SECTION 02734

SEWER SERVICE LATERAL LINING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish all labor, materials, equipment, and incidentals required to install cured-in-place pipe (CIPP) lining to rehabilitate existing active service laterals as directed by the WSD. Service laterals shall be lined from the connection with the main sewer to the property line or easement edge, unless otherwise noted or approved by the WSD. A brim seal connection style, or full-wrap style lining shall be used to address the connection between the main sewer and the service lateral.

B. Furnish all labor, materials, equipment, and incidentals required to conduct air testing, post-rehabilitation CCTV inspections, and other requirements described herein for final service lateral lining acceptance.

C. This specification shall also apply to installing CIPP lining for laterals discharging directly into manholes, if the pipe diameter is 6-inch or less.

D. Service laterals may be a combination of tees, wyes, or break-in taps of varying sizes (4-inch to 8-inch) with angles generally ranging up to 90 degrees. In most cases, a cleanout will be installed at the property line or easement edge.

E. If any active service laterals are identified as defective and the Contractor is unable to line the lateral from the main sewer to the property line or easement edge, the Contractor shall inform the WSD about the lateral's condition and shall propose a rehabilitation method that maximizes the lateral's rehabilitated length while minimizing the extent of surface disruption. The WSD will direct the Contractor as to the acceptable approach for rehabilitating or replacing the service lateral in question.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Shop drawings and schedules for all service lateral lining and appurtenances required

2. Design data and specification data sheets listing all parameters used in the lining design

3. Thickness calculations based on ASTM F1216-09, Appendix XI.1.2 for fully deteriorated pipe

a. All service lateral lining design calculations shall be sealed and signed by a Tennessee registered professional engineer.

4. Detailed procedure for installing the service lateral lining

5. The service lateral lining manufacturer's name and the facility location where the service lateral lining will be manufactured

6. A licensed and certified trainer and representative from the lining system manufacturer shall be on-site to assist in the work for a minimum of one (1) week.

7. The Contractor shall be an approved installer as certified and/or licensed by the lining manufacturer.

8. Material Certifications. Written certification is required from the manufacturer stating all materials used in the work were manufactured and tested in accordance with ASTM F1216 and is being used or installed in conformance with the manufacturer's recommendations.

9. Storage and Delivery Procedures. Provide the lining manufacturer's recommended storage and delivery procedures. This shall include storage and delivery temperatures, maximum time from wet-out to installation, and other pertinent information.

10. Material Safety Data Sheets. Submit Material Safety Data Sheets (MSDS) for each component of the service lateral lining system.

11. Test Results. Prior to using any materials, furnish the proposed material's test results from an independent laboratory in conformance with these specifications. All submitted test data shall have been performed on field installed samples within the last 12 months. Testing by an independent laboratory shall verify the products to be used meet all minimum strength standards as set forth in ASTM F1216, Table 1. Testing shall also verify any product to be used on the project meets the minimum chemical resistance requirements as established in ASTM F1743, Table 2, where the testing is in accordance with Section 7.2.1 of ASTM F1743.

12. Pipe Cleaning Narrative. Submit a narrative describing in sufficient detail the proposed methods for root cutting and cleaning the existing laterals. Prepare such narrative to include the degree of cleaning as recommended by the lining manufacturer. Such narrative shall indicate the lining manufacturer's technical representative's approval for the proposed cleaning methods.

13. Lining Thickness Calculations. Perform lining thickness calculations for each size of laterals and furnish them to the WSD with supporting assumptions. Calculations shall be done after cleaning, televising, and other field inspections have been accomplished. Design parameters shall be used in calculations.

14. Curing Cycle and Cooling Rate. If the lateral lining is heat-cured, submit the resin manufacturer's recommended curing cycle and the recommended cooling rate. Submit a copy of the cure logs for each lateral installation.

15. Post-lining inspection data. Submit the final television inspection in a Granite XP compatible database that shows the rehabilitated laterals.

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

2. ASTM F1216 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

3. ASTM F2561 – Standard Practice for Rehabilitation of a Sewer Service Lateral and its Connection to the Main Using a One Piece Main and Lateral Cured-in-Place Liner

4. ASTM F1743 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)

5. ASTM D2990 – Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics

1.04 QUALITY ASSURANCE

A. The Contractor performing the service lateral lining work shall be experienced and equipped to complete this work expeditiously and in a satisfactory manner.

