thickness and void space for resin distribution that when compressed at installation pressures will produce a predictable finished thickness that meets or exceeds the design thickness after cure.

1. Include no material in fabric tube that may cause de-lamination in cured CIPP. No dry or unsaturated layers shall be acceptable upon visual inspection as evident by color contrast between felt fabric and activated resin containing a colorant.
2. Seams in Fabric Tube (If Applicable): Meet requirements of ASTM D5813.
3. Coat outside layer of tube with an impermeable material compatible with resin and fabric.

D. Wall Color of Interior Pipe:

1. Light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.
2. Hue dark enough to distinguish a contrast between fully resin saturated felt fabric and dry or resin lean areas.

E. Resins:

1. Type: Corrosion resistant polyester or vinyl ester resin and catalyst system or epoxy and hardener system manufactured specifically for sewer rehabilitation, that when properly cured within tube composite meets requirements of ASTM F1216, ASTM F1743, or ASTM F2019, and specified physical properties.
2. Produce CIPP that complies with or exceeds specified structural and chemical resistance requirements.
3. Be compatible with liner material.
4. Properties:

    a. Viscosity Control: Up to 5 percent by mass, a thixotropic agent for viscosity control, which will not interfere with visual inspection.
    b. Facilitate better heat transfer and retention during installation.

5. Additives: May contain pigments, dyes, or colorants, which shall not interfere with visual inspection of cured liner.
6. Quantity: Be sufficient to fill volume of air voids in tube with additional allowances for polymerization shrinkage and loss of resin through cracks and irregularities in original pipe wall.
7. Use serial vacuum impregnation or pressure impregnation process, or equal, to provide maximum resin impregnation throughout the tube.

2.4 FABRICATION

A. Prior to inversion if applicable, coat outside and inside layer of tube (before inversion/pull-in as applicable) with an impermeable, flexible membrane that will contain the resin and facilitate, if applicable, vacuum impregnation and monitoring of resin saturation during resin impregnation (wet out) procedure.

B. Include distance markings on exterior of manufactured tube along its length at regular intervals not to exceed 5 feet. Use these marks as a gauge to measure elongation during insertion. Should overall elongation of a reach exceed 5 percent, reject and replace liner tube.

C. Conduct application of resin to felt tubing (wet-out) under factory conditions using vacuum impregnation and materials fully protected against UV light, excessive heat, and contamination at all times.

D. If on-site wet out is required, maintain ambient conditions similar to those encountered during factory wet outs.

E. Liners that are factory impregnated and transported to project site in refrigerated trucks shall be installed no more than two weeks after date of impregnation at factory or sooner according to manufacturer’s recomendations.

F. When cured, CIPP liner shall form a continuous, tight-fitting, hard, impermeable liner that is chemically resistant to chemicals normally found in domestic sewage per Table X2.1 in ASTM F1216. CIPP liner shall be chemically resistant to trace amounts of gasoline and other oil products commonly found in municipal sewerage and soils adjacent to sewer pipe to be lined.

G. CIPP Liner Tube:

1. Manufacture or fabricate to a size that will tightly fit internal circumference of sewer being rehabilitated after being installed and cured.
2. Allow longitudinal and circumferential expansion into account when sizing and installing CIPP liner.
3. Size tube to diameter of existing pipe and length to be rehabilitated and be able to stretch to fit irregular pipe sections and through bends and dips within the pipeline.

    a. Determine minimum tube length necessary to effectively span designated run between manholes.
    b. Verify lengths in field prior to ordering and prior to impregnation of tube with resin, to ensure that tube will have sufficient length to extend entire length of run.

        1) Measure inside diameter and circumference of existing pipelines at face of each manhole in field prior to ordering liner so that liner can be installed in a tight-fitted condition with little or no wrinkling.

4. Length of CIPP Liner: To effectively carry out insertion of CIPP liner and sealing of CIPP liner at outlet and inlet manholes.

    a. Measure required diameter and length of each pipe segment in advance of wet-out and submit to Engineer at least one week prior to installation of each CIPP liner.

5. Ensure correct liner is installed in each sewer reach being rehabilitated.

2.5 SEALS

A. End Seals:

1. Hydrophilic rubber, molded as a one-piece, three-inch wide cylinder which when installed will form a 360-degree seal between the host pipe and the newly installed liner.
2. Use of caulking, rope or band type of an end seal will not be allowed.
3. Install epoxy at the end of each lined pipe to cover any piece of existing pipe that are exposed at manhole walls.
4. Basis-of-Design Manufacturers:

    a. End Seals: Insignia™ End Seals by LMK Enterprises or equal.
    b. Epoxy Resins: Sikadur 31 or equal.

2.6 CIPP SPOT REPAIRS

A. Not Used.

2.7 STYRENE REDUCING AGENT

A. Gelatin, water soluble, biodegradable, non-toxic, FDA approved powder or capsule.

B. Add in a calculated amount according to manufacturer's recommendations into the down-tube for water curing or directly into the water holding tank for steam curing.

C. Basis-of-Design Manufacturers:

1. StyRedux by Integrated Chemical & Equipment Corporation or equal.

2.8 SOURCE QUALITY CONTROL

A. CIPP lining may be inspected at manufacturing plant for compliance with specification requirements by an independent testing laboratory provided by County. Ensure that manufacturer cooperates with these inspections.

B. County or an agent of County may inspect CIPP liner during manufacturing and wet-out. Give County or its agent an opportunity to witness manufacturing of project CIPP liners. Provide full access to witness wet-out process and provide information related to manufacturing as requested by County or County's agent without delay and without claims of confidentiality or product privacy

C. County is responsible for costs associated with witnessing the manufacturing and plant inspection of CIPP liners.

PART 3 - EXECUTION

3.1 PREPARATION

A. County has CCTV from 2019 that will be made available to Contractor for their review.

B. Notify property owners or businesses that discharge sewage directly to sewer being lined and whose service lateral, if any, will be affected by lining work, that their utility service will be temporarily discontinued during installation of CIPP liner

1. Deliver written notification at least 72 hours in advance, giving start date, start time, and estimated completion time for the work being conducted.
2. Include any restrictions on use of sewage system facilities including exact days and hours when sewer system cannot be used.

