ITEM NO. 1100
SLIP-LINING SANITARY SEWERS

1100.1 **DESCRIPTION**: This item shall consist of slip-lining sanitary sewer pipe, which is accomplished by pulling or pushing liner pipe into existing sewers by use of mechanical or hydraulic equipment. Once in place, liner pipe is allowed time to normalize and is then cut to fit between manholes. Annular spaces between liners and existing sewers are sealed at each manhole. Manhole inverts and benches are reworked and reshaped. Existing sewers remain in operation during slip-lining process, with sewage flow diverted around operations in progress.

1100.2 **SUBMITTALS:** Contractor shall submit manufacturer's product data, instructions, recommendations, shop drawings, and certifications.

1100.3 **MATERIALS:**

1. Manufactures:

   a. Liner pipe systems shall be fiberglass reinforced plastic (FRP) or T-Lock Liner concrete pipe, as approved by SAWS.

   b. Acceptable manufacturer for FRP liner pipe: Shall conform to the specifications contained within the latest revision of SAWS' Material Specifications.

   c. Acceptable manufacturer for Amer-Plate T-Lock pipe: Ameron Protective Linings.

2. FRP Liner Pipe and Fittings:

   a. Pipe, joints and fittings: ASTM D 3262-11, Type 1, Liner 2, Grade 3.

   b. FRP Liner Pipe: Reinforced plastic mortar pipe manufactured by centrifugal casting process resulting in dense, nonporous, corrosion-resistant, consistent, composite structure. Minimum stiffness: 72 psi, measured in accordance to ASTM D2412-11.

Use with a stiffness of 72 psi where specified or shown in the contract documents.

c. Resin Systems: Thermosetting polyester epoxy resin, with or without filler, meeting ASTM D3262-11.

d. Reinforcing Glass Fibers: Commercial grade E-type glass filaments, with binder and sizing compatible with impregnating resins.

e. Filler: Sand with at least 98% silica content, and maximum moisture content of 0.2%.

f. Joints: Low-profile FRP jacking bell-and-spigot joints or flush bell and spigot joints, with elastomeric sealing gaskets for watertight joints meeting ASTM D4161-01(2010).

g. Dimensions and Tolerances:

(1) Pipe outside diameters and tolerances: Comply with ASTM D3262-11, Cast Iron Pipe Equivalent Outside Diameters, and table below.

(2) When possible, supply pipe in nominal lengths of 20 feet. Where radius curves in existing pipe or limitations in entry pit dimensions restrict pipe length, shorter lengths may be used. Engineer shall first approve of all proposed pipe joints that are shorter than 20 feet.

(3) Minimum FRP pipe outside diameters and minimum wall thicknesses:

Minimum Existing Sewer Nominal Diameter (inches)	Minimum Wall Liner O.D. (inches)	Minimum Wall Thickness 46 psi. Stiffness (inches)	Thickness 72 psi. Stiffness (inches)
21	19.50	0.42	0.48
24	21.60	0.46	0.53

30	25.80	0.54	0.63
36	32.00	0.66	0.77
42	38.30	0.78	0.91
48	44.50	0.90	1.05
54	50.80	1.02	1.19
60	57.10	1.14	1.33
66	62.90	1.26	1.47
72	69.20	1.38	1.61
78	75.40	1.50	1.75

(4) Fabricate pipe ends square to pipe axis plus or minus 0.25 inches, or plus or minus 0.5% of nominal diameter, whichever is greater.

h. Fittings:

(1) Flanges, elbows, reducers, tees, wyes and other fittings capable of withstanding operating conditions.

(2) Fabrication: Contact-molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays.

1. Liner Pipe Seals at Manholes:

a. Sealer for annular spaces between liner pipes and host sewers at manholes: Oakum strips soaked in Scotchseal 5600, as manufactured by 3M Corporation, or approved equal found in SAWS Material Specifications.

b. Non-Shrink Grout: Strong Seal's QSR patching material, or approved equal found in SAWS Material Specifications.

2. Clamps and Gaskets: Stainless steel, including bolts and lugs, as manufactured by JCM Industries (Type 108) or pre-approved equal. Furnish full circle, universal clamp couplings with at least 3/16 inch thick neoprene grid-type gaskets. Select clamps to fit outside diameter of liner pipe as follows:

Liner Pipe O.D.	Minimum Clamp Length

(Inches)	(Inches)
7.125	15
8.625	18
10.750 or greater	30

3. Bedding Material: Comply with Item No. 804, "Excavation, Trenching, and Backfill."

1100.4 CONSTRUCTION

1. Obstruction Removal and Point Repair: Make point repairs and remove obstructions, such as roots, rocks and other debris, prior to installing liner pipe. Inspector is to first validate the need for either an obstruction removal or point repair. Refer to Item No. 1103, "Point Repairs and Obstruction Removals."