B. Be able to provide crews as needed to complete the work without undue delay and within the contract time allotted.

C. The service lateral lining shall be provided by a single manufacturer. The supplier shall be responsible for providing all test requirements specified herein as applicable.

D. The WSD may inspect the service lateral lining after delivery. The service lateral lining shall be subject to rejection at any time if it fails to meet any requirements specified, even though sample lining may have been accepted as satisfactory at the manufacturer. Lining rejected after delivery shall be marked for identification and removed from the job site at once.

E. Final Installed Lining Thickness. The final installed lining thickness shall not be less than or more than 10 percent greater than the required thickness. The final installed lining thickness measurement shall be determined from lining sample coupons retrieved from the sewer, plate samples or as deemed necessary by the Engineer. It shall be the Contractor's responsibility to consider site conditions and their installation process to determine the proper lining thickness to install.

F. Non-Compliance. If the flat plate samples do not meet the required 4,500 psi flexural strength and 250,000 psi flexural elasticity modulus as outlined, actual installed samples must be taken. The installed samples shall be taken as directed by the WSD and in accordance with all applicable ASTM requirements. From these samples, the installed thickness shall be determined by taking an average of at least 10 thickness measurements. Installed samples shall then be prepared for re-testing in accordance with these specifications.

1.05 DELIVERY, STORAGE AND HANDLING

A. Care shall be taken in shipping, handling, and storing to avoid damaging the service lateral lining. Extra care shall be taken during cold weather construction. Any lining damaged in shipment shall be replaced as directed by the WSD.

B. Any lining showing a split or tear, or which has received a blow that may have caused damage, even though damage may not be visible, shall be marked as rejected and removed at once from the job site.

C. At all times, the lining materials, including the wet-out lining, shall be maintained at a proper temperature, such as in refrigerated facilities, to prevent premature curing prior to installation. The lining shall be protected from UV light prior to installation. Any lining showing evidence of premature curing will be rejected for use and will be removed from the site immediately.

1.06 PUBLIC NOTIFICATION

A. Notify the owners and residents of any homes or businesses whose service lateral will be affected by the lining work. Also, deliver written notification to each such resident or business 3 days prior to such lining work, further advising of the work. Include in the notifications any restrictions on using the sewage system facilities. Describe exact days and hours when the sewer system cannot be used. CONTACT ANY HOME OR BUSINESS THAT CANNOT BE RECONNECTED WITHIN TIME STATED IN THE WRITTEN NOTICE.

B. THE MAXIMUM TIME ANY HOME OR BUSINESS SHALL BE WITHOUT SANITARY SEWER SERVICE IS 10 HOURS and NOT BETWEEN 6:00 PM AND 8:00 A.M. ANY SERVICE OUT LONGER THAN 10 HOURS WILL HAVE SERVICE RESTORED AT CONTRACTOR'S EXPENSE OR TEMPORARY MEASURES TAKEN.

1.07 GUARANTEE

A. All lining work shall be fully guaranteed by the Contractor and manufacturer for 3 years from the acceptance date. A written warranty shall be submitted. During this period, all serious defects, including failure of the seal between the service lateral lining and the main sewer, discovered by Metro shall be removed and replaced by the Contractor in a satisfactory manner at no additional cost to the City of Brentwood. At their own expense, WSD may conduct an independent television inspection of the lining work prior to the guarantee period's completion. Any defects replaced at that time shall be fully guaranteed by the Contractor and manufacturer for one year from the date the defect was repaired. Wrinkles, blisters, dry spots in resin, or other defects in the finished service lateral, which in the WSD's opinion, negatively affect the service lateral's integrity or strength or the pipe's flow capacity or performance of solids passage are unacceptable. Contractor will be responsible to remove and repair, at Contractor's expense, all such defects in a manner satisfactory to the WSD. Defects also include but are not limited to the following:

1. Leakage through the lining or between lining and pipe

2. More than 10 percent reduction in the lining thickness

3. Lining separating from the pipe

4. Excessive wrinkles inhibiting flow

B. The lining shall be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. The lining shall have a smooth surface free from leaks, cracks, and crazing. Some minor waviness that, in the WSD's opinion, will not appreciably decrease the flow cross-section or affect the flow characteristics shall be permissible.