C. Method of notification, and the text included in the notification, will be approved by County.

D. Clean each length of pipe to be lined, in accordance with Section 330130.41 "Cleaning of Sewers" and dispose of resulting residual material offsite in a manner acceptable to County and Engineer.

E. Conduct a pre-rehabilitation CCTV inspection of sewers to be rehabilitated by CIPP lining methods in accordance with Section 330130.16 "TV Inspection of Sewer Pipelines" Perform inspection to identify pipe defects, to document location of service lateral connections, if any, and to confirm point repair locations.

1. Project manager or superintendent shall review pre-rehabilitation inspection videos to confirm its quality and locations of point repairs to be performed.

F. Only after confirmation that video quality is adequate for a clear review of pipeline, submit to Engineer. Engineer will review pre-rehabilitation inspection videos to confirm locations of point repairs to be performed. If an Inspector or Engineer is on site or immediately available, allow viewing of pre-installation video to verify the pipe is ready for CIPP installation which includes proper cleaning, trimming protruding taps, and mitigating significant infiltration.

G. Infiltration runners or gushers as defined by NASSCO PACP that are observed during the pre-rehabilitation CCTV shall be stopped by injecting a chemical hydrophilic grouting using a remote packer, in accordance with Section 331113.26 “Grouting”, unless otherwise approved by Engineer.

H. Maximum amount of time any home or business shall be without sanitary sewer service is 4 hours and not between 6:00 PM and 8:00 AM. Bypass any service out longer than 10 hours to a sanitary sewer without additional compensation.

I. Provide bypass pumping of sewage flows in accordance with Section 331210 “Temporary Bypass Pumping Systems.” Service connection effluent, if any, may be plugged only after proper notification to affected residence and may not remain plugged overnight. Do not begin liner installation until required plugs or a sewage by-pass system and all pumping facilities have been installed and tested under full operating conditions, including bypass of mainline and side sewer flows. Once lining process has begun, maintain existing sewage bypass flows until resin and felt tube composite is fully cured, cooled down, fully televised, and CIPP ends finished.

J. Do not allow wastewater flows from existing sewers to enter new or rehabilitated facilities until new or rehabilitated facilities have been cleaned and tested as required in Contract Documents.

K. Provide CIPP liner in full length of sewer. Complete installation of CIPP liner in accordance with applicable provisions of ASTM F1216 or ASTM F1743 and manufacturer’s recommendations.

L. If in the opinion of CIPP liner manufacturer or County or Engineer, rate of infiltration in sewer segment is high enough to risk washout of resin, perform measures, as required, to minimize infiltration prior to installation, including pre-liners, grouting, etc.

M. For the ends, use digital pressure/vacuum type gauges with a pressure range of 0 to 50 psi and plus or minus 0.25 percent test gauge accuracy.

3.2 INSTALLATION

A. Install CIPP liner via inversion using hydrostatic head in accordance with ASTM F1216 or ASTM F1743 and manufacturer’s recommendations, or inserted through a manhole by means and methods required by manufacturer.

1. Ensure sufficient hydrostatic head is used during installation process to hold liner tight to pipe wall, producing dimples at service connections, and flared ends at two access manholes.

B. Closely follow requirements in submitted liner field curing reports, including minimum inversion pressure, ideal head, maximum hot head, and maximum cold head for each installation.

C. If CIPP does not fit tightly against original pipe at its termination points, fill full circumference of CIPP exiting host pipe with a resin mixture compatible with CIPP, approved by CIPP manufacturer and Engineer. Perform work without additional compensation.

1. There shall be no significant leakage of groundwater between existing pipe and CIPP at manhole connection or service lateral connections.
2. Remove any leakage and eliminate infiltration found at manhole and service connections.

D. Fit heat source with monitors to accurately gauge temperature of incoming and outgoing water supply. Place another such gauge between CIPP liner and pipe invert at downstream end to determine temperature during curing process. Maintain temperature in CIPP during entire curing process as recommended by resin manufacturer. Provide a written temperature data chart and curing log to County's Representative for review to ensure that curing temperatures for resin meets manufacturer's recommendations.

E. Cure full length from manhole to manhole of the installed resin-impregnated flexible felt tube CIPP liner using circulating heated water in accordance with ASTM F1216 and manufacturer’s recommendations. Cure resin into a hard impermeable pipe with minimum specified thickness, providing a structurally sound, uniformly smooth interior, and tight-fitting liner within existing pipe.

1. Perform cool-down procedures in accordance with ASTM F1216 and manufacturer’s recommendations and guidelines.
2. Be linear and gradual.
3. Do not allow super cooled air to be injected.

F. When installing CIPP lining in multiple sewer segments at one time, remove top one-half of CIPP liner in intermediate manhole, leaving the invert in place. Fill void between CIPP liner and existing channel with non-shrink grout. Reconstruct manhole bench as required to provide a smooth transition to new CIPP liner.

G. Cutting and sealing of CIPP liner at manhole connections shall provide watertight pipe and manhole seals. Seal cut edges of cured liner with same resin as used in liner. Use catalyst or hardener compatible with those used in liner previously, but without requiring an external heat source to begin exothermic reaction (curing). Allow no leakage of groundwater into manhole between CIPP liner and existing sewer pipe and between existing sewer pipe and manhole wall.

H. Prior to installing liner in host pipe, confirm temperature monitoring system’s proper functioning by connecting to a computer to verify that sensors are reporting their ambient temperatures. No more than two sensors in sequence can be found faulty during this test. If three or more sensors in sequence are discovered faulty, provide a new sensor array and test again for its proper functioning without additional compensation.

