



Date: October 5th, 2017
To: Interested Bidders
From: Greg Johnson
Subject: **ADDENDUM #1** for CIPP Relining of Sewer Mains

Attached is Addendum No. 1 for the City of Burlington, Cured-In-Place-Pipe Relining of Sewer Mains Bid Documents, dated 9/29/2017.

This Addendum No. 1 forms a part of the Contract Documents and modifies the original Invitation for Bid.

Acknowledge receipt of this Addendum in the space provided on the Bid Sheet. Failure to do so may subject the Bidder to disqualification. Please incorporate this information into your Contract Documents as appropriate.

If you have any questions, please feel free to contact me at gjohnson@burlingtonvt.gov or (802) 233-0263.

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**City of Burlington
CIPP Relining of Sewer Mains
ADDENDUM NO. 1**

CLARIFICATIONS / ADDITIONAL INFORMATION

1. Replace the following note below the Bid Form:

*“BIDDER hereby agrees to commence WORK under this contract on the date of issuance of the NOTICE TO PROCEED and to fully complete the PROJECT within **90 consecutive calendar** days thereafter. BIDDER further agrees to pay as liquidated damages, the sum of \$ 200 for each consecutive calendar day thereafter as provided in Section 4 of the General Conditions.”*

With

*“BIDDER hereby agrees to commence WORK under this contract on the date of issuance of the NOTICE TO PROCEED and to fully complete the PROJECT by **May 1st, 2018**. BIDDER further agrees to pay as liquidated damages, the sum of \$ 200 for each consecutive calendar day thereafter as provided in Section 4 of the General Conditions.”*

2. Add the following specifications under DIVISION 1 – GENERAL REQUIREMENTS:

**SECTION 01570
TRAFFIC REGULATIONS**

1. GENERAL

1.1 DESCRIPTION

- A. Work under this section shall include all operations necessary to maintain traffic flow, both vehicular and pedestrian on all roads affected by work done under this Contract, and to maintain access to all properties adjacent to the work. This work shall include, but not be limited to use of uniformed traffic control and flaggers, furnishing, erecting, moving, and dismantling barricades, signs, and temporary lighting to inform the general public of hazards existing near the site of the work.
- B. Work under this section shall also include prevention of slippery surface conditions resulting directly from the Contractor's operations. As part of this section, the Contractor shall also facilitate the passage of school buses and provide safe access to all school bus stops, and notify the School Superintendent or his authorized agent at least 72 hours in advance where he intends to work and the location of all detours.

1.2 UNIFORMED TRAFFIC CONTROL (IF APPLICABLE)

- A. Uniformed traffic control shall mean uniformed law enforcement personnel hired by the Contractor to control traffic along State highways only. The cost of uniformed traffic

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control officers shall be paid under Pay Item, Uniformed Traffic Control.

- B. Uniformed traffic control shall be acceptably attired in uniforms, headgear, and exposed badges that will readily distinguish them from all other employees and shall present a neat appearance to the traveling public at all times. Uniformed traffic control shall include transportation with appropriate emergency lights and equipment.

1.3 FLAGGERS (IF APPLICABLE)

- A. Flaggers shall be used by the Contractor to control traffic in all areas of the Project as necessary.
- B. Flaggers are personnel hired and paid by the Contractor. Flaggers may or may not be uniformed traffic control officers. Cost for flaggers shall not be paid under a separate pay item but shall be included under other pay items. These flaggers may work in conjunction with uniformed traffic control personnel along State highways.
- C. Flaggers or UTO serving as a trained flagger shall wear safety apparel meeting requirements of ISEA "American National Standard of High-Visibility Apparel" and labeled as meeting the ANSI 107-1999 standard performance for Class 2 risk exposure. Individuals engaged in traffic control shall wear the high-visibility vest with "TRAFFIC CONTROL" visible, without exception so that they are readily distinguished by the traveling public as a person in charge of directing traffic. Acceptable clothing shall include approved headgear and blaze orange vests with reflective stripes.

1.4 GENERAL RESPONSIBILITY

- A. The employment of uniformed traffic control officers or flaggers shall in no way relieve the Contractor of any responsibility or liability under the terms of the Contract.

1.5 QUALITY ASSURANCE

- A. Work under this section shall be carried out in accordance with Section 630 of the Standard Specifications for Construction, Vermont Agency of Transportation (latest edition) and Manual on Uniformed Traffic Control Devices.
- B. Uniformed traffic officers and flaggers shall be trained in traffic control by their employer. All Contractors and Subcontractors providing traffic control personnel to a project shall have an employee certified to train traffic control personnel. All traffic control personnel on a project shall have completed the course in traffic control given by the certified employee representing the specific Contractor or subcontractor providing traffic control personnel for that project.
- C. Certification to train traffic control personnel may be obtained by completing one of the following courses.
 1. Vermont Agency of Transportation Flagger Training Course.
 2. Associated General Contractors of New Hampshire Flagger Certification course; or
 3. By obtaining certification from the American Traffic Safety Services Association as a Worksite Traffic Supervisor.

