SECTION 02720 - SLIPLINING SANITARY SEWERS

City of San Diego, CWP Guidelines

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NTS: This specification addresses rehabilitation of an existing gravity sanitary sewer employing the sliplining technique. Both high density polyethylene (HDPE) and fiber glass reinforced polyester mortar pipe are included.

The Specifier must analyze sewer videotapes and other information to determine the liner pipe diameters, Dimension Ratios, and Stiffness Numbers for the liner pipe.

Point repair requirements are included in case obstructions in the host pipe must be excavated and replaced.

This section cross references Section 02721 - Grout for Sliplining Sanitary Sewers, although not all sewers will require grouting. Match the maximum grout pressure criterion in this section with the same criterion in Section 02721. Delete the cross reference if grouting is not required.

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PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing materials, equipment, and labor necessary for sliplining of existing gravity sanitary sewers.

1.2 RELATED SECTIONS

A. The WORK of the following Sections apply to the WORK of this Section. Other Sections of the Specifications not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. 02200 - Earthwork
2. 02616 - Reinforced Concrete Pipe, Rubber Gasket Joint (With or Without PVC Lining)
3. 02730 - Sanitary Sewerage System Testing
4. 02721 - Grout for Sliplined Sanitary Sewers

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

ASTM D 1248	Polyethylene Plastics Molding and Extrusion Materials
ASTM D 2122	Dimensions of Thermoplastic Pipe and Fittings, Determining
ASTM D 2412	External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading, Determination of
ASTM D 2657	Standard Practice for Heat-Joining Polyolefin Pipe and Fittings

ASTM D 2837	Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
ASTM D 2992	Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting) Resin Pipe and Fittings
ASTM D 3262	"Fiberglass" (Glass-Fiber-Reinforced Thermosetting - Resin) Sewer Pipe
ASTM D 3350	Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3681	Chemical Resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe in a Deflected Condition
ASTM D 4161	"Fiberglass" (Glass-Fiber-Reinforced-Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM F 477	Elastomeric Gaskets (Seals) for Joining Plastic Pipe
ASTM F 585	Standard Practice for Insertion of Flexible Polyethylene Pipe Into Existing Sewers
ASTM F 714	Polyethylene Plastic Pipe (SDR-PR) Based on Outside Diameter
AWWA C 151	Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or other Liquids

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300.

1. Manufacturer's product data with complete information on pipeline materials, physical properties, dimensions, maximum recommended external grout pressure, and minimum bending radius or maximum joint angular deflection. Include a manufacturer's certificate of compliance with specifications for proposed materials.

2. Test reports prepared by an independent testing laboratory certifying that polyethylene pipe conforms to the specified requirements of ASTM standards.

3. Video tapes showing the initial condition of sewer and showing the completed installation.

4. Quality Control Program defining CONTRACTOR's and material supplier's field quality control procedures.

B. **Samples:** Furnish pipe samples if requested by the CONSTRUCTION MANAGER. The OWNER may run tests on field samples following applicable ASTM specifications at an independent laboratory to verify the required physical properties and characteristics of supplied materials. The OWNER will pay for tests on liner material which meets specification requirements. CONTRACTOR shall pay for failed tests and retesting of failed materials.

PART 2 -- PRODUCTS

2.1 POLYETHYLENE LINER PIPE

A. Except as indicated below, polyethylene pipe shall be HDPE in accordance with SSPWC subsection 500-1.3.2, having the composition of SSPWC subsection 207-19.2, and having light color on the inside surface. Joints shall be butt heat fusion type.

B. Liner material shall be homogeneous, without defects. Cause for rejection includes physical defects of the polyethylene liner, such as concentrated ridges, discoloration, excessive spot roughness, pitting, visible cracks, foreign inclusions, varying wall thickness, and diameter variations greater than 5 percent due to temperature induced flattening.

C. The Standard Dimension Ratio (DR) and the outside diameter of liner shall be as indicated.

2.2 FIBER GLASS REINFORCED POLYESTER MORTAR LINER PIPE

A. Except as indicated below, centrifugally cast polyester mortar pipe shall be in accordance with SSPWC subsection 500-1.8.1.

B. Materials

1. Resin systems shall have demonstrated satisfactory performance for the proposed application. Designation according to ASTM D 3262 shall be Type 1, Liner 2, Grade 3.

2. Reinforcing glass fibers shall be the highest quality commercial grade glass filaments with binder and sizing compatible with the impregnating resins.

3. Fillers shall be silica sand or other suitable material.

4. Rubber gaskets shall comply with ASTM F 477.

5. The internal liner resin shall be suitable for sewer pipe service and shall be highly resistant to sulfuric acid produced by biological activity from hydrogen sulfide gases.

C. Joints shall be low-profile jacking or flush slip lining bell-and-spigot joints with elastomeric sealing gaskets to produce watertight joint. Joints shall conform to the requirements of ASTM D 4161.