I. Cure resin system per recommendations of CIPP system manufacturer. Achieve temperatures and duration of holding per System Manufacturer’s established procedures.

1. If any sensor or sensors along the reach indicates that there is a localized issue with

respect to achieving proper curing, immediately address such issues.

2. Sensor array's database required in previous Paragraph shall have an output report that identifies each sensor by its station in reach and shows maximum temperature achieved during processing of CIPP and time sustained at or above Manufacturer's required curing temperature at each sensor.
3. Record temperature of liner until it has completed the cool-down process.

J. Take measures to ensure that in release of static head, a vacuum shall not be produced that could damage the newly installed CIPP liner.

K. Incorporate mitigation measures to control styrene odors during installation and curing of liner. If any styrene odor complaints occur on jobsite, have means and methods to immediately mitigate the issue.

L. Vent or exhaust noxious fumes or odors generated during and remaining after curing process is completed. Retain process in place at manholes, laterals, and other underground structures until noxious odors have dissipated to an acceptable level in accordance with OSHA requirements for materials used. Maintain until there is no more pollutant or potential health hazard.

M. Provide piping, pumps, valves, and other equipment to discharge curing water.

N. After installation of first 500 linear feet of CIPP lining, install no additional CIPP lining until acceptance testing demonstrates that products meet specified thickness and strength properties. Upon review and approval by Engineer of test results, remainder of lining installation may resume.

3.3 FIELD TESTING AND ACCEPTANCE

A. Field acceptance of CIPP lining shall be based on County's and Engineer's evaluation of installation, including a review of CIPP liner curing data, review of post-rehabilitation CCTV inspection data, and review of certified test data for installed CIPP liner, including air testing. Complete CIPP sample testing and repairs to installed CIPP before final completion, meeting requirements of these specifications and documented in written form.

B. For every 1,500 linear feet of CIPP liner installed, perform sampling and testing to determine installed CIPP liner flexural properties and CIPP liner thickness. After the test results have been collected and have passed minimum specified standards, County may require collecting random samples for testing.

1. Frequency of testing may be reduced as approved by Engineer after sufficient tests are performed to verify CIPP liner design, production, and installation procedures.

C. Frequency of testing may be increased by Engineer when tests show that installed CIPP liner does not meet specifications. Where tests fail, reevaluate liner thickness design to determine if installed physical properties meet minimum design requirements. Replace and reline with approval from Engineer witout additional compensation.

D. Perform testing by an independent testing laboratory certified by the American Association for Laboratory Accreditation (A2LA). Submit to Engineer the name and location of independent testing laboratory, a certified statement from laboratory indicating that they are independent

from and not associated with Contractor in any way, and A2lA certification for independent testing laboratory.

E. Pay expenses for sampling and testing of installed liner. Chain of custody for test samples shall be through County's representative. Cost of all manufacturer's testing to qualify products furnished to project site shall be responsibility of Contractor.

F. Sampling and testing of the installed CIPP liners shall conform to ASTM F1216 and the following requirements:

1. Measure CIPP liner thickness in accordance with ASTM D5813 and flexural properties in accordance with ASTM D790. Label and date samples and provide to inspector or County's representative same day of installation for shipping to independent testing laboratory. Copy Engineer on all transmittals to independent testing laboratory. Submit testing results to Engineer within 30 days after installation of CIPP liner or payment will be withheld.
2. After recalculations correct CIPP lining not meeting new calculated thickness requirements in a manner approved by Engineer. County's decision on how to correct deficient CIPP liner installations shall be final. Options for correcting deficient CIPP liner installations that will be considered by County include the following:

    a. Removal of existing CIPP liner and re-lining the sewer.
    b. Open-cut replacement of sewer from manhole to manhole.
    c. Relining sewer with existing CIPP liner in place.

G. Perform a post-rehabilitation CCTV inspection of sewers rehabilitated using CIPP lining methods in accordance with Section 330130.16 "TV Inspection of Sewer Pipelines." Perform post-rehabilitation CCTV inspection following installation of CIPP liner and reinstatement of all active service laterals, if any. Review post-rehabilitation inspection videos to confirm the quality of videos and of installed CIPP. Only after confirmation that videos are of good quality, shall they be submitted to Engineer. If it is determined that repairs are needed at any segment, perform a new CCTV inspection of the entire segment after completing repairs.

H. Liner Installation Inspection: A visual inspection of liner will be considered acceptable if liner shows no significant, wrinkles, lifts, ridges, splits, cracks, delaminations, flats, dry spots, pinholes, shrinkage, foreign inclusions, crazing, reverse curvatures, or other type of defects in CIPP lining. Significant defects shall also be defined to include defects that may create a maintenance issue in future such as inhibiting CCTV cameras or allowing solids to get caught on defect, or defects that appear to reduce long-term structural strength or stability of pipeline.

1. Longitudinal wrinkles and fins in height up to a maximum of five percent of inside diameter of host pipe or 1 inch, whichever is smaller, may be acceptable and shall be evaluated by Engineer for acceptance on a case-by-case basis.
2. Repair or replace defective lining. If during removal process, the pipe is damaged, perform a point repair without additional compensation.

I. Post CCTV Video Inspection and Submittals: Contractor shall submit a digital CCTV of post-lined sewer within seven business days for each pipe segment. Engineer shall review and approve payment based upon satisfactory completion of a liner that is free of significant defects.

1. Remove wrinkles or fins deemed significant at the discretion of Engineer using a milling

head, relined or replaced as directed by Engineer. Leave no evidence of other major defects in CIPP lining.

2. Repair longitudinal shrinkage of CIPP liner's length of more than 3 inches from face of manhole with a fiberglass reinforced CIPP spot repair.
3. Measure circular shrinkage via man entry to try to insert a 1/16 inch thick ruler or similar into any gap more than 8 inches past manhole wall.
4. Document measurements with digital photos and submit to Engineer for approval. Repair circular shrinkage per manufacturer recommendations.