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2. PRODUCTS

2.1 SIGNS

- A. Road construction approach signs shall be built, erected, and located in accordance with Vermont Agency of Transportation Standard Drawing E-8 and E-9.
- B. Hand held signs shall be a 18" flagman's paddle with a rigid handle. The STOP face shall have white letters and a white border outlining an octagonal red background. The SLOW face shall have black letters and a black border outlining a diamond-shaped orange background. Red, white, and orange areas shall be reflectorized. Lettering shall be 6" Series C letters per Vermont Agency of Transportation's Standard Specifications for Construction, and Manual on Uniformed Traffic Control Devices.

3. EXECUTION

3.1 GENERAL

- A. See Contract Drawing No. 20, Traffic Control Plan, for requirements for signage and traffic control.

3.2 TRAFFIC CONTROL PERSONNEL RESPONSIBILITY

- A. Traffic control personnel shall direct traffic in accordance with subsection entitled Responsibility for Use of Flaggers, Section 107.09, Vermont Agency of Transportation Standard Specifications for Construction and/or these Specifications and Manual on Uniformed Traffic Control Devices.
- B. If the traveling public should stop to ask questions, uniformed traffic control personnel or flaggers shall answer them concisely in a courteous manner, but shall remain alert to their duties.
- C. Please note that the UTO, under authority granted by law (Title 23 VSA) may direct and control traffic. Suitable examples in work zones might include the direction and control of traffic at intersections where signals are not functioning or are malfunctioning. In these cases, the presence of the blue light may not be suitable or necessary. The wearing of departmentally required and approved reflective garments is required.
- D. Flaggers are allowed to stop and release traffic as indicated in the latest MUTCD, Section 6E.04 Flagger Procedures.

3.3 TWO-WAY RADIO COMMUNICATION

- A. Traffic control personnel shall use two-way radio communication at all times when two (2) traffic control personnel are used.

END OF SECTION

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3. Add the following specifications for (UV Cured) Cured-In-Place-Pipe as part of DIVISION 2 - SITEWORK

SECTION 02307
Ultraviolet Cured-In-Place Pipe for Sewer Mains

PART 1 - GENERAL

1.01 scope of work

- A. The Work specified in this Section includes furnishing all labor, supervision, equipment, appliances and materials and performing all operations including cleaning; removal and disposal of debris; bypass pumping; pre- and post-construction television inspection (NASSCO PACP standards); performing sample testing; lining existing sanitary sewer lines; installing end seals; reconnecting active building connections and installing UV cured top hats at laterals damaged during the reconnection process; removing protruding taps by remote methods; stopping active leaks that might interfere with the integrity of the liner to be installed; providing water; complete and accepted, in accordance with the contract documents
- B. The completed liner and top hat liner will form a continuous, tight fitting, corrosion resistant and verifiable non-leaking cured in place pipe.
- C. Information relative to structures, numbers, pipe sizes, pipe material and pipe lengths have been shown on the Contract Drawings
- D. Service lateral connections may be a combination of tees, wyes, or break-in taps with varying sizes and angles ranging from 30 to 90 degrees.
- E. Removal and replacement of fences, repair to yards, lawns, sidewalks, driveways, and other public or private property, due to action or processes related to the work being performed shall be included in the cost of the Work.
- ~~F. The Contractor shall comply with the Owners Water Usage Procedure as outlined in Section 01046, paragraph 1.12~~
- G. All manholes shall be considered Permit Required Confined Spaces, in accordance with OSHA standard 29 CFR 1910.146.
- H. The Contractor is required to perform television inspection (CCTV) prior to construction to verify the following.

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1. Conditional Assessment to NASSCO PACP standards, identifying areas that will require open excavation to allow for lining.
 2. Center Line of each lateral inlet and rotational direction (e.g. 135.23 ft @ 9 O'clock)
- I. The Contractor is required to perform television inspection whilst the liner is fully inflated and pressed against the host pipe during the curing process
1. The Contractor shall be able to stop the curing process to remove any defect found in the uncured liner. Defects found in fully cured liner shall be cut out and replaced at no cost to the District.
- J. The Contractor is further required to perform a CCTV Inspection one (1) year after substantial completion. If the contractor were to perform the CCTV Inspection at, shortly after or significantly after the one (1) year mark, the contractor will still be held liable for any defects that are discovered. Retainage will be held in accordance with the Agreement until the CCTV has been completed, submitted.

1.02 Related Work

- A. Section 01010, Summary of Work
- B. Section 01740, Guarantees
- C. Section 01570, Traffic Regulations

1.03 Submittals

- A. Shop drawings, a list of materials and technical data shall be submitted to the Owner for approval prior to any work being performed under this Section of the Specifications.
- B. The Contractor shall submit to the Owner, in writing, the information below prior to or at the time indicated. Failure to do so will prevent progression of the work to the next step.
- C. The Contractor is required to submit the following
 1. Shop drawings which detail short and long term properties (providing all supporting test data) of all component materials and construction including the CIPP liner, end seals, UV cured top hats, etc.
 2. Recommendations for material storage, CIPP liner handling, insertion, curing, trimming and finishing.
 3. Structural Calculations for each CIPP and top hat liner size, recommended thickness