D. Dimensions and Tolerances:

1. Supply pipe in nominal lengths of 20 feet, when possible. Where radius curves in existing pipe or limitations in entry pit dimensions restrict pipe to shorter lengths, use nominal sections of between 2-1/2 and 10 feet.

2. The liner pipe shall have the maximum outside diameter indicated on the drawings. Nominal size and actual outside diameter shall comply with Table 3 of ASTM D 3262.

3. The minimum wall thickness shall be the greater of (1) the indicated thickness or (2) the thickness recommended by the manufacturer to withstand pushing forces with a safety factor of 2.5. The actual thickness measured at any single point on the pipe shall not be less than 90 percent of the minimum thickness.

[4. Stiffness of the liner pipe shall satisfy design requirements for dead, live, and hydrostatic loads and maximum grout pressure of [12] psi (safety factor no less than 2)].

5. Ends of pipe shall be square to the pipe axis plus or minus 0.25-inch or plus or minus 0.5 percent of the nominal diameter, whichever is greater.

2.3 MANHOLE SEAL

A. A manhole seal between liner pipe and existing host sewer shall be formed with oakum strips soaked in Scotchseal 5600 as manufactured by 3M Corporation, or equal.

2.4 CLAMPS AND GASKETS

A. Clamps shall be stainless steel, including bolts and lugs as manufactured by JCM Industries, Type 108. Furnish full circle, universal clamp couplings with 1/4-inch thick grid gasket. Select clamps to fit outside diameter of liner pipe. Use minimum clamp width per the following table:

Liner Pipe O. D. (Inches)	Minimum Width of Clamp (Inches)
7.125	15
8.625	18
10.750 or greater	30

2.5 TELEVISION EQUIPMENT

A. **Pipe Inspection Camera:** In addition to the requirements of SSPWC subsection 500-1.1.5, add the following:

1. Camera system shall be pan and tilt type.

2. Tape shall be recorded at standard play.

B. **Videotape:** In accordance with the requirements of SSPWC subsection 500-1.1.5.

2.6 MANUFACTURERS, OR EQUAL

A. Polyethylene Liner

1. Chevron
2. Phillips 66 Driscopipe

B. Fiberglass Plastic Pipe

1. Hobas Pipe USA, Inc.

PART 3 -- EXECUTION

3.1 CLEANING AND PRELIMINARY INSPECTION

A. The CONTRACTOR shall clean the existing host pipeline and manholes according to SSPWC subsection 500-1.1.4.

3.2 TELEVISION INSPECTION

A. The CONTRACTOR shall perform pre-installation inspection immediately after cleaning and post-installation inspection according to SSPWC subsection 500-1.1.5. The purposes of inspection are to document the physical condition and cleanliness of the host pipe and to detect defective sliplining WORK.

3.3 DELIVERY, STORAGE, AND HANDLING

A. Prevent injury or abrasion to pipe during loading, transportation, and unloading. Do not drop pipe from cars or trucks, nor allow pipe to roll down skids without proper restraining ropes. Use suitable

pads, strips, skids, or blocks for each pipe during transportation and while awaiting installation in the field.

B. Pipe with cuts, gashes, nicks, abrasions, or any such physical damage which are deeper than 10 percent of the wall thickness shall be removed from the Site and be replaced with undamaged pipe at no additional cost to the OWNER.

3.4 DIVERSION PUMPING

A. Install and operate diversion pumping equipment to maintain sewage flow and to prevent backup or overflow.

B. Design all piping, joints and accessories to withstand twice the maximum system pressure or 50 psi, whichever is greater. A spare pump and piping shall be at the site, ready for use in case of a breakdown.

C. In the event of accidental spill or overflow, immediately stop the overflow and take action to clean up and disinfect spillage. Notify the CONSTRUCTION MANAGER.

3.5 POINT REPAIRS

A. The CONTRACTOR shall make point repairs at locations identified on the Drawings and where obstructions are detected by cleaning and pre-installation television inspection above. Point repairs directed by the OWNER at locations not identified in the Contract Documents will be added to the WORK of this Section by Change Order.

B. Pipe materials shall be the same type as the existing pipe. [Reinforced concrete pipe shall be in accordance with Section 02616.]

C. Excavation

1. Excavate according to Section 02200 the existing pipe at the point of obstruction to the minimum length known to require replacement. Determine the condition of the pipe by internal lamping at least 10 feet in both directions and further excavate any additional length to be replaced. Obtain approval from the CONSTRUCTION MANAGER before excavating beyond the minimum length.

2. Remove and replace failed pipe and pipe with obstructions, using Fernco couplings, matching the slope and grade of the existing pipe.

3.6 INSERTION OR ACCESS PITS

A. Locate pits so that the total number is minimized and footage of liner pipe installed in a single pull or push is maximized. Use excavations at point repair locations for insertion pits, where possible.

