PART 1 GENERAL

1.1 SCOPE:

A. This item shall include all work and materials to install, insert a flexible polyester felt liner saturated with a thermo-setting resin into the existing sewer line for rehabilitation purpose.

B. When complete, the cured liner should extend from end to end in a continuous, tight fitting, watertight pipe-with-in-a-pipe. All service laterals shall be restored to leak-free condition at their connections to the liner, and be leak-free over their lengths to respective property lines.

C. The Contractor shall furnish, prior to use of the lining materials, satisfactory written guarantee of his compliance with the Specifications for all materials used in the Insituform® process furnished by others than Insituform® of North America, Inc.

D. Should the Contractor choose to submit a deviation that does not meet all the requirements of the Owner's specifications, he shall include a description of the deviation with data showing the engineering aspects of the deviation. Acceptance of such deviations shall be subject to the approval of the Engineer.

PART 2 PRODUCTS

2.1 INSITUFORM LINER:

A. The lining material shall be polyester fiber felt tubing lined on one side with an impermeable 3-ml minimum thickness membrane, such as polyurethane or polyvinyl chloride (PVC). It shall be fully impregnated with the liquid thermosetting resin required.

B. The tubing shall be properly sized to the diameter and length to be lined. The finished lining material thickness shall be as shown on the Plans. The cured lining material shall conform to the minimum structural standards listed below:

TABLE B-1

LINER MATERIAL TEST	STANDARD	RESULT
Tensile Strength	ASTM D 638	3,000 psi
Flexure Strength	ASTM D 790	3,000 psi
Modulus of Elasticity	ASTM D 790	300,000 psi

PART 3 EXECUTION

3.1 GENERAL:

A. The Contractor shall designate a location where the uncured resin in original containers and the unimpregnated liner will be vacuum impregnated prior to installation. The Contractor shall provide for the Engineer's inspection of the materials and "wet-out" procedure. A resin and catalyst system compatible with the requirement of this method shall be used. The quantities of the liquid thermosetting materials shall be sufficient to provide saturation of the lining thickness shown on the Plans.

B. Preparatory to lining any sewer reach, the users of the sewer shall be notified of the work; the pipe shall be cleaned per SECTION 6200 "Sanitary Sewer Pipe Installation" paragraph 3.5. The structural repairs and/or other work designated on the Plans shall be completed; and the flow shall be diverted in such a way that overflow of the upstream sewer is avoided, while eliminating all flow in the reach to be lined.

C. All preparations shall be completed to the Owner's satisfaction prior to beginning to insert the liner into the sewer. Once the insertion phase is begun, the work shall be carried through to completion without delay or interruption until all service reconnections are completed.

D. As part of his preparatory responsibilities, the Contractor shall ensure that no other work is simultaneously in progress upstream or downstream of his operations which may adversely affect the successful completion of his work.

3.2 SCHEDULING:

A. The work shall be so scheduled and conducted such that the liner insertion water service interruption begins between the hours of 7 p.m. and 9 p.m. or 8 a.m. and 10 a.m.

B. Users of the sewer reach to be lined shall be notified in writing 48 hours in advance of service interruption. The notice shall include the following items:

1. Day and date of service interruption.
2. Estimated time, in hours, water service will be shut off.
3. Estimated time, in hours, sewer service will be turned off.
4. Approximate time service interruption will begin.

C. A written record of these notifications shall be maintained by the Contractor and turned over to the Engineer.

D. The water service interruption shall not exceed eight hours and the sewer service interruption shall not exceed an additional one-half-hour per connection.

E. The water service shall be turned off only by the Owner and shall be phased with the liner insertion such that its discontinuance time for each user is minimized. The Contractor shall restore the water service as soon as the liner is cured.

F. Each user shall be notified verbally when water and sewer service is restored again.

3.3 SEWER CLEANING AND CLEARING:

A. The sewer shall be cleared of all obstructions such as solids, dropped joints, protruding service connections, or collapsed pipe that will prevent insertion of the liner or prevent it from obtaining a circular cross section when completed.

B. Obstructions that cannot be removed by conventional cleaning equipment shall be removed by excavating a repair pit. Prior to commencing the work, the Contractor shall obtain the Engineer's written approval for any work not shown on the Plans by necessary to achieving a quality product.

C. Television reports and tapes are available for review by the Contractor. Structural failures requiring repair prior to lining installation are noted on the Project Plans.

3.4 SEWER REPAIRS:

A. Where shown on the Plans or approved by the Engineer, excavate a repair trench, remove the defective mainline sewer pipe, and construct new sewer per SECTION 6200. The inverts of the new and existing pipe shall match at each end of the repair.