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4. Methods and equipment used to reinstate connection sewers, lateral pipes or manholes.
 5. CCTV Inspection reports and all measurements to internal connections that require reestablishment (locations for reconnection of active services).
 6. Manufactures recommended installation procedure
 7. Documentation confirming material meets ASTM F2019
 8. Independent test results of CIPP samples taken
 9. Warrantee information
 10. MSDS for all hazardous chemicals used or anticipated to be onsite.
 11. Manufacturers resin data test results
 12. Experience record of contractor performing the work
 13. Bypass pumping plan and emergency action plan
 14. Curing log showing temperature, pressure, and time
 15. CIPP Repair methods
 16. Physical samples
- D. If pre-installation and post-installation inspections are combined onto one hard copy, submit copy after completion of each section lined per the schedule above described. Request may be made to include more than one segment to a hard copy in order to maximize use
- E. Sample removed for testing will be individually labeled and logged to record the following
1. Owner's project number and name
 2. Sample number
 3. Segment number of line as noted on plans
 4. Thickness of liner and resin
 5. Date and time of sample
 6. Name of Contractor or Subcontractor performing the work
 7. Date, location and name of testing company
 8. Results of test certified by tester
- F. Samples shall be taken once (1) every run or at the Owner's request and numbered as follows:
1. Sample #/A : Resin Sample
 2. Sample #/B : upstream thickness test
 3. Sample #/C : downstream thickness test
 4. Additional samples will be lettered consecutively after C.
 5. Updated copies of the log shall be submitted to the Owner after each Crew-day is completed
- G. Reports shall be submitted on 8-1/2 X 11 paper, larger drawings shall be folded to this format. Submittals shall be stamped by the Contractor to indicate,

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Contractor, Date of Submittal, Owners project title and number, applicable Section of Specification to be referenced, and shall be signed by preparer.

- H. CCTV videos shall be submitted in a clear snap-top plastic protective box, labeled on DVD and protective box to indicate:
 - 1. Owner's Project Name
 - 2. Owner's Project Number
 - 3. Date of video inspection
 - 4. Segment number of line
 - 5. Contractor's name
 - 6. Inspection being done (pre-inspection, curing inspection, post inspection)
- I. Within fourteen (14) days of any planned bypass, the Contractor shall submit a bypass plan for any proposed bypass or dewatering activity.

1.04 *references*

- A. The following standards based on the latest edition form a part of this Specification as referenced.
 - 1. ASSHTO Standard Specification for Highway Bridges
 - 2. ASTM D543 – Practices for Evaluating the Resistance of Plastics to Chemical Reagents
 - 3. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
 - 4. D3567 Practice for Determining Dimensions of "Fiberglass" (Glass Fiber Reinforced Thermosetting Resin) Pipe and Fittings
 - 5. ASTM F1216 Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
 - 6. ASTM D2990 - Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics
 - 7. NASSCO Standards
 - 8. Whenever reference is made to "Form 816" in these Specifications, it shall refer to "State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges, and Incidental Construction, Form 816" and its latest supplements and revisions.
 - 9. WRc Sewerage Rehabilitation Manual, Type II Design, 4th Edition, 2001

1.05 *QUALITY ASSURANCE*

- A. **CONTRACTOR EXPERIENCE AND LINER SYSTEM APPROVAL**

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1. The Contractor shall have successfully managed and completed UV cured-in place pipe (CIPP) rehabilitation projects on lines sizes defined in the Contract Documents in the United States and its territories within the last five (5) years previous to bid date.
2. The Superintendent in Charge of the installation shall have a minimum of five (5) years' experience prior to bid date overseeing the installation of UV CIPP sewer liners in the United States and its territories. Jointly the Contractor and Superintendent in Charge shall have successfully installed 50,000 linear feet (9 miles) of sewer liner in the United State and its territories prior to the bid date. Should the Superintendent in Charge be replaced during the Contract for any reason, the new Superintendent in Charge shall have experience equal to or greater than the original, the new Superintendent in Charge shall be subject to Owner approval in advance.
3. Liner design calculation shall be stamped by a Registered Professional Engineer licensed by the State of Connecticut. Design calculations shall be submitted in accordance with subsection 1.03 above.
4. Lateral repair products must have a minimum of 100 UV cured top hat liner installations in wastewater collection system in the US.

B. PRODUCT QUALITY ASSURANCE

1. All sampling and testing shall be done by an independent testing agency submitted on by the Contractor and approved by the District. The testing lab shall be listed in the ASTM International Directory of Testing Laboratories, or have documented compliance with Section 01451, "Independent Testing Services".
2. CIPP and Top Hat liners shall be provided by a single manufacturer. The supplier shall be responsible for the provision of all test requirements specified herein as applicable. In addition, all liners or top hats to be installed under this Contract may be inspected at the plant for compliance with this Section by an independent testing laboratory provided by the Owner, at the Contractor's expense. The Contractor shall require the manufacturer's cooperation in these inspections.
3. The contractor shall prepare samples of the installed CIPP liner and UV cured top hat liners for subsequent testing of its physical properties.
 - a. *Contractor shall cut two (2) samples of uncured liner from each run, one from the upstream side and another from the downstream side, of the liner being installed. Insert one section of light train in the restraint system above ground and cure the liner under similar conditions as those of the liner installed in the ground. The sample shall be identified as described in subsections 1.03-E and 1.03-F above. The contractor shall split the sample with the Owner. The owners sample shall also be labeled as describe in previous sections above.*