2. Bypass Pumping: Refer to Item No. 864, "Bypass Pumping."

3. Insertion or Access Pits:

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

   b. Before excavating, check with various utility providers (e.g., CPS Energy, AT&T, Time Warner, etc.), and determine locations of utilities in or near the work area. Costs of utility repairs, temporary service and other costs arising out of damage to, or interruption of, utilities, resulting from operations under this Contract, shall be borne by Contractor at no additional cost to SAWS.

   c. Perform excavation and backfill in accordance with Item No. 804, "Excavation, Trenching and Backfill."

   d. Perform excavation requiring trench safety in accordance with OSHA standards and Item No. 550, "Trench Excavation Safety Protection."

   e. Install and operate necessary dewatering and surface water control measures.

4. FRP Liner Pipe Installation: FRP liner pipe may be pushed or pulled into existing sewers. Insert pipes, spigot end first, with bell end trailing. Apply pushing force to pipe wall end inside bell in accordance with manufacturer's instructions. Do not apply jacking loads to end of bell. Maximum allowable joint angular deflection is one degree.

5. Clamp Installation:

   a. Where excavations for liner pipe insertion are made between two manholes, cut ends of liner pipe smooth, square to pipe axis. Join liner pipes with appropriately sized stainless steel universal clamp couplings. Butt together gap between ends of liner pipe with space between ends not exceeding 2 inches.

   b. Bedding: As specified in Item No. 804, "Trench Excavation and Backfill."

6. FRP Collar/Closure: Install FRP collar closure pieces in accordance with manufacturer's recommendations.

7. Field Quality Control: After liner installation, perform the following tests:

   a. Service lateral connection test: After all service laterals have been completed for a particular sewer section, verify integrity of re-connections at points where they join liners and existing service lines by performing smoke test.

   b. Refer to Item No. 849, "Air and Deflection Testing for Sanitary Sewers," for applicable test procedures.

8. Sealing Liner in Manhole:

   a. Allow liner pipe to normalize to ambient temperatures and recover from imposed stretch before cutting to fit between manholes, sealing at manholes and shaping manhole invert. Allow at least 12 hours for normalization of polyethylene.

   b. Cut liner so it extends 4 inches into manholes. Make smooth, vertical cuts and slope areas over top of exposed liner using non-shrink grout.

c. Seal annular spaces between liner and sanitary sewer main at each manhole with chemical seal and nonshrink grout. Place strips of oakum soaked in sealer in a band to form effective water-tight gasket in annular space between liner and existing pipes in manhole. Make width of the sealing band at least 12 inches, or one-half pipe diameter, whichever is greater.

d. Finish seal liner pipe to host pipe with non-shrink grout placed around annular space from inside manhole. Apply grout in a band measuring at least 6 inches wide. Obtain the Engineer's approval of sealing methods, including seal chemicals and materials.

e. Use cementitious grout to form smooth transitions with reshaped inverts and raised manhole benches to eliminate sharp edges of liner pipe, concrete benches, and channeled inverts. Build up and smooth manhole invert to match flow line of new liner.

9. Grouting Annular Space:

a. Provide grouting plan and obtain approval of grouting plan fromInspector before proceeding with the Work.

b. Grout annular space between the outside of liner and inside of existing pipe for sewer pipe diameters 18 inches and larger, in accordance with Item No. 1101, "Slip-lining Grout."

10. Post-Installation Video Recording: Provide the Inspector with a NASSCO-(PACP) standard video, recorded in MPEG-1 format and written to a DVD, showing completed work, including condition of restored connections. Comply with Item Nos. 849, "Air and Deflection Testing for Sanitary Sewers," 866 "Sewer Main Television Inspection," and 868, "Sewer Main Cleaning." The DVD shall include good sound quality and identification of area being videoed, to include cross streets references, addresses, time and date. Each DVD shall be marked with the name and contract number, name of Contractor, and a description and location of view being recorded. The video shall include usage of an inclinometer, noting the slope at which the main was installed.

11. Final Cleanup: Upon completion of installation and testing, clean and restore project area affected by work of this Section. No separate pay item.

1100.5 MEASURMENT AND PAYMENT:

1. Measurement for slip-lining is on a linear foot basis for installed liner pipe, measured from center line of upstream manhole to center line of downstream manhole. Depth range for payment is based on depth measured at sewer main from natural ground level to flow line of sanitary sewer for each pipeline segment.

2. Insertion pits, access pits, clamp installation, embedment (bedding, haunching and initial backfill), field quality control (testing), sealing liner at manholes, grouting annular space, building up, shaping and reworking manhole inverts and benches, and pre-installation and post-installation cleaning and television inspection of completed work are included in slip-lining unit price and not paid for separately.

3. Excavations initially begun as obstruction removals or point repairs which the Contractor later decides to use as insertion pits are considered as insertion pits and not paid for separately.

4. Trench safety systems, well pointing and other applicable bid items associated with insertion pits will be paid for at their respective contract unit prices.

- End of Specification -