J. CIPP liner shall be watertight. Groundwater infiltration through liner wall shall be zero.

K. Leave pipe-to-manhole connections watertight and free of infiltration.

L. Test installed CIPP for water tightness.

M. Suppliers shall be responsible for provisions of specified test requirements as applicable.

END OF SECTION 330130.72

SECTION 331113.26 - GROUTING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required to eliminate infiltration runners or gushers at sewer main joints and defects to sewer mains using chemical grout that is installed using a grout packer. Sewer main cleaning, testing, and grouting shall be as described in this Section. All equipment shall enter sewer mains from the manholes.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.3 SUMMARY

A. Section includes:

1. Grout seal.

1.4 MEASUREMENT AND PAYMENT

A. Measurement: Application of grout with a packer shall be measured on a per each basis as stated on the Bid Form, complete in place, in accordance with the Contract Documents.

B. Payment: Price paid for grouting with packer to eliminate infiltration runners and gushers shall include full compensation for labor, materials, tools, equipment, and incidentals necessary to launch a grout packer in the sewer main, applying grout to seal the infiltration, cleaning, air testing for leaks and integrity, associated CCTV taping, and removal of the grout packer upon successful grouting.

1.5 ACTION SUBMITTALS

A. Detailed grouting plan in writing (at least 72 hours, excluding weekends and holidays, before grouting starts) prior to each grout operation for review by the ENGINEER. Include:

1. Calculations in detail showing quantities of grout needed and pressure calculations to avoid casing collapse during grouting.
2. Injection pump capacity, equipment used for mixing and grout mix, and monitoring equipment.

B. Submit the following:

1. Name of the Supervisor directly responsible for grouting operations.
2. Qualifications of the grouting superintendent.
3. Certification of all installers by the grout manufacturer or their approved representatives.
4. Product information on the grout, additives, and packer. Grout and additive product data shall include both chemical and physical properties.
5. Manufacturer's installation instructions.
6. Safety Data Sheets.

1.6 INFORMATIONAL SUBMITTALS

A. Mill certificates for dry cement delivered to site. Submit cement mixtures prior to placement.

B. Grout Record: Volume of grout used for each casing segment after grout is emplaced.

1.7 QUALITY ASSURANCE

A. Where reference is made to standards referenced herein, revisions in effect at time of bid opening shall apply.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer with sufficient equipment and expertise to perform these operations.

C. Sealing shall be performed by a crew under the direct supervision of a superintendent who has a minimum of two years documented experience in the sealing procedures as specified herein and as considered standard in the sewer rehabilitation industry. Submit documentation of this experience with references for approval prior to the start of work.

1.8 SYSTEM DESCRIPTION

A. General

1. Sealing equipment shall consist of two separate pumping systems capable of supplying an uninterrupted flow of sealing materials to completely fill the voids. The gel side of the system shall be a closed system to minimize exposure to moisture. Pump fittings and hoses shall be designed to transport a high viscosity material and shall not be affected by acetone or ketone solvents. The sizing of the system shall be such that the water side can transport materials at 8 to 10 times the rate of the gel side.
2. The system shall be such that the amount of chemical grout injected into each sewer joint can be precisely measured. The number of pump strokes shall be used to measure the quantity of grout pumped into each pipe joint. Field verification of the gallons of grout pumped per stroke shall be made at the beginning and end of each workday.
3. Sealing materials shall pass from the pumping system through instant reading, controlled flow meters and then through a dual hose system into the sealing device. The device (referred to as a packer) shall be a cylindrical case of a size less than pipe size, with the cables at either end used to pull it through the line. The packer device shall be constructed in such a manner as to allow a restricted amount of sewage to flow at all times.

4. Air impervious inflatable sleeves shall be mounted over the cylinder with the ends of the sleeve sealed to the ends of the casing. The sleeves shall be so constructed that they can be pneumatically expanded from the center to both ends. The center portion of the sleeve shall be sealed to the casing by a broad confining band. 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 confined portion of the sleeve. No sealing device which is expanded mechanically nor where the expansion sleeve is not continuous will be allowed in order to prevent damage to the pipe from excessive amounts of sealing pressures or air leakage in the center area of such sealing device.

PART 2 - PRODUCTS

2.1 DESCRIPTION OF WORK

A. Clean (including roots, etc.), grout and test each defect as required. Furnish and utilize such equipment as is necessary to conduct all of the work specified in this Section from inside each sewer main. Access from private property shall be considered only after all options to access from the main sewer have been attempted. Where private property access is required, Contractor shall be responsible for obtaining requisite easements. Contractor shall provide a copy of the executed easements to the County prior to accessing private property.

2.2 SEALING MATERIALS

A. General

1. Mixing, handling, and application of chemical sealing materials shall be in strict accordance with the manufacturer's recommendations.
2. While being injected, the chemical sealant must be able to react/perform in the presence of water.
3. The cured sealing material must prevent the passage of water through the pipe joint and the annular space. The sealing material must withstand submergence in water without degradation, remain flexible after curing, and must be able to withstand freeze/thaw and wet/dry cycles without adversely affecting the seal.
4. The cured sealant must be chemically stable and resistant to acids, alkalis and organics normally found in sewage, and must not be biodegradable.
5. Residual sealing materials must be easily removable from the sewer line to prevent reduction or blockage of sewage flow.
6. Handling, formulation and storage of the sealing gel compound shall be in strict conformance with the manufacturer's recommendations. The uncured gel shall be delivered to the site in unopened containers, with the date of manufacture clearly indicated, no uncured gel manufactured more than six months prior to the date of application shall be utilized. Any uncured gel compound determined to be more than six months old shall be immediately removed from the site. Once a container of uncured gel has been opened it shall be used as soon as practically possible. If the container of gel is not used within 24 hours of being opened, ensure that the gel has not been contaminated. Any contaminated gel, as determined by the County, shall be removed from the site and disposed of.