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- b. UV cured top hat liner samples shall be prepared so as to simulate installation methods and trauma of the product.*

C. SAMPLE TESTING

1. The cured sample shall be tested by an independent testing laboratory in accordance with Section 01451. All samples shall have chain of custody documentation to the testing lab. No payment shall be made until the results of the test have been received and confirmed to meet the required standard. Failure to meet the specified physical properties shall be considered defective work and shall be replaced at no cost to the District.
2. The contractor shall be responsible for all costs associated with the testing of the liner physical properties and composition.
3. The cured sample shall be subject to the following independent tests:
 - a. *Short-term Flexural (Bending) Properties - The initial tangent flexural modulus of elasticity and flexural yield strength measured in accordance with ISO 178 and wall thickness in accordance with DIN EN 13566-4.*
 - b. *Wall thickness shall be measured in accordance with DIN EN 13566-4. The average thickness shall be calculated using all measured values and shall meet or exceed the minimum design thickness approved by the Owner. The minimum wall thickness at any point shall be within 87.5% of the average wall thickness specified.*

D. MATERIAL HANDLING

1. Contractor shall exercise adequate care during transportation, handling and installation to ensure that the CIPP material is not torn, cut or otherwise damaged. If any part or parts of the CIPP material becomes torn, cut or damaged before or during the curing process, the contractor shall repair or replace the damages section in accordance with the manufactures recommendations and approved by the Owner.
2. Any product sensitive to Ultra-violet light shall be stored in a dark area free from Ultra-Violet radiation sources including but not limited to, sunlight, electrical arcing (arc welding), mercury-vapor lamps and black lights.

E. WARRANTY

1. The liner and top hat liner shall be guaranteed against excessive infiltration, failure caused by static loading and live loading as determined

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- by ASSHTO H-20 from a period of one (1) year or until such time that the one year maintenance inspection is completed and accepted.
2. The liner and top hat liner shall be guaranteed against failure resulting from defective materials and/or defective workmanship for a period of one (1) year or until such time that the one year maintenance inspection is completed and accepted.

1.06 PUBLIC NOTIFICATION

- A. All property owners shall receive notification that their sewer service will be interrupted during the CCTV inspection and liner installation. The property owners shall also be notified that the interruption has ended. The Contractor shall distribute all written notices to each affected property owner at the following times:
 1. Seven (7) days prior to lining activities
 2. Between Twenty-Four (24) and Forty-Eight (48) hours prior to lining activities
 3. Within Twenty-Four (24) hours after completion of lining activities
 4. Within One (1) hour from when the lateral pipe has been reestablished and open to the Main Line Sewer
- B. The Owner will provide copies of all public notifications for distribution by the Contractor.
- C. Each notice shall include the date, start time and estimated time when service will be completely restored. The Contractor shall provide a telephone number for property owners to call for information regarding the work.
- D. The Contractor shall contact any homeowner or business that cannot be activated within the time stated in the written notice.
- E. The maximum amount of time any home or business shall be without sanitary sewer service is eight (8) hours. Any home or business that is without sanitary service for longer than eight (8) hours will be bypassed to the sanitary sewer at no additional cost to the Owner.
- F. Contractor's schedule is subject to approval based on critical stakeholders and at no additional cost to the Owner.

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- G. The Contractor and appropriate subcontractors shall attend community outreach meetings scheduled by the Owner as necessary.

PART 2 - PRODUCTS

2.01 *GENERAL*

- A. The CIPP lining shall be a resin-impregnated fiberglass flexible tube which is inserted into the sewer to be rehabilitated and cured-in-place by an acceptable UV curing method. The tube may have a suitable polyurethane membrane coating for protection of the interior surface and to provide a uniform, smooth flow surface and may be removed after installation and curing is completed. The resin shall be a liquid UV curable resin and shall be suitable for the design conditions as well as the curing process.
- B. All material and installation procedures provided by the Contractor for use in the CIPP installation shall be equal to or exceed the requirements of ASTM F2019.
- C. Wrinkles in the finished liner which reduce the hydraulic capacity of the pipe are unacceptable and shall be removed or repaired by the contractor at no cost to the Owner.
- D. Contractor shall be responsible for control of all material and process variables to provide a finished CIPP installation with the minimum properties specified in ASTM F2019.

2.02 *TELEVISION INSPECTION*

- A. The mobile unit and video equipment shall be defined as in Section 02764, "Television Inspection".
- B. The final DVD shall be in a format playable by Windows Media Player.