B. The Owner, at no cost to the Contractor, will inspect the new sewer by videotape. Any mis-alignments and/or grade deficiencies will be repaired at the expense of the Contractor.

3.5 FLOW CONTROL:

A. The Contractor shall at all times provide for the flow of sewage around the reach, or reaches, of pipe to be lined. The by-pass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent capacity and size handle the flow.

B. In rare situations it may be permissible to plug the upstream manhole without pumping the flow around the reach to be lined. Such a condition will be shown on the Plans or approved in witting by the Engineer prior to the work.

3.6 INSTALLATION:

A. The wet-out liner material shall be inserted through and existing manhole and fully extended to the next designated manhole. The inversion head shall be adjusted to sufficient height to extend the liner from manhole to manhole, to hold the liner snug to pipe wall, and to produce dimples at side connections and flared ends at the manholes. Care shall be taken not to over stress the felt fiber at the elevated curing temperatures that may cause damage or failure of the liner prior to cure.

B. CURING OF THE LINER:

1. After insertion is completed, the Contractor shall uniformly raise the water temperature in the entire liner above the temperature required to effect a cure of the resin as determined by the resin\catalyst system employed. The liner shall be held under positive head pressure until the resin has cured and attained the physical strengths specified in the materials section.

2. Water temperature in the line during the cure period shall not be less than 150^0F or more than 200^0F as measured at the far end of the lower quadrant (invert).

3. The cure period shall be of a duration recommended by the resin manufacturer during which time the recirculation of the water to maintain the temperature in the liner within the temperature range will be continued.

C. COOL DOWN OF THE LINER:

1. The Contractor shall cool the hardened liner to a temperature below 100^0F before relieving the static head. Care shall be taken in the release of the static head such that a vacuum will not be developed that could damage the newly installed liner.

2. While the liner is cooling, water services shall be restored to the users, and they shall be instructed to limit its use until the sewer service is reconnected.

3.7 SEALING LINER IN MANHOLES:

A. If due to broken or misaligned pipe at the manhole wall, lining 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 liner.

3.8 SERVICE RECONNECTION:

A. After the liner has been cured, the Contractor shall restore the existing service connections. The services shall have a smooth invert and capacity shall be restored to a minimum of 90 percent of the original.

B. Service laterals shall be lined to the property line.

3.9 MEASUREMENT AND PAYMENT:

A. LINER - Payment will be made at the contracted price bid per linear foot of specified Insituform® Liner supplied to and installed at the project site, including all royalties, fees and taxes chargeable to the Contractor for the work.

B. BY-PASS - Payment will be made at the contracted lump sum price for flow control, including mobilization, notifications to sewer users, by-pass pumping, testing, and cleanup and any ancillary items of work essential to proper and effective performance of the work.

C. SERVICE RECONNECTION - Payment for service reconnection to the cured liner shall be at the unit price bid for each reconnection authorized regardless of the method used and shall cover all labor, equipment, and materials employed to accomplish the work, complete.

D. SEWER POINT REPAIRS - Payment for repairs to the existing sewer pipe where called for on the Plans shall be made at the contracted prices for the various applicable items of work listed in the Proposal. Said items may include any or all of the following: common trench excavation and common or granular backfill, pavement removal and replacement, sanitary sewer pipe/bedding, tee and wye fittings, shoring sheeting, and bracing, etc. Incidental to and included in these costs shall be all work necessary to provide the Owner with a videotape of all repair work.

E. TV INSPECTION: Payment for TV inspection and digital deliverables will be paid by LS as indicated in the Bid Proposal.

PART 4 TESTING

4.1 INSPECTION:

A. The finished lining shall be continuous over the entire length of an insertion run between two manholes and be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. The lining shall be impervious and free of any leakage from the pipe to the surrounding ground or from the ground to inside of the lined pipe.

B. Any defects visible during the warranty period which will affect the integrity or strength of the lining shall be repaired at the Contractor's expense, in a manner mutually agreed by the Owner and the Contractor.

4.2 HYDROSTATIC TESTING AND TELEVISION INSPECTION:

A. The water tightness of the liner shall be tested in accordance with SECTION 6200 "Sewer Pipe Installation", Hydrostatic Testing, as the liner is cured. The Contractor will conduct a TV inspection of the work after the liner is installed and tested and the services have been restored at no expense to the Contractor.

B. Contractor shall provide a digital TV inspection of the finished product in the current format of the City Maintenance Division requirements.

END OF SECTION