1.08 WATER

A. Water for all construction operations shall be available from City fire hydrants at normal commercial rates.

B. Water usage shall be in accordance with City backflow and metering polices.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The service lateral lining shall be a seamless, corrosion-resistant, cured-in-place pipe lining product that seals the service lateral pipe and the junction between the service lateral pipe and main sewer. The portion of the lateral lining system that connects to the main/lateral interface shall be either a full-wrap or brim-seal connection type.

B. The service lateral lining shall be a resin-impregnated, flexible polyester felt, non-woven textile tube, needle punched felt, circular knit or circular braid, glass fiber reinforced plastic or equivalent material tube which is cured -in-place by an acceptable curing method. The tube shall be able to conform to bends, offset joints, bells, and disfigured pipe sections.

C. The service lateral shall provide a 50-year service life and shall have the minimum structural properties listed below:

Minimum Structural Properties	
Physical Properties	**Minimum Standard**
Flexural Strength (ASTM D790)	4,500 psi
Flexural Modulus of Elasticity (ASTM D790)	250,000 psi

D. The service lateral shall be designed, fabricated, and installed for the actual conditions encountered for this application including the host pipe material, in accordance with the applicable ASTM F1216, ASTM D2990 provisions, and shall meet the following minimum design conditions:

1. AASHTO H-20 live load with two trucks passing

2. Soil Weight 120 pounds per cubic foot

3. Friction coefficient Ku′=0.130

4. Estimated maximum groundwater level at ground surface

5. Fully deteriorated pipe with 2 percent (min.) ovality. If existing pipe's ovality is found to be worse, use actual percent up to 5 percent (max.).

6. Soil Modulus 1,000 psi

7. Safety factor = 2

8. Soil Depth: The cover depth will be determined by field measurements.

E. The finished lining shall have a 3 mm minimum thickness for 4-inch laterals and 4.5 mm for 6-inch laterals.

F. The service lateral lining shall have sufficient wall thickness to withstand all anticipated external pressures and loads that may be imposed after installation. The design shall be performed and certified by a Tennessee registered professional engineer.

G. The service lateral lining shall be manufactured and installed by T-Liner by LMK Technologies; SCS+L by BLD Services, LLC; epros DrainMtH System by Trelleborg Pipe Seals Milford, Inc.; or approved equal.

H. When cured, the service lateral lining shall extend from the mainline into the lateral connection in a continuous tight fitting, watertight pipe-within-a-pipe to eliminate any visible groundwater leakage and future root growth at the lateral to mainline connection and along the lateral. The service lateral product system shall be compatible with the mainline and/or lateral pipe or lining. The lining portion within the mainline pipe may be a full-wrap or brim-seal connection or style.

I. When cured, the finished service lateral product shall be chemically resistant to domestic sewage over the rehabilitated pipe's expected lifetime. The lining material and resin shall be completely compatible.

J. The connection between the service lateral and the main sewer shall be lined so a continuous overlap between the service lateral lining and the main sewer extends 3-inches minimum from the lateral along the entire circumference.

K. A leak-free seal must be created to form a sealing bond between the service lateral product and the host lateral and mainline pipe walls. The Contractor should use either a hydrophilic) material or an epoxy-sealing component at each lining tube end to provide a leak-free seal.

L. When cured, the lining shall form a hard, impermeable lining which is chemically resistant to chemicals found in domestic sewage.

2.02 RESIN

A. The resin system shall meet the requirements of ASTM F1216, Section 5.2. The resin installed service lateral lining system shall produce a service lateral that will comply with the structural requirements specified herein and shall provide chemical resistance for the flow media in the gravity pipe. The resin shall be compatible with the rehabilitation process, shall be able to cure in water's presence or absence and shall have an initiation temperature for cure as recommended by the resin manufacturer. Unless otherwise specified, provide a general purpose or enhanced strength unsaturated, thermosetting, polyester, vinyl ester, epoxy or silicate resin and a catalyst system compatible with the installation process. The resin shall be vacuum impregnated into the lining.

B. Submit documentation from the resin manufacturer specifically describing the resin system's chemical characteristics including allowable mixing, impregnation, and handling time, transportation, and storage time, and recommended curing cycle including

temperatures, pressures, and times. The resin manufacturer's documentation must also include maximum allowable time for handling the impregnated tube prior to insertion and the maximum allowable elapsed time from insertion to exotherm. If remedial measures are available to extend either of the maximum allowable times indicated above, without affecting the resin's physical properties, the resin manufacturer should describe these measures and the time limits beyond which even these measures will not prevent altering the resin's physical properties.