2.03 *CHEMICAL RESISTANCE*

- A. Domestic Sewage: The chemical resistance test should be completed in accordance with ASTM Test Method D543. Exposure should be for a minimum of one month at 86 degrees Fahrenheit. No more than twenty (20%) percent loss of

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initial flexure strength and flexure modulus shall result when subject to the following solutions:

Chemical Solution	Concentration percent
Tap Water (pH 6-9) H ₂ O	100%
Nitric Acid	5%
Phosphoric Acid	10%
Sulfuric Acid	10%
Gasoline	100%
Vegetable Oil	100%
Detergent	0.1%
Soap	0.1%

- B. All test results shall be certified by an approved testing laboratory in accordance with Section 01451, "Independent Testing Services"

2.04 COMPONENT PROPERTIES

A. Flexible Tube

1. The tube shall consist of one or more layers of fiberglass laminate that meets the requirements of ASTM F2019
2. Tubing material shall be free from tears, holes, cuts, foreign materials and other surface defects.
3. The wall color of the interior pipe surface of CIPPL after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.

B. Resin

1. The liquid UV curable resin shall saturate the tube and produce a properly cured liner which is resistant to abrasion due to solids, grit, and sand.
2. Polyester, vinyl ester, or epoxy resin and catalyst system shall comply with the following requirements and that when properly cured meets the requirements of ASTM F1216. Resins created from recycled materials are not allowed.

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C. Top Hat (if specified)

1. The product shall be a fiberglass laminate impregnated with an UV-light reactive Polyester resin which when cured is chemically resistant to domestic sewage over the expected life time of the rehabilitated pipe.
2. The product shall be compatible with the lining system utilized for the main and/or lateral sewer lines.
3. The flexible fiberglass top hat tube insert shall be fabricated to a size that when installed will key into the internal surface irregularities of the lateral joint and neatly fit tight to the internal circumference of the lateral. The top hat tube shall be a laminate made of non-woven fiberglass materials that allow for circumferential stretching and angular alignment with the lateral pipe connection geometry during insertion.
4. The insert laminate shall seal to the inside wall of the sewer main 3 inches around the lateral opening.
5. Top hats shall extend no less than twelve (12) inches and no greater than twenty (20) inches into the lateral.

D. Hydrophilic Seals

1. The end seals shall be composed of hydrophilic rubber and molded as a one-piece cylinder with a minimum width of three (3) inches. When installed, the end seal shall form a 360 degree seal between the host pipe and the newly installed liner.
2. Hydrophilic end seals shall be Insignia End Seals by SewerSeal Technologies, 7740 Reinhold Drive Suite C, Cincinnati, Ohio 45237, 515-641-0999, or approved equal.
3. The materials utilized for the hydrophilic end seal shall be as recommended by the manufacturer and shall be provided in kits that are designed to accommodate varying pipe diameters, manhole depths, junction configurations, and pipe liner products. The hydrophilic end seal kits shall be compatible with ultra violet curing methods. The components of the hydrophilic end seal kits shall include a tubular sleeve, and a mechanical fastener.
4. The use of caulking, rope or a band type end seal will not be allowed.

2.05 *FINISHED AND CURED CIPP LINER and TOP Hat PROPERTIES*

- A. The physical properties of the cured CIPP shall have a minimum initial test values as given in Table 1 of ASTM F2019, supplemented below, for polyester, vinyl ester and epoxy resins.

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Test Property	Test Value	Test Method
Flexural Strength	20,000 psi	ASTM D790
Flexural Modulus	1,000,000 psi	ASTM D790
Tensile Strength	20,000 psi	ASTM D3039

- A. The physical properties of the cured Top Hat Liner shall have a minimum initial test values as given in Table 1 of ASTM D790, supplemented below, for polyester, vinyl ester and epoxy resins.

Test Property	Test Value	Test Method
Flexural Modulus	800,000 psi	ASTM D790

2.06 *DESIGN CRITERIA*

- A. The liner and top hat liner shall be designed in accordance with the standards set forth in ASTM F2019, Appendix XI and these specifications.
- B. All material properties used in design calculations shall be long-term values. Contractor shall familiarize himself with site conditions when preparing liner and top hat design.
- C. Contractor shall calculate the required minimum thickness for each pipe and lateral based on the pipeline condition, actual level of deterioration may vary within any given section of sewer.
- D. Contractor shall supply all assumed values and calculations for the design including but not limited to:
1. Modulus of Soil reaction
 2. Unit weight of soil
 3. Minimum ovality for straight runs
 4. Traffic loads
 5. Groundwater

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- 6. Allowance for flood elevation
- 7. Safety Factors

- E. External Buckling Design: Where the CIPP is designed as a standalone pipe, a fully deteriorated condition, the Contractor shall furnish to the Owner, third party testing and verification of design analysis techniques for each manufacturer or CIPP product.
- F. The bond between CIPP and top hat Layers shall be strong and uniform. All layers after cure must form one homogenous structure pipe wall.
- G. The following design parameters shall be used and not devalued

Parameter	CIPP System
Pipe Condition	Fully deteriorated
Design Life	50 years
Soil Type	Saturated
Design Thickness	The needed output product thickness, at a minimum, to meet the design thickness
Groundwater Depth	Ground surface level
Ovality of Pipe	2% of circumference minimum
Soil loads	130 pcf
Traffic Loads	AASHTO H-20 live load with two trucks passing and applicable construction loads as required by the Contractor's means and methods
k Enhancement Factor	7
Modulus of Soil	Max 1000 psi
Poisson's ratio	0.3
Long Term Flexural Strength	50% of initial ASTM D-790
Long Term Young's Modulus (e)	50% of initial ASTM D-790
Max Deflection (vertical axis)	7.5%
Min F.S	2.0

- H. Liner thickness for the Work specified, will be calculated by the Contractor for each specific line segment shown in the Contract Drawings. The Contractor shall verify the depth of cover for all line segments shown as part of the CIPP and top hat design. Contractor's design shall be based on the depth of cover for each pipe segment.