B. Acrylic base gel chemical sealing material shall have the following characteristics:

1. A minimum of 10% acrylic base material by weight in the total sealant mix. A higher concentration (%) of acrylic base material may be used to increase strength of set during injection.
2. The ability to tolerate some dilution and react in moving water during injection.
3. A viscosity of approximately 2 centipoise, which can be increased with additives.
4. A constant viscosity during the reaction period.
5. A controlled reaction time from 5 seconds to 6 hours.
6. The ability to increase mix viscosity, density, and gel strength by the use of additives.
7. Acrylic base gel chemical sealing material shall be Avanti AV-118 or equal.

C. Urethane base gel chemical sealing material shall have the following characteristics:

1. One part urethane prepolymer thoroughly mixes with between 5 and 10 parts of water weight. The recommended mix ratio is one part urethane prepolymer to 8 parts of water (11% prepolymer).
2. A liquid prepolymer having a solids content of 77% to 83%, specific gravity of 1.04 (8.65 lbs./gal.) and a flash point of 20 degrees F.
3. A liquid prepolymer having a viscosity of 600 to 1200 centipoise at 70 degrees F that can be pumped through 500 feet of hose with a 1000 psi head at a flow rate of 1 ounce per second.
4. Water used to react the prepolymer shall have a pH between 5 and 9.
5. A cure time of 80 seconds at 40 degrees F, 55 seconds at 60 degrees F, and 30 seconds at 80 degrees F, when 1-part prepolymer is reacted with 8 parts of water only. Cure time shall be adjustable by the use of additives to the reaction water.

D. Icoset shall be added to all chemical grout installed under this contract. The application shall be in accordance with the manufacturer's recommendations.

E. A representative of the grout manufacturer shall be on site for one day at the start of the project to assure that all requirements are met.

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to grouting, the Contractor shall thoroughly clean the interior of the sewer main of deposits, debris, foreign matter, and any obstructions or defects that prevent the movement or seating of the packer. Cleaning shall be performed in accordance with Section 330130.16.

B. The Contractor shall maintain complete records of all joint sealing performed in each sewer reach. The records shall include at least the following:

1. Date.
2. Time.
3. Identification of sewers tested, including MH section, street location and tributary area.
4. Label of corresponding television inspection videotape.
5. The test pressure used at each joint.

6. Location of each joint sealed by footage or station.
7. Location of each joint not sealed including reason for not sealing.
8. Joint sealing verification results.
9. Gallons of grout pumped for each joint/crack.
10. Two copies of the typed record sheets shall be furnished to the Engineer at the completion of testing and sealing work.

C. The Contractor shall be prepared to bypass pump the sewage flow as part of his operation where the sealing procedures require such diversion. Where the sealing equipment is designed to allow the passage of flow, the flow shall be limited to that as recommended by the equipment manufacturer.

D. Where normal cleaning or light cleaning efforts do not remove the deposits, debris, foreign matter or obstructions, the Contractor, upon the County's approval, shall use heavy cleaning or specialty cleaning.

E. The equipment shall consist of a closed-circuit television system and a sealing packer device along with the necessary chemical sealant containers, pumps, controls, regulators, valves, hoses, etc. The sealing packer shall be so constructed that it can straddle 8-in or larger main sewer lines. When properly positioned and with the end elements inflated, an inflatable inversion sealing tube shall be extruded. The pumping unit, metering equipment, and the packer device shall be designed so that proportions and quantities of materials can be regulated in accordance with the type and size of the leak being sealed. Mainline packer and lateral bladder device shall be manufactured by American logiball, Inc. or equal.

3.2 PIPELINE SEALING BY INJECTION METHOD

A. The Contractor shall note the location of all leaking defects and joints to be grouted using the pre-CCTV footage.

B. The pipeline packer shall be positioned over the area of infiltration by means of a metering device at the surface and the closed-circuit television camera in the line. Accurate measurement of the location of the defect to be sealed shall be made, using a portion of the packer as a "Datum" of measurement point or target. Such measurement, target or point shall also be used to obtain necessary measurement for positioning injection area of packer over the area to be sealed.

C. The packer sleeves shall then be pneumatically expanded and shall seal against the inside periphery of the pipe to form a void area at the defect or joint now completely isolated from the remainder of the pipeline.

D. Into this isolated area sealant material shall be pumped through the hose system at controlled pressures which are in excess of groundwater pressures. The pumping, metering and packer shall be integrated so that proportions and quantities of materials and pressures for materials and sealing gel can be instantly monitored and regulated in accordance with the type and size of the leak, percentage of voids being filled, type of soil surrounding the pipe and the rate of flow of the sealing gel solution in relation to the back pressures.

E. Grout shall be pumped until the soil surrounding the leaking defect or joint is saturated or solidified. Grouting shall be stopped at refusal. Refusal shall be defined as the inability of the

leaking defect or joint to accept any further grout, due to the formation of a cohesive seal in the surrounding soil thereby preventing any further grout flow. Refusal shall be monitored by the Contractor during the grouting process. Any instantaneous increase of the packer's void pressure by 5 psi or more compared to the normal void pressure shall denote refusal. Refusal may also be observable when the pumping pressure exceeds the holding pressure of the packer end elements.

F. No defect/joint shall be considered sealed unless, while under continuous pressure, a minimum of 1/2 gallon per inch of pipe diameter has been applied, i.e., 4 gallons for 8-inch pipe. Additional application of grout shall be implemented only after County's approval.

G. Gel times shall not be less than 20 seconds unless approved by the Engineer. The Contractor shall keep records of the test pressure before and after sealing and the amount of sealing material used per joint. The quantity of sealing material used per joint shall be measured by counting the number of strokes of the grout pumps.