PART 3 - EXECUTION

3.01 PRE-INSTALLATION

A. A digital CCTV video inspection must be done on the mainline pipe with a pan and tilt camera and the service lateral to confirm the proposed repair falls within the limitation parameters set by the manufacturer on the following aspects:

1. The location and clock reference of the lateral junctions to be lined
2. Any offsets, any intrusions from the lateral into the main
3. Angle at which the connection comes in
4. Any changes in the lateral's approach angle for the repair length
5. Potential flows coming throughout the lateral pipe
6. Potential flows going through the main pipe
7. Diametric connection size for the lining length
8. Main pipe's size at the service lateral point
9. Service lateral's condition including the presence of debris, turns, bends, changes in diameter, or other observations
10. Active infiltration present within the work area vicinity
11. Any defects noted in the mainline pipe or lateral should be documented using NASSCO PACP/LACP Standards.

B. Inform the WSD about service laterals in which a service lateral lining cannot be installed from the main sewer to the cleanout established at the property line or easement line. The Contractor shall identify these service laterals and provide the WSD with documentation about the conditions encountered including the CCTV inspection. If a full-length lateral lining cannot be installed or a point repair on the service cannot be performed, the WSD may direct the Contractor to install a short lateral lining with no cleanout required extending up the lateral from the main. The length is to be field determined to the maximum length possible, but should extend 3 feet minimum up the lateral from the main

C. Inform the WSD about service laterals in which a short length service lateral product cannot be installed. The Contractor shall identify, document, and video record these services and inform the WSD about the conditions encountered. If a short length lateral

lining cannot be installed, the service connection will be “cut and buffed” to restore a 95% minimum service opening.

3.02 LINE PREPARATION

A. Prior to installing the service lateral product, the area around the lateral sealing surface in 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. All laterals to be lined shall be cleaned as required prior to lining. The term “cleaned” shall mean removing all sand, dirt, roots, grease, and other solids or semisolid materials from the interior face of the sewer mainlines and the service laterals.

B. Built-up deposits on the main and lateral pipe walls shall be removed. The removal shall reach at least 1 foot beyond the scheduled service lateral installation length to allow the bladder to inflate tightly against the pipe walls ensuring a smooth transition from service lateral product to the existing pipe wall.

C. Televise the lateral to provide a detailed record of existing conditions and lateral connections. Have a copy of the pre-lining inspections in the field. Immediately prior to lining insertion, the camera shall traverse the lateral to inspect for debris which may have entered the line after the existing condition inspection.

D. Where active infiltration is present and when it is recommended by the service lateral lining manufacturer, the infiltration must be stopped in advance by grouting.

E. Additional precautions need to be taken when applying the sleeve to a main pipe lined with a CIPP lining with a polyolefin coating. The coating is to be lightly scarified, scraping off the coating in the main CIPP in the service lateral lining’s vicinity, and verified by the WSD. This scuffing is mandated for service lateral linings required to adhere to the pipe wall. Service lateral linings with hydrophilic material are not required to have the existing lining scarified.

F. The Contractor shall be responsible, if needed, for bypassing sewage while installing the service lateral lining product. In cases where the temporary sewage backup is accepted as a replacement for bypassing, the Contractor shall be responsible for all damage caused by sewage backing up into properties or sanitary sewer overflows.

3.03 INSTALLATION

A. The service lateral lining shall be vacuum-impregnated with resin (wet-out) under controlled conditions. The resin volume used shall be sufficient to fill all voids in the textile lining material at nominal thickness and diameter. The volume shall be adjusted by adding 5% to 10% excess resin for the change in resin volume due to polymerization and to allow for any resin migration into the cracks and joints in the original pipe. All resin shall be contained within the translucent bladder during vacuum impregnations. No dry or unsaturated area in the lateral tube shall be acceptable upon visual inspection.

