SAnitary District # 2 Specifications

curred in Place Sewer Lining

1. GENERAL
	1. SUMMARY
		1. This section covers the work necessary for the installation of cured-in-place pipe liner into an existing sewer, including pipeline cleaning, internal inspections, flow control, obstruction removal, reconnection of existing active service laterals, testing, cleanup, restoration and appurtenant work, complete as specified and shown on the attached Sanitary Sewer Lining Location Drawing.
		2. Contractor shall confirm pipe sizes, lengths, and materials of construction prior to ordering materials.
		3. Contractor shall be responsible for designing and installing a cured-in-place liner system in accordance with the Contract Documents, referring to all of the Drawings, Specifications and Shop Drawings submitted to provide details of the liner system which affects the work covered under this section.
		4. The Contractor shall notify all property owners that will be affected by the work 72 hours in advance of the work, giving the date, start time and estimated completion time for the work being conducted and the expected impacts to the property owner.
		5. Method of Measurement
			1. Cured-in-Place Liner:
				1. Measure liners by distance in linear feet.
				2. Measure liners horizontally, on the surface, from center-to-center of manholes to the nearest 0.1-foot.
				3. Measure each pipe size separately.
			2. Removal of Protruding Service Connections: Measure each protruding service connection as a unit.
			3. Service Lateral Reconnections: Measure each connection as a unit.
			4. Sewer Cleaning and Disposal of Sewer Cleaning Materials: Measure by volume of material to be disposed of, in cubic yards.
		6. Basis of Payment:
			1. Cured-in-Place Liner:
				1. Payment for cured-in-place liner will be made at the unit price per linear foot as stated in the Bid Form. Payment will be based on the actual number of feet installed, as measured by the Sanitary Districts Representative.
				2. The unit price payment for the cured-in-pace liner constitutes full compensation for all labor, equipment, materials and incidentals necessary to install the cured-in-place liner, complete, including sewer televising prior to and after installation, testing, sewage bypassing, manhole connections, control of water, and all pre-grout (pressure/chemical) or pre-liner installation as necessary to control ground water infiltration, protection of existing utilities and adjacent property and all required surface restoration work.
			2. Removal of Protruding Service Connections:
				1. Payment for removal of protruding service connections will be made at the unit price per each as stated in the Bid Form. Payment will be based on the actual number of protruding service connections removed, as measured by the Sanitary District Representative.
				2. The unit price payment for removing protruding service connections constitutes full compensation for all labor, equipment, materials and incidentals necessary to remove or repair the protruding service connection or obstruction.
			3. Service Lateral Reconnections:
				1. Payment for service lateral connections will be made at the unit price per each as stated in the Bid Form. Payment will be based on the actual number of service lateral reconnection installed, as measured by the Sanitary District Representative.
				2. The unit price payment for service lateral connections constitutes full compensation for all labor, equipment, materials and incidentals necessary to install the service lateral connections, complete, including determining, identifying and documenting whether lateral connections active or inactive, and defining location of active services by measurement from inside face of manhole wall. No additional payment will be made for excavations required for reopening service lateral connections and Contractor shall be responsible for all costs and liability associated with such excavation and restoration work. No payments will be made for inactive services, unless reconnection is directed by the Sanitary District’s Representative.
			4. Sewer Cleaning and Disposal of Sewer Cleaning Materials:
				1. Payment for sewer cleaning and disposal of sewer cleaning materials will be made at the unit price per cubic yard as stated in the Bid Form. Payment will be based on the actual number of cubic yards disposed, as measured by the Sanitary Districts Represenative. The volume will be measured by each truck load.
				2. The unit price payment for the sewer cleaning and disposal of sewer cleaning materials constitutes full compensation for all labor, equipment, materials and incidentals necessary to clean the sewer and dispose of the sewer cleaning materials, complete including loading, transportation and disposal of sewer cleaning materials at a licensed landfill, and all tipping fees or charges from the disposal facility.
	2. References
		1. ASTM:
			1. D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
			2. F1216 - Rehabilitation of Existing Pipelines and Conduits by Inversion and Curing of a Resin-Impregnated Tube
			3. F1743 - Rehabilitation of Existing Pipelines and Conduits by Pulled-inplace Installation of Cured-inplace Thermosetting Resin Pipe (CIPP)
	3. submittals
		1. Submittals during construction shall be made in accordance with Section 01 33 00. In addition, the following specific information shall be provided:
			1. Certification that materials used in the liner meets or exceeds these specifications. The manufacturer of Cured-In-Place sewer liner must document, through references, the production and installation of a minimum of 500,000 linear feet of liner.