H. Upon completion of the injection, the television camera shall be moved to a position to observe and inspect the results of the injection. If inspection shows the seal was not completely effective, the process shall be repeated until all infiltration has been eliminated. Before final acceptance and payment for joint sealing is made, each joint sealed shall be re-tested. Should a joint fail to pass the test, it shall be re-sealed and re-tested until the test requirements can be met.

I. All residual sealing material that extends into the pipe, reduces the pipe diameter, or restricts flow in any way shall be removed from the pipe. The sealed joints shall be left flush with the existing pipe surface. If excessive residual sealing materials accommodate sewer line, and/or if directed by the Engineer, the Contractor shall clean the entire reach to remove all residual materials. After completion of grouting operations, all excess grout shall be flushed to the downstream manhole, removed and disposed.

J. Upon completion of grouting, the packer shall be deflated to allow for the gel ring formed around the void to break away. The grouted defect or joint shall then be air tested. If the air test fails, additional grouting shall be performed at no cost to the County. This process shall be repeated until the defect or joint passes the air test.

3.3 DISPOSAL

A. Furnish for collection of cleaning solvents used in the cleaning of the sealing equipment. Collected solvents shall be disposed of by an approved solvent recovery process. Disposal of cleaning solvents into the sewer system or into natural watercourses will be strictly prohibited.

3.4 FIELD TESTING AND ACCEPTANCE

A. Field acceptance of chemical sealing of the pipeline shall be based on the Engineer's evaluation of the appropriate installation and curing data along with review of the television inspections.

B. Groundwater infiltration of the chemical sealing shall be zero.

C. At the discretion of the Engineer, up to 2 sewer reaches that have been tested and sealed shall be randomly selected for retesting. If retesting reveals failure rate greater than 25 percent of the

original average sealing rate, then the Contractor shall provide written explanation of this occurrence. The Engineer reserves the right to continue retesting sewer reaches to determine if the initial selection was an isolated case. If the average failure rate for all retested sewer reaches is above 25 percent of the original sealing rate, then all sealing performed to date shall be repeated at no additional cost to the Owner.

D. If any defective chemical sealing is discovered after it has been installed, it shall be removed and replaced with sound chemical sealing in a satisfactory manner at no additional cost to the Owner.

END OF SECTION 331113.26

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SECTION 331210 - TEMPORARY BYPASS PUMPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Furnish all labor, materials, equipment, and incidentals required and install, field test, and operate temporary bypass pumping systems as proposed by the Contractor for the purpose of diverting sewer flow around work areas as required.

B. Design, installation and operation of temporary bypass pumping systems shall be the Contractor's responsibility. Provide services of a professional bypass company who can demonstrate to County and Engineer that the company specializes in design and operation of temporary bypass pumping systems. Bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction. A suggested bypass pumping approach is shown on the drawings for informational purposes only.

C. Provide redundant pumping systems at 100% of pumping capacity for all bypass pumps such that when an operating pump fails, pumping switches over automatically to the redundant pump. This automatic switching shall also initiate an alarm condition.

D. Maintain temporary bypass pumping systems so that they are completely functional throughout the required period of service.

E. Following the required period of service, remove temporary bypass pumping systems from site.

F. Provide all maintenance including manufacturer recommended preventive maintenance and on-call repair services. Provide repair services and/or replacement equipment 24 hours per day, seven days per week within 2 hours of being called.

G. Provide a refueling service to maintain continuous 24-hours per day, seven days per week pumping system operation.

H. Related Requirements:

1. Section 330130.72 “Cured-In-Place Pipe Lining.”

1.3 UNIT PRICES

A. Measurement: Measurement for temporary bypass pumping and associated piping shall be as listed in the Bid Form. Temporary bypass pumping and piping shall be in accordance with Contract document and shall include installation, operations, maintenance, and removal.

B. Payment: Payment shall be based on the type of bypass pumping, piping installation as detailed below:

1. Temporary Bypass Piping – Above Grade (Installation and removal): Price paid for all above grade temporary bypass piping installed from Spout Run Parkway to the terminal manhole at N Nash St. Payment shall be full compensation for labor, materials, equipment, tools, and incidentals required to install above grade temporary bypass piping, installing required appurtenances, installing surface anchors to restrain the pipe, operations and maintenance, safeguarding above grade pipe runs, providing safety barriers along the bypass route, draining the temporary bypass piping at the completion of bypass, dismantling the above grade temporary bypass piping upon completion, and performing associated site restoration to equal or better condition as the existing.
2. Temporary Bypass Piping – Spout Run Parkway (Installation and removal): Price paid for all buried temporary bypass piping installed on N Spout Run Parkway (Eastbound). Payment shall be full compensation for labor, materials, equipment, tools, and incidentals required to install buried temporary bypass piping, installing required appurtenances, all required excavation for installation and removal, all required re-paving upon installation and removal of the buried temporary bypass piping, operations and maintenance, draining the temporary bypass piping at the completion of bypass, dismantling the buried piping upon completion and performing associated site restoration to equal or better condition as the existing.
3. Temporary Bypass Piping – Buried Pipe Crossings: Price paid for all buried temporary bypass piping along County Streets, Roads and VDOT right of ways. Payment shall be full compensation for labor, materials, equipment, tools, and incidentals required to install buried temporary bypass piping (Ductile Iron), installing required appurtenances, access vaults, all required excavation activities for installation, all required re-paving upon installation, operations, maintenance, draining the bypass piping at the completion of bypass, plugging the ends of the buried piping, and performing associated site restoration to equal or better condition as the existing.
4. Temporary Bypass Pumping – Spout Run Parkway: Price paid for all temporary bypass pumps and appurtenances installed in the Spout Run Parkway area, on NPS property. Payment shall be full compensation for labor, materials, equipment, tools, and incidentals required to install bypass pumps, associated suction and discharge connections, adjustments to manholes to facilitate suction and discharge, bypass appurtenances which includes but is not limited to floats, auto-dialers, air release valves, flow control valves, check valves, silencers/mufflers, alarms, meters, plugs, hoses, etc; operations, maintenance, associated barricading, refueling, and servicing. Payment shall also include dismantling of the bypass equipment, bypass suction and discharge fittings, mains and features, removal of plugs, restoring all manholes used for bypass to existing or better conditions.
5. Temporary Bypass Pumping – Langston Blvd Eastbound: Price paid for all temporary bypass pumps and appurtenances installed all the Eastbound run of Langston Blvd as shown on the plans, on VDOT property. Payment shall be full compensation for labor, materials, equipment, tools, and incidentals required to install bypass pumps, associated suction and discharge connections, adjustments to manholes to facilitate suction and discharge, bypass piping, anchoring bypass piping, bypass appurtenances which includes but is not limited to floats, auto-dialers, air release valves, flow control valves, check valves, silencers/mufflers, alarms, meters, plugs, hoses, ramps, etc; operations, maintenance, associated pump and piping barricading, refueling, and servicing. Payment shall also include dismantling of the bypass equipment, bypass suction and discharge