B. Perform excavation and backfill in accordance with requirements of Section 02200 - Earthwork.

C. Remove the top of the existing sewer down to the springline for a sufficient length for the method of insertion.

D. **Proving Mandrel:** Furnish a rigid, solid wall cylindrical mandrel with maximum length of two times the host sewer inside diameter and with outer diameter equal to the outside diameter of the proposed liner pipe. Pull the mandrel through the entire length of sewer to be sliplined. If the mandrel will not pass the entire length, note the location and pull the mandrel from the other and to define the entire length of the undersize pipe or obstruction. Excavate the undersize pipe, remove the crown down to the springtime on both sides, and enlarge the host pipe sufficiently that the liner pipe will reside in the lower half (invert to springline) after insertion.

3.7 POLYETHYLENE LINER INSTALLATION

A. **Preparation:** Connect a power winch cable to the end of liner by use of a suitable pulling head. Secure pulling head to liner and attach to power winch cable so that liner can be satisfactorily fed and pulled through the host sewer. Provide proper protection in insertion pit to prevent ragged edges of existing pipe from scarring liner pipe. Refer to insertion procedures given in ASTM F 585. Do not allow sand or other debris to enter the liner.

B. Joints:

1. Assemble sections of polyethylene liner pipe on site above the ground. Make joints by heating and butt-fusion method in strict conformance with manufacturer's instructions and ASTM D 2657.

2. Use operators who are trained and experienced with the butt-fusion method for pipe jointing in the field.

3. Form joints with a smooth, uniform double rolled back bead made while applying the proper melt, pressure, and alignment. Fabricate a sample joint from each machine before proceeding with the pipe joints. The CONTRACTOR shall visually evaluate each sample joint for bond continuity and test for impact resistance.

4. The maximum length of continuous liner which may be assembled above ground and pulled at any one time is 500 linear feet.

5. Prevent machine damage to liner or breakage of butt-fused joints. Allow sufficient time for liner to return to its normal length.

C. Pulling Liner:

1. Limit pulling force exerted on liner to that recommended by the manufacturer for the outside diameter and SDR of the liner.

2. Use a suitable line and pulling head arrangement so that pulling tension will not exceed the manufacturer's recommended value.

3. As an alternate, use of a measuring device, such as a spring gauge, may be permitted when approved in advance by the CONSTRUCTION MANAGER. Connect the device to pulling cable so that it registers the pulling force being exerted on liner. Do not exceed pulling force indicated above.

D. Alternate Installation Techniques. Pushing the liner as an insertion method or a combination of pulling and pushing may be used. Avoid liner buckling. Cut out and remove any portion damaged during insertion process.

3.8 FIBER GLASS REINFORCED POLYESTER PIPE INSTALLATION

A. FRP liner pipes may be pushed or pulled into the existing sewer. Insert the pipes, spigot end first, with the bell end trailing. Do not apply a jacking load to the bell fitting. Do not exceed safe jacking loads recommended by the manufacturer. Maximum allowable joint angular deflection shall be 2 degrees or manufacturer's recommended limit, whichever is lesser.

3.9 CLAMP INSTALLATION

A. Where excavations for liner insertion are made between two manholes, cut ends of the liner smooth, square to axis of the liner. Join liners with appropriately sized stainless steel universal clamp couplings.

3.10 ENCASEMENT

A. In excavations such as insertion pits where liner is not enclosed by existing host sewer, encase liner with Class [450-C-2000] trench backfill slurry in accordance with SSPWC subsection 201-1.1.2.

3.11 FIELD TESTING

A. After liner installation, perform a low pressure air test in accordance with Section 02730 before liner has been sealed in place at the manholes. Check integrity of joints that have been made and verify that liner has not been damaged by inserting it into host sewer. Repair using liner manufacturer's recommended procedures and retest for leaks.

3.12 GROUTING ANNULAR SPACE

A. Grout annular space between the outside diameter of liner and inside diameter of host pipe 18 inches nominal diameter and larger in accordance with Section 02721.

3.13 SEALING LINER IN MANHOLE

A. Allow 24 hours for liner pipe to normalize to ambient temperatures and recover from imposed stretch before cutting to fit between manholes, sealing at manholes, and manhole invert shaping.

B. Cut liner pipe so that it extends 4 inches into manhole.

C. Seal the annular space between liner and host pipe at each manhole with a chemical seal and nonshrink grout. Place a strip of oakum soaked in sealer in a band to form an effective water-tight gasket in the annular space between liner and existing pipes in manhole.

D. Make width of the sealing band a minimum of 12 inches or one-half the diameter of pipe, whichever is greater. Finish seal with a non-shrink grout placed around annular space from inside manhole. Apply grout in a band not less than 6 inches wide. Sealing method, including chemicals and materials, shall be approved by the CONSTRUCTION MANAGER.

E. Use Class 560-C-3250 concrete according to SSPWC subsection 201-1.1.2 to form a smooth transition with a reshaped invert and a raised manhole bench to eliminate sharp edges of liner pipe, concrete bench, and channeled invert. Build up and smooth invert of manhole to match flow line of new liner.

END OF SECTION