			2. Videotapes of internal inspections prior to and upon completion of liner insertion.
			3. Test results.
			4. Television inspection reports.
			5. Proposed plan for bypassing sewage during liner installation.
			6. Service lateral connections door notification cards.
			7. Liner thickness design calculations prior to installation.
	4. Manufacturers
		1. Lining processes which meet these specification will be accepted.
2. PRODUCTS
	1. Cured-In-Place Liner Tube
		1. The finished liner shall be fabricated from materials which, when cured will be chemically resistant to withstand internal exposure to domestic sewage including exposure to hydrogen sulfide gas. Contractor shall use the chemical solution and concentrations shown on ASTM F1216, Table X2.1, for purpose of defining chemical resistance requirements.
		2. Resin:
			1. The resin shall be a corrosion resistant polyester, vinyl ester, or epoxy and catalyst system.
			2. The resin shall not contain fillers, except those required for viscosity control or fire retardance. The manufacturer of the liner made add up to 5 percent by mass, a thixotropic agent for viscosity control, which will not interfere with visual inspection.
			3. The resins may contain pigments, dyes, or colorants, which shall not interfere with visual inspection of cured liner.
		3. Reinforcing Material:
			1. Non-woven, needle interlocked polyester felt formed into sheets of required thickness.
			2. Felt tubes may be made of single or multiple layer construction, with any layer not less than 1.5 mm thick.
			3. Mechanical strengthener membrane or strips may be sandwiched in between layers where required to control longitudinal stretching.
			4. “Plastic” membrane used during insertion of inflation bag may be left on internal surface of liner after curing.
			5. Minimum thickness of bonded “plastic” membrane and inner liner, if used, shall be 0.25 mm, +5 percent, and shall not affect structural dimension requirements of cured liner.
		4. Felt Content:
			1. Content shall ensure cured thickness of liner as specified.
			2. Thickness of cured liner to be as specified (+10 percent - 4 percent) and shall not include thickness of “plastic” inner liner.
		5. Resin Content: 10 to 15 percent by volume greater than volume of felt in liner bag.
		6. Minimal structural standards listed:
			1. Modulus of Elasticity:
				1. Standard: ASTM D790
				2. Value: 250,000 psi
			2. Flexural Strength:
				1. Standard: ASTM D790
				2. Value: 4,500 psi
	2. DESIGN CRITERIA
		1. The cured-in-place liner thickness shall be designed in accordance with ASTM F1216 Appendix X1 and following design conditions:
			1. Ground Water Table Elevation: Contractor to verify groundwater elevation prior to initiating work.
			2. Assume no bonding to original pipe wall.
			3. H-20 live load.
			4. Fully deteriorated “host” pipe.
			5. Factor of Safety against Buckling: 2.0.
			6. Long-term modulus of elasticity for 50-yr design.
			7. Unit Weight of Soil: 130 pounds per cubic foot.
			8. Bond between layers shall be strong and uniform. All layers, after cure, shall form one homogeneous structural pipe wall with no part of tube left unsaturated by resin.
			9. Pipes shall be assumed to have ovalities as observed in the field, but not less than 3 percent.
			10. Modules of Soil Stiffness:
				1. E1 = 1250 psi. for sewer depth of 8 to 25 feet
	3. Cleaning Equipment
		1. Contractor shall supply equipment for sewer cleaning capable of removing sludge, grease, debris, roots and other deleterious materials and obstructions from sewers without damage to existing lines. Selection of equipment shall be based on conditions of lines at time work commences and at sole discretion of the Contractor to achieve removal of materials specified.
	4. Television Survey Equipment
		1. The television cameras used for the surveys shall be of types specifically designed and constructed for such surveys. The cameras for the main line pipe survey shall be of the pan and tilt type, capable of turning to look at right angles to the pipe’s axis over an entire vertical circle. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the large diameter pipes. Two sets of lights are required. One set shall be mounted on the camera’s transport platform and point forward. The other set shall be mounted on the camera and point where the camera is looking. Information obtained by Contractor shall be recorded on a DVD and on hard copy lay sheets.