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- I. Pre-liner Requirements: The outer foil shall be suitable to control resin loss and liner thickness in heavily infiltrated areas and areas subject to void space. Any damage or defects resulting from a loss of resin or a reduction in CIPP wall thickness shall be repaired at the Owners discretion at no cost to the Owner.

PART 3 – EXECUTION

3.01 *GENERAL*

- A. Work performed under this Specification shall be done in accordance with Municipal, State and Federal Standards. Traffic control and safety is the responsibility of the Contractor.
- B. All equipment, materials, labor and processes required to complete the work must be ready on-site before installation begins.

3.02 *TIME OF OPERATION*

- A. It is suggested that the Contractor schedule his/her operations to coincide with low flow levels in the existing pipe (if any). It will be necessary for the Contractor to determine the optimal time period for scheduling the work. It is the responsibility of the Contractor to inspect the site and determine site conditions.

3.03 *DEWATERING*

- A. It is the Contractors responsibility to dewater the sewer and maintain existing sewerage flows at all times. A plan for dewatering must be submitted to the Engineer and the Owner for review and approval prior to commencement of any work.
- B. The Contractor shall be responsible to maintain the existing flows at all times in an acceptable manner as not to create a nuisance of or in any way endanger the adjoining properties, utilities, or environment.
- C. By-passing sanitary sewer flows to a storm sewer or other watercourse is not allowed at any time.

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- D. The Owner assumes no liability to the Contractor for any delay, cancellation, loss of expense to which he/she may become subject, directly or indirectly, due to normal or heavy flows in the existing sewer.

3.04 TV INSPECTION AND CLEANING

- A. The pipe to be lined must be clean and televised per industry standards.
- B. The pipe to be lined shall be cleaned such that no debris or obstructions remain and the pipe is free of all debris and obstruction that negatively affect the flow of wastewater through these pipes. Sanitary pipes not free of debris or obstructions may be removed from the work by the Engineer. The Engineer reserves the right to require additional cleaning of pipes to be lined to remove debris or obstruction at time of liner installation. Additional cleaning will be at no cost to the Owner.
- C. An experienced person trained in locating breaks, obstacles and service connections by visual inspection shall perform the inspection of sewer mains. The interior of the sewer shall be carefully inspected to determine the locations of conditions which may prevent proper installation of CIPP. Contractor shall furnish television report and DVD to the Owner as required.
- D. The Contractor shall measure the actual inside diameter at different location of the sewer to determine the appropriate size of CIPP liner to use.
- E. Prior to lateral rehabilitation activities, the area around the lateral sealing surface in both the main and lateral shall be inspected. Waste product build-up, hard scale, roots, lateral cutting debris or resin slugs must be removed using high pressure water jetting or in-line cutters. Clean each service lateral to be lined and dispose of any resulting material as specified in Section 02764. The term "cleaned" shall mean the removal of all sand, dirt, roots, grease, and all other solids or semisolid materials from the entire interior of the sewer lines.

3.05 LINE OBSTRUCTIONS

- A. It shall be the responsibility of the Contractor to clean the line of all line obstructions such as solids, dropped joints, protruding taps or collapsed pipe that will prevent the installation of the liner. As a general guide, a 10% reduction in the pipe area should be considered for repair or removal. It is the intent of this Contract that all such reductions have been removed under previous Contracts. If inspection reveals an obstruction that cannot be removed by conventional sewer

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cleaning equipment or internal cutting, then the contractor shall inform the Owner that a Point repair is needed to uncover and remove or repair the obstruction.

3.06 HYDROPHILIC END SEALS

- A. Access to the manhole interior using conventional methods shall be necessary to measure the pipe interior at the manhole prior to installation of the hydrophilic end seal. The pipe interior shall be measured from 6:00 to 12:00 and from 3:00 to 9:00, with the mean determining the normal pipe diameter.
- B. After the mainline and ends of pipe have been accessed; cleaned and inspected the hydrophilic end seal product shall be placed inside the end of pipe to be rehabilitated. The mechanical fastener is placed into a conformation such that the outer profile of the mechanical fastener is smaller than the diameter of the pipe to be rehabilitated, and the mechanical fastener is placed within the tubular sleeve. Dual-sided adhesive tape may be applied to the outer surface of the mechanical fastener to adhere the outer surface of the mechanical fastener to the inner surface of the tubular sleeve. The tubular sleeve is then placed inside the end of the pipe, and the mechanical fastener is placed into a conformation where the tubular sleeve is held to the pipe wall.
- C. Insert continuous hydrophilic water stops at each manhole opening, centered within the intersection of the host pipe and the manhole wall. If defects in the host pipe near the manhole are such that the end seal will not form a watertight seal between the liner and host pipe, apply hydraulic cement to the defects in the host pipe to provide a smooth surface to receive the end seal.