B. The service lateral product shall be loaded on the applicator apparatus, attached to a robotic manipulator device, and positioned at the cleanout or pipe opening of the service connection that is to be rehabilitated. For service lateral full-wrap style linings with compression gaskets, the mainline lining and bladder shall be wrapped around the "T" launching device and held firmly by placing 4 hydrophilic material bands around the main lining. For service lateral full-wrap linings that do not use hydrophilic material, a 300 ml volume adhesive sealant shall be applied to the main/lateral interface and shall be

applied as a 2-inch wide band on the main lining. For service lateral brim-sill connection style linings, 300 ml minimum volume excessive resin or hydrophilic materials shall be applied to the main/lateral interface and shall be applied as a band on the main brim-seal. The robotic device with a television camera shall be used to align the repair product with the service connection opening. The insertion pressure shall be adjusted to fully deploy the service lateral product into the lateral connection and hold the service lateral product tight to the main and lateral pipe walls.

C. The pressure apparatus shall include a bladder with sufficient length in the main and lateral lines so the inflated bladder extends beyond the ends of the service lateral product's lateral tube and main line tube, pressing the end edges flat against the internal pipe wall, thus forming a smooth transition from service lateral product to pipe diameters without a step, ridge, or gap between the service lateral product and the lateral and mainline pipes' inner diameters.

D. For service lateral linings with hydrophilic materials, the main bladder shall be inflated causing the main sheet to unwrap and expand, embedding the hydrophilic material between the main lining and the main pipe as the main lining is pressed tight against the main pipe.

E. After insertion is completed, recommended pressure must be maintained on the impregnated service lateral product according to ASTM F1216-09, Sections 7.4.2 and 7.4.3, pressing the lining firmly against the inner pipe wall during the entire curing process. The lining shall be cured at ambient temperatures or by a suitable heat source. In no instance will sewage be used to invert or cure linings or calibration tubes.

F. The finished service lateral lining shall be free from dry spots, lifts, and delamination. The installed service lateral lining should not inhibit the CCTV post installation video inspection for the mainline and service lateral pipes or future pipe cleaning operations. For service lateral linings with compression gaskets, the CIPP shall taper at each end providing a smooth transition to accommodate video equipment and maintain proper flow in the mainline. In all cases, the finished product must provide an airtight/watertight verifiable non-leaking connection between the main sewer and sewer service lateral. During the warranty period, any defects with the service lateral that affect the lateral connection's performance, cleaning, or water tightness shall be repaired at the Contractor's expense in a manner acceptable to the WSD.

G. Following the lining installation, provide the WSD with an electronic picture and recorded data identifying the location and showing the completed work and restored condition for all the rehabilitated service laterals from the sewer main to the service reconnection point. The Contractor shall televise the rehabilitated lateral to provide a detailed record of finished conditions using NASCCO PACP/LACP guidelines. When complete, the Contractor shall submit the rehabilitated lateral inspections in a Granite XP-compatible database and the accompanying logs on DVDs or an external USB hard drive.

3.04 FIELD TESTING AND ACCEPTANCE

A. The lining's field acceptance shall be based on the WSD's evaluation of the installation including post-lined digital CCTV inspection and reviewing certified test data for the installed pipe samples. The CCTV inspection for each lateral shall extend 10 feet minimum past the end of the rehabilitation work on the service lateral. For laterals where a cleanout was installed, the CCTV inspection shall include the cleanout and the connection to the existing, undisturbed service lateral.

B. The lining shall have zero groundwater infiltration, and each lateral must pass a 2-minute 4 psi air test conducted by the Contractor.

C. A flat plate sample shall be collected for every 50 lateral installations, and the sample shall be submitted to a third party testing laboratory to confirm strength properties (flexural strength and flexural modulus) in accordance with ASTM F1216. The test results must meet or exceed the strengths in the design, or the Contractor must provide a 10% credit for up to 50 laterals the sample represents.

D. All service connections shall be open, clear, and watertight.

E. The lining shall have no evidence of splits, cracks, breaks, lifts, kinks, delaminations, or crazing.

F. If any defective lining is discovered after it has been installed, it shall be removed and replaced by the Contractor with a new lining, a new pipe, or other measures with the WSD's approval at no additional cost to the City of Brentwood. Any lining installation not meeting specified strengths or thickness shall provide other acceptable remediation measures or credit as approved by the WSD. The re-inspection requirements as listed above shall apply to this re-installed section of line.

3.05 CLEANUP

A. After the installation work and testing have been accepted, restore the project area affected by the operations to a condition at least equal to what existed prior to the work.

END OF SECTION