3. Execution
	1. Liner fabrication
		1. Contractor shall fabricate liner to size that when installed, will fit internal circumference of pipe, including allowances for circumferential stretching during insertion, maximum pipe out of roundness specified for complete installation, and conform to requirements of ASTM F1216.
	2. Sewer Cleaning:
		1. Contractor shall clean grease, sludge, roots and other debris from line to provide proper installation of liner system. Contractor shall remove sludge, grease, roots, debris and other solid or semi-solid material resulting from cleaning operations at downstream manhole. Contractor shall not pass material from an upstream sewer segment to the next downstream sewer segment. If hydraulic cleaning equipment used, Contractor shall construct a weir or dam in the downstream manhole to trap solids for removal. Contractor shall remove all materials resulting from cleaning operations from site on daily basis and dispose of at a licensed landfill. Contractor shall be responsible for all charges from a licensed landfill for disposal of cleaning materials. Contractor shall protect sewer and manholes from damage during cleaning operations.
		2. Contractor shall remove or repair protruding services, or other defects that would prevent insertion of liner. Contractor shall make own determination of removal or repair required by review of TV inspection tapes. Service connections that are protruding into the main sewer shall be cut flush with the pipe wall prior to installing the CIPP. The cutting shall be accomplished using an internal robotic cutter specifically designed for such work. The internal remote cutter shall be capable of cutting PVC, vitrified clay, cast iron, ductile iron and orangeburg pipe. All cut pieces of the service connection shall be removed from the main sewer pipe.
		3. If the invert of the sewer pipe is eroded more than 2-inches in depth, Contractor shall fill the annular space with nonshrink grout.
		4. If Contractor determines that the existing pipe is 3 percent or more out of roundness, Contractor shall redesign liner. Contractor shall notify Engineer of condition of pipe prior to redesign.
	3. Pre-Liner Installation and Post-Liner installation Television Surveys
		1. Upon completion of the sewer line cleaning, both before and after liner installation, the entire sewer line shall be fully televised from the centerline of one manhole to the centerline of the next manhole by the Contractor. A clear voice-over narrative is required to help define the tape’s subject and explain areas of interest and their locations in the pipe. The work consists of furnishing all labor, materials, accessories, equipment, tools, transportation, services and technical competence for performing all operations required to execute the internal closed circuit television inspection survey of all sewers cleaned, including isolating and evacuating all lines. The survey shall be performed on one sewer sections at a time, between adjacent manholes.
		2. Contractor shall move the camera through the line in either direction at a uniform rate (not greater than 30 feet per minute), stopping when necessary to permit proper documentation of the sewer’s condition and features. The camera shall be panned, tilted and rotated as is necessary to best view and evaluate all features and points of interest found.
		3. Contractor shall keep television survey logs which clearly show the location of each service lateral connection, unused conditions and other points of significance.
	4. Sewage Bypassing
		1. Contractor shall provide for flow of sewage around sections of pipe to be lined.
		2. Contractor shall provide pump or bypass lines of adequate size and capacity to handle flow.
		3. Contractor shall coordinate bypassing operations with Owner.
	5. Cured-in-Place Liner
		1. Contractor shall conform to requirements of ASTM F1216 or ASTM F1743 and as hereinafter specified.
			1. As a part of cleaning and televising or in conjunction with cleaning and televising, Contractor shall determine the extent of any groundwater infiltration in the pipe(s) to be lined and shall then install a pre-grout (pressure/chemical) or a pre-liner in any areas of the pipe which have infiltration of groundwater, to ensure that infiltrating ground water does not affect the cure of the resin. All areas which are pre-grouted or pre-lined shall be noted on the record plans.”
		2. Preparation of Liner:
			1. Contractor shall designate a location where uncured resin in original containers and unimpregnated liner will be vacuum impregnated prior to installation. Contractor shall allow Engineer to inspect materials and “wet out” procedure prior to installation. The resin and catalyst systems compatible with requirement of this method shall be used. Quantities of liquid thermosetting materials shall be to manufacturer’s standards to provide lining thickness required.
			2. Contractor shall impregnate the liner tube with resin not more than 24 hrs before proposed time of installation and stored out of direct sunlight at temperature less than 40 degrees F (4 degrees C).