3.07 CIPP INSTALLATION

- A. Prior to installation, the bypass pumps, including backups, shall be tested and running. The cost for these access points is incidental to the project. Locations for the manhole/access points shall be submitted per Subsection 1.03.
- B. Resin Impregnation: The wet-out or resin impregnation shall only occur at the manufactures plant and in accordance with ASTM F2019.
- C. Tube installation forces or pressure shall be limited so as not to stretch the tube longitudinally by more than 2% of the original length.

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- D. No CIPP installation will be undertaken in weather conditions that could jeopardize the installation of the CIPP, or be detrimental to the long term performance of the CIPP.
- E. The liner shall be installed using the pull-in method as described in ASTM F2019 sections 6.2.1 and 6.2.2.
 - 1. 6.2.1 – Sliding Foil and Winch Cable: Upon verification of the removal of all debris and protrusions a sliding foil and a winch cable may be pulled through the line. The Sliding foil shall cover approximately the lower third or up to half of the circumference of the pipe, as recommended by the manufacturer. At the upstream end it is locked in place by being inserted underneath the plug used to block the flow in the manhole.
 - 2. 6.2.2 - Pulling Head or Pulling Manifold and Invert Roller: The liner is connected to the winch cable by forming a pulling head or using a pulling manifold. A pulling head can be made by turning the end of the liner over into a loop. If a pulling manifold is used it shall be attached to the end of the liner with sufficient strength to transfer the pulling force. It contains a mounting point for the air/stream hose. During the mounting of the pulling manifold care shall be taken to provide an air tight fit of the calibration hose to the manifold. If a pulling head has been used it shall be dismantled after pulling in the liner. Then a manifold is mounted airtight into the calibration hose. In invert guide roller is placed in the winch manhole. The invert roller shall allow the pulling head or manifold to enter the manhole before the pulling is terminated. A swivel connection to the pulling cable may be added to avoid twisting the liner.
- F. The existing pipe must be dewatered for any CIPP installation that does not use an inversion method to expand the tube against the pipe wall. The Contractor shall eliminate any incoming water and remove standing water, at no additional cost to the Owner.
- G. The inlet air hose shall be connected to the installation equipment and shall be equipped with an air compressor of sufficient capacity to expand the impregnated fabric tube. While the tube expands under pressure a multi lamp ultraviolet curing assembly shall be drawn through the pipe without causing curing to commence.
- H. The ultraviolet curing lights shall be tuned or optimized to the photo initiator system of the resin or the initiator system of the resin shall be optimized to the output of the ultraviolet curing lights.

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1. Travel through the pipe shall be at a pre-determined speed which allows for cross-linking polymerization of the CIPP resin. Air pressure shall be adjusted to sufficient pressure to hold the impregnated fabric tube tight to the pipe wall. The desired pressure shall be maintained by adjustment of the outlet valves.
 2. A full protocol for time, rate of travel of the UV assembly, pressures and amounts of lamps in operation shall be maintained as documentation for the correct curing of the fabric tube. The protocol shall be recorded automatically from the beginning of inflation of the liner until the end of curing. It shall also show the basic information in a header, and clearly identify the renovated section.
- I. Finish: The finished CIPP shall be continuous over the entire length of the run and be as free as commercially practicable from any visual defects such as foreign material, dry spots, pinholes, and delamination. It shall also meet the leakage requirements or pressures test specified herein for main line and lateral connections.
- J. If broken due to misaligned pipe at the manhole wall, the Contractor fails to make a tight seal; the Contractor shall apply a seal at that point. The seal shall be of a resin mixture compatible with the CIPP and at no additional cost to the Owner.
- K. For post-construction television inspection, the Contractor is responsible for adhering to NASSCO's Pipeline Assessment and Certification Program (PACP) guidelines. Verification of NASSCO PACP certification is required.
- L. Video inspections and tap reopening shall be performed using a swivel head camera capable of looking directly up a tap. Cutting and trimming equipment shall be able to satisfactorily perform the operations. Satisfactory operation of cameras and other equipment must be demonstrated and approved before lining operations begin.
- M. After the tube has been cured in place, the Contractor shall reconnect all the existing service connections. The Owner reserves the right to use means such as dye testing to confirm activity, as necessary at the cost of the Owner. Opening the lateral connections shall be done without excavation, and in the case of non-man entry pipes, from the interior of the pipeline by means of a television camera and a cutting device that reestablishes them to not less than 90% capacity.
- N. The cuts shall be trimmed to a neat, clean, circular opening concentric with the service line pipe, free of jagged edges, "sawteeth", resin plugs or resin shelves.

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All cuts shall be brushed with a like resin or wire brush to form a smooth opening so as not to catch floatables in the sewage.