fittings, mains and features, removal of plugs, restoring all manholes used for bypass to existing or better conditions.

6. Temporary Bypass Pumping – Langston Blvd Westbound: Price paid for all temporary bypass pumps and appurtenances installed all the Westbound run of Langston Blvd as shown on the plans, on VDOT property. Payment shall be full compensation for labor, materials, equipment, tools, and incidentals required to install bypass pumps, associated suction and discharge connections, adjustments to manholes to facilitate suction and discharge, associated paving work, bypass piping, anchoring bypass piping, bypass appurtenances which includes but is not limited to floats, auto-dialers, air release valves, flow control valves, check valves, silencers/mufflers, alarms, meters, plugs, hoses, etc; operations, maintenance, associated barricading, refueling, and servicing. Payment shall also include dismantling of the bypass equipment, bypass suction and discharge fittings, mains and features, removal of plugs, restoring all manholes used for bypass to existing or better conditions.

1.4 ACTION SUBMITTALS

A. Submit, in accordance with Section 01330, the following.

1. A detailed description of each proposed temporary bypass pumping system including pumps, pump drives, piping, hoses, valves, fittings, controls, wiring and any other related accessories required to provide a complete operating system in conformance with the requirements of this Section.
2. Detailed plans and sections showing the proposed pumping system layout including dimensions and elevations. Plan shall include but not be limited to the following:

    a. Staging area and access requirements for all pumps.
    b. Number, size, material, location, and method of installation of suction piping (including traffic/road ramps).
    c. Number, size, material, location, and method of installation of discharge piping (including traffic/road ramps).
    d. Pump size, capacity, number of units, diesel engine specifications, fuel tank capacity, fuel consumption requirements, and method of refueling.
    e. Calculations of static lift, pipe size selection, friction losses, flow velocity and pump selection.
    f. Pump curves showing pump operating range.
    g. Proposed method of freeze protection.
    h. Proposed method of noise control for each pump.
    i. Temporary pipe supports, anchorage, cover material and other accessories as required to stabilize the piping system.
    j. Installation schedule and maintenance schedule.
    k. Vendor phone number and pager number for 24-hour service.
    l. A minimum of five reference installations of projects with similar size in wastewater pumping applications. Include contact names and phone numbers.
    m. List of recommended spare parts to be stored on-site for emergency maintenance.

3. Provide information on the vendor's service staff capabilities and replacement parts inventory to show that the vendor has sufficient resources to provide emergency service and replacement equipment and/or parts to the site within 4 hours of a service call.

4. A description of system operation and controls. Include a list of all alarm conditions and procedures for correcting problems including equipment replacement.
5. A description and schedule for the proposed procedures for start-up and testing of the facilities to demonstrate compliance with specified automatic operation and maintenance of a constant discharge pressure.
6. A plan of operations for inclement weather including snowstorms. The plan shall demonstrate the ability to maintain pumping system operations throughout inclement weather events.
7. A description and schedule for the proposed procedures for dismantling the system and restoring normal operations.

1.5 QUALITY ASSURANCE

A. Employ the services of a vendor who can demonstrate five years of recent and continuous specialization in the design, installation, operation, and removal of temporary bypass pumping systems in wastewater applications. The complete system shall be furnished from a single vendor who shall be capable of providing service staff, repair parts and replacement of any deficient system component within four hours of a service call, 24-hours per day, seven days per week.

B. Provide the services of the manufacturer's representative for physical checkout field testing and operation and maintenance instruction for a minimum of one person day per pumping system. See requirements in PART 3.

C. Provide the services of the manufacturer's representative or designated alternative, who shall be contactable 24-hours per day via telephone or pager and shall be available to be on site within four hours of being contacted at no additional cost to the County.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Primary Bypass, Area 1 – Spout Run Parkway (NPS):

1. Pump Installation: Dry Pit
2. Pump Location: As shown on Plans
3. Pump Power Source: Diesel/Electric
4. Pump Suction: Special Installation in MH by Contractor

B. Primary Bypass, Area 2 – Spout Run Parkway (NPS)

1. Pump Installation: Dry Pit/Wet Pit
2. Pump Location: As shown on Plans
3. Pump Power Source: Diesel/Electric
4. Pump Suction: Submersible wet pit/suction piping

C. Secondary Bypass, Area 3 – Langston Blvd Westbound

1. Pump Installation: Wet Pit

2. Pump Location: In Manhole as shown on Plans
3. Pump Power Source: Diesel/Electric
4. Pump Suction: Submersible wet pit

D. Secondary Bypass, Area 4 – Langston Blvd Eastbound

1. Pump Installation: Dry Pit
2. Pump Location: In Sidewalk, as shown on Plans
3. Pump Power Source: Diesel/Electric
4. Pump Suction: Suction piping

E. Furnish pumping units and all accessories from a single vendor. Each temporary bypass pumping system shall be complete including pumps, drives, piping, piping headers, valves, flow meter, level switches, controls, emergency auto-dialer, and appurtenances as required for a complete system.