			3. If Contractor does not “wet out” on-site, then Contractor shall transport the resin-impregnated liner to site immediately prior to inversion in suitable light‑proof container with temperature maintained below 40 degrees F (4 degrees C).
		3. Insertion of Liner:
			1. Contractor shall insert the liner through an existing manhole or other access by means of an inversion processor a pull-in method and a application of hydrostatic head which is sufficient to fully extend the liner to the next designated manhole or termination point, hold tube tight to “host” pipe wall, and produce dimples at service lateral connections. If Contractor elects pulled in place, care should be exercised not to damage the tube as a result of pull-in friction. A lubricant may be used and shall conform to requirements of ASTM F1216.
		4. Curing Liner:
			1. After the insertion is complete, Contractor shall provide a heat source and water recirculation equipment capable of delivering hot water throughout section to uniformly raise water temperature above temperature required to effect cure of resin.
			2. Contractor shall provide a heat source with suitable monitors to gauge temperature of incoming and outgoing water supply. Contractor shall place a second gauge between the impregnated liner and pipe invert at remote manhole to determine temperatures during cure. The water temperature in line during cure period shall be as recommended by resin manufacturer.
			3. The initial cure shall be deemed complete when inspection of exposed portions of liner reveals liner to be hard and sound and remote temperature sensor indicates that temperature is of magnitude to realize an exotherm. The cure period shall be of duration recommended by resin manufacturer, as modified for lining process.
			4. Contractor shall cool the hardened liner to temperature below 100°F before relieving static head in inversion standpipe. Contractor shall cool down the hardened liner by introduction of cool water into inversion standpipe to replace water being drained from downstream end. Care shall be taken in release of static head so that vacuum will not be developed that could damage newly installed liner.
	6. Connections
		1. Service Lateral Reconnections:
			1. Contractor shall determine active service lateral connection locations from TV inspection videotapes taken by Contractor. Contractor shall reinstate and reconnect service laterals. If Contractor determines that a lateral connection is either inactive or abandoned, Contractor shall notify Owner in writing regarding their determination. Owner will determine if such lateral connection should remain closed or to be opened.
			2. Contractor shall reconnect service laterals from within the pipe without excavation, using a remote controlled television camera and cutting device that re-establishes service for minimum of 95 percent of flow capacity. The liner shall be sufficiently tight so there is no annular space between connection and liner. If post and liner installation television inspection survey indicates any annular space between connection and liner, Contractor shall provide a watertight seal between the connection and liner. Use of “hydro-tight” or equal seal will be deemed acceptable.
			3. Whenever the property owner’s use of the service lateral must be interrupted by the work, Contractor shall notify the residents 3 days prior to the interruption. This notification shall be accomplished with door hanger notification cards to be placed at the addresses of effected customers. Contractor shall provide and prepare the door hanger notification cards. The notification cards must be submitted and approved by the Owner prior to use. Property owners shall be informed when service interruption will take place and the approximate duration. Service lateral connections shall not be out of service for more than 24-hours during lining process.
		2. Manhole Connections: Contractor shall provide watertight seal between sewer pipe and liner, at connection to manhole. Use of “hydro-tight” or equal seal will be deemed acceptable.
	7. Testing
		1. Testing Finished Liner:
			1. The liner shall be continuous over entire length of inversion run and be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes, and delamination.
			2. The liner shall conform to shape of pipe existing before installation and not be out of round by more than 15 percent.
			3. Contractor shall seal the space between the “host” pipe and liner with resin mixture compatible with liner, if the liner does not fit tightly against the “host” pipe at the termination points within the manholes.
			4. The cured liner shall be accurately measured as described in ASTM F1743 and shall not be more than 5 percent less than thickness specified.
		2. Testing Felt and Resin Content of Liner: The liner shall be visually inspected in accordance with ASTM F1743 to ensure number of layers of felt conforms to specified number of layers and thickness. Contractor shall calculate the resin to felt ratio by weight and the ratio shall fall in range 1.10:1 to 1.15:1.
		3. Testing for Flexural Strength and Modulus of Elasticity: Contractor shall test each section of liner in accordance with ASTM D790. Specimens tested shall be actual thickness of fabricated liner. Contractor shall not machine specimen on surface. The test shall be made with a smooth (inner) face in compression using 5 specimens.
	8. Final Examination
		1. Contractor shall televise the interior of the pipe after completion of work and provide tapes and inspection logs to Owner.

END OF SECTION