- O. The CIPP shall make a tight seal at the manhole opening with no annular gaps using hydrophilic end seals as specified herein. Materials and procedures used shall be submitted for approval as part of the CIPP system. Where the liner continues through the manhole, the upper portion of the liner will be removed and the bottom half to remain resulting in a smooth, continuous flowline through the manhole. Inverts may be rebuilt using epoxy grout or the CIPP liner material should be sealed to the invert and bench with quick-set epoxy mortar or high viscosity epoxy. These procedures shall be completed before proceeding to the next manhole section.
- P. The Contractor shall make sure through video inspection or whatever other means necessary that each active lateral connection is opened, free to discharge and is not plugged or backed up as a result of the lining operation

3.08 Top Hat Installation (if applicable)

- A. The top hat shall be loaded on the applicator apparatus, attached to a robotic manipulator device and positioned in the mainline pipe at the service connection that is to be rehabilitated. The robotic device together with a television camera will be used to align the top hat with the service connection opening. Air pressure, supplied to the applicator through an air hose, shall be used to insert the resin impregnated connection repair product into the lateral pipe. The inserted top hat will then be inspected using a TV camera to confirm the top hat is correctly positioned and/or centered in the lateral opening prior to curing. The insertion pressure will be adjusted to fully deploy the top hat into the lateral connection and hold the top hat tight to the main and lateral pipe walls.
- B. The pressure apparatus shall include a bladder of sufficient length in both the main and lateral lines such that the inflated bladder extends beyond the ends of both the lateral tube and main line brim segments of the top hat pressing the end edges flat against the internal pipe wall thus forming a smooth transition from top hat to pipe diameters without a step, ridge or gap between the top hat and the inner diameters of the lateral and mainline pipes.
- C. After insertion is completed, recommended pressure must be maintained on the impregnated top hat for the duration of the UV light curing process
- D. The packer is then deflated, removed from connection and returned to the manhole to repeat the cycle.

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- E. The finished top hat shall be free of dry spots, lifts and delamination. The installed top hat should not inhibit the post installation video inspection, using a closed circuit television camera, of the mainline and service lateral pipes or future pipe cleaning operations.
- F. After the work is completed the contractor will provide the customer with an electronic picture and recorded data identifying the location and showing the completed work and restored condition of all the rehabilitated laterals.

3.09 INSPECTION

- A. For each continuous length designated by the Owner in the Contract Documents or each production run of liner utilized (in the case where resins are applied as part of the manufacturing process), one liner sample shall be prepared from a section of the cured pipe at an intermediate manhole or at the termination point. (note: In areas with limited space and larger diameter pipes, other sampling techniques may be required).
- B. The liner samples shall be tested in accordance with the applicable ASTM procedures for the resin being used.
- C. CCTV inspections will be required at the completion of the CIPP and one (1) year after substantial completion. If the Contractor were to perform the CCTV at the one (1) year mark or shortly after, they are still liable to repair any defects that are discovered.
- D. If the liner fails to meet the test criteria, it will be repaired as necessary by the Contractor, and retested, at no additional expense to the Owner. The pipe line will not be considered acceptable until it successfully passes the requirements of this test.
- E. The Contractor shall be responsible for all costs, and delays incurred due to efforts to locate and repair any leaks in any sewer pipeline which fails the test, regardless of whether the failure is due to workmanship, material failure or the result of improperly installed equipment.
- F. All testing will be conducted by the Contractor or his/her approved Subcontractor in the presence of the Owner's representative. The Contractor or his/her Subcontractor shall keep a written record that will show the results of the tests conducted. The records shall include sufficient data on length of line, weir levels,

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time, and related features noted during the testing of each segment of the line. A copy of records shall be given the Owner's Representative and Engineer.

- G. Payment for work will not be considered until post videos are received, reviewed and accepted by the Owner. The Owner reserves the right to re-review tapes after payment for final acceptance. The post video shall include full mainline surveillance as well as the viewing of all laterals for adequate cutting of openings.

3.10 CLEAN-UP OPERATIONS

- A. All materials removed from the pipe line and from the pipe lining process shall be satisfactorily disposed of offsite by the Contractor.
- B. Prior to final acceptance, the Contractor shall demonstrate, in the presence of the Owner, the capability of the liner to perform as specified. Any deficiencies found in the liner shall be corrected at no additional cost to the Owner.

3.11 FIELD TESTING AND ACCEPTANCE

- A. Following installation of each cured-in-place pipe, conduct a television inspection of the completed work as specified in Section 02764. An additional television inspection shall be performed one (1) year after substantial completion. If the Contractor were to perform the CCTV at the one (1) year mark or shortly after, they are still liable to repair any defects that are discovered. Retainage will be held in accordance with the Agreement until the CCTV has been completed, submitted and accepted by the Engineer.
- B. Field acceptance of the liner shall be based on the Engineer's evaluation of the installation including inspection videos and a review of certified test data for the installed pipe samples.
- C. Groundwater infiltration of the liner shall be zero.
- D. All service connections shall be open and clear.
- E. There shall be no evidence of splits, cracks, breaks, lifts, kinks, delaminations or crazing in the liner.

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- F. If any defective liner is discovered after it has been installed, it shall be removed and replaced with either a sound liner or a new pipe at no additional cost to the Owner. Repair methods shall be submitted to the Engineer for approval. Any liner failure that requires excavation work to repair shall be initiated within two (2) hours of failure observation.

END OF SECTION

END OF ADDENDUM NO. 1