F. The pumps shall be capable of handling solids, debris, fibrous material, stringy material, and other elements normally founds in sanitary sewer flows.

G. Pumps, drives, and controls shall be designed and built for 24-hour continuous service at any and all points within the required range of operation, without overheating, without cavitation, and without excessive vibration or strain. Parts shall be so designed and proportioned as to have the strength, stability, stiffness, and be constructed to meet the specified requirements. Methods shall be provided for inspection, repairs, and adjustment.

H. Necessary foundation bolts, nuts, and washers shall be furnished.

I. Each piece of equipment shall be furnished with a nameplate (with embossed data) securely mounted to the body of the equipment. As a minimum, the nameplate for the pumps shall include the manufacturer's name and model number, serial number, rated flow capacity, head, speed and all other pertinent data. As a minimum, nameplates for drives shall include the manufacturer's name and model number, serial number, horsepower, speed, input voltage, amps, number of cycles and power and service factors.

J. Noise shall not exceed the County’s ordinances or standards.

K. Equipment shall be suitable for outdoor operation under adverse weather conditions. Provide protection from freezing as required to maintain system operation.

L. Pumping system control panels shall be NEMA 4 and include flow indication, a flow totalizer, indicator lamps showing which pumps are operating, selector switch for auto or manual start and stop for each pump and visual and audible alarms for indication of operation failure and alarm conditions, and an auto-dialer to call preset numbers in case of emergencies. The auto-dialer shall call the Contractor’s superintendent and the bypass contractor’s operator when certain emergency conditions are met.

2.2 PERFORMANCE REQUIREMENTS

A. Capacities and Characteristics:

1. Pumps shall be identical in every respect with all parts interchangeable.
2. Each pump shall be designed for conditions of service. Pumps shall have a rising head capacity curve for stable pump operation from minimum head operating point to shut-off head.

    a. Service: Temporary Bypass Pumping.
    b. Number of Pumps: As required by the Application.
    c. Liquid: Raw wastewater.
    d. Estimated Capacity Total Peak (gpm):

        1) Estimated Flow entering MH 750 = 7.2 mgd
        2) Estimated Flow entering MH 742 from North (Langston Blvd West Bound) = 0.8 mgd
        3) Estimated Flow entering MH 742 from South (Langston Blvd East Bound) = 1.7 mgd

    e. Type of Drive: Diesel engine or electric.

3. Pumping System Components:

    a. Pumps shall be centrifugal, end suction, fully automatic self-priming units that do not require the use of foot-valves, vacuum pumps, diaphragm pumps, or isolation valves or float apparatus in the priming system.
    b. Submersible pumps shall be capable of being installed inside existing manholes. Submersible pumps and associated discharge piping used on this project shall be fully contained within the manhole. Submersible pump end connections shall be flanged, ASME B16.1, Class 125. Submersible pump impeller selection shall be suited for sanitary sewer application.
    c. Pump seals shall be high pressure, mechanical self-adjusting type with solid carbide faces capable of withstanding suction pressures to 100 psi without the pump running. Mechanical seal shall be cooled and lubricated in an oil bath reservoir, requiring no maintenance or adjustment. The oil bath reservoir shall not come in contact with or leak into the pumped water. Each pump shall be capable of running dry, with no damage for extended periods of time. All pump seal metal parts shall be stainless steel. All elastomers shall be Viton.
    d. Each pump shall be driven by a diesel engine or electric motor. Diesel engine shall be water cooled. If the Contractor uses electric motor driven pumps, power costs are the responsibility of the Contractor.
    e. If using diesel driven pumps, each pump and diesel engine shall be skid mounted with integral fuel tank and skid lifting bracket.
    f. Provide automatic start/stop controls for the pumping system to automatically maintain system flow. Controls shall be contained in a local control panel with provision to manually operate each pump, provide indication of pump operation, and indicate the total flow being pumped.
    g. Provide all required suction and discharge pipe and fittings, discharge manifold pipe and fittings, shutoff valves, check valves, flow meter, pressure regulating valves, insulation, freeze protection, and all required accessories. All pipe and fittings shall be steel with flanged or quick connect coupling connections, or high-density polyethylene pipe with fused joints. All joints must be 100 percent restrained. Suction piping shall be rated for 25-inch Hg vacuum. Discharge piping, fittings,

connections, valves, and other discharge piping accessories shall be rated for a minimum working pressure of 150 psi.

h. Provide an auto-dialer on each pump.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the system supplier's recommendations and approved shop drawing submittals.

B. Install pumping units on a firm level surface.

3.2 FIELD QUALITY CONTROL

A. Provide field test plan in accordance with the approved shop drawing submittal. Field tests shall demonstrate conformance with system requirements.

B. Conduct field testing by the pump system supplier's representative in the presence of the Engineer. Furnish the services of the pump system supplier's representative for a minimum of one day per temporary bypass system to conduct required testing.

C. Field testing shall demonstrate a minimum of 24-hours of continuous operation. During the 24-hours of continuous operation, the system shall demonstrate the ability to automatically start and stop pumps in response to changing flow conditions, place a call to the preset numbers when certain emergency conditions are met.

D. Remove and replace any system component that fails to perform in accordance with specified requirements.

3.3 SYSTEM OPERATION

A. Perform all required maintenance on the equipment to maintain the system integrity and capacity as specified.

B. Provide clean-up and disposal of contaminated material and reporting for all product spills.

3.4 EQUIPMENT REMOVAL

A. At the completion of the period of service, disconnect all temporary piping and remove all system components from the site. Restore the work site to its original condition.

END OF SECTION 331210

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