

## SECTION 1

### CURED-IN-PLACE PIPE LINER

#### PART 1 GENERAL

##### 1.01 SCOPE OF WORK

Furnish all labor, materials, equipment, and incidentals required and install and test cured-in-place pipe (CIPP) lining and appurtenances complete as specified herein.

It is the intent of this specification to provide for the reconstruction of sewers by the installation of a resin-impregnated flexible felt tube inserted or inverted into the existing pipe using hydrostatic pressure. Curing shall be accomplished by an approved method that shall produce a hard, corrosion resistant, composite pipe with no annular space between the cured-in-place pipe and the existing sewer.

The CONTRACTOR will be responsible for the CIPP lining of sewer lines on an as needed basis starting October 1, 2015 and ending June 30, 2018. The City of Lowell (CITY) will supply the CONTRACTOR with written work schedules. The work schedule will include as much work as is currently available to be completed. There is no guarantee as to the minimum amount of work per proposed work schedule. A substantial portion of the work will include the installation and testing of CIPP lining in cross-country sewer lines with limited access.

##### 1.02 RELATED WORK

- A. Sewer line and manhole cleaning is included in Section 2.
- B. Television Inspection of sewers is included in Section 3.
- C. Removal of protruding taps is included in section 4.
- D. Maintenance of flow in existing sewers and drain is included in Section 5.

##### 1.03 SUBMITTALS

- A. Submit to the CITY.
  - 1. Shop drawings and schedules of all CIPP liner and appurtenances required. Submit structural design calculations and specification data sheets listing all parameters used in the liner design and thickness calculations based on Appendix XI of ASTM F1216. All calculations shall be prepared under and stamped by a Professional CITY registered in the Commonwealth of Massachusetts.
  - 2. Proposed method and procedures to be used in curing the liner including but not limited to curing schedule and recommended cool down procedure.

3. Submit to Lowell Regional Wastewater Utility (LRWWU) a detailed written plan of the method of flow maintenance and noise prevention measures ten days in advance of flow interruption.
4. The name of the liner manufacturer, the location of the facility where the liner was manufactured, and a list of materials to be furnished.
5. Certified test reports from the manufacturer that the liner for this Contract was manufactured and tested in accordance with the ASTM Standards specified herein.
6. Method for restoring active services including procedure for locating services, equipment to be used, and qualifications of field personnel.
7. Proposed method for sealing out infiltration at restored services and at pipe to manhole connections.
8. The CONTRACTOR performing the CIPP lining work shall be fully qualified, experienced and equipped to complete this work expeditiously and in a satisfactory manner. Submit the following information for review and approval before any CIPP lining work is performed:
  1. The number of years of experience in performing this type of specialized work.
  2. The name of the CIPP lining manufacturer and supplier for this work and previous work listed below. The CONTRACTOR shall be an approved installer as certified and/or licensed by the CIPP liner manufacturer.
  3. A list of municipal clients that the CIPP CONTRACTOR has performed this type of work for without defects or performance problems for a period of 5 years after installation.
    - a. The list shall contain names and telephone numbers of persons to be called to verify previous satisfactory performance.
    - b. A full description of the actual work performed.
    - c. The list of municipal clients and description of projects shall include the approximate liner footage (lf) of lining work completed. Provide a sufficient number of references to total 50,000 lf or more of lining work completed to date.
9. Qualifications of the CONTRACTOR as described in Section 1.05A below.

#### 1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
  1. ASTM D543 - Test Method for Resistance of Plastics to Chemical Reagents.
  2. ASTM D638 - Test Method for Tensile Properties of Plastics.
  3. ASTM D790 - Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

4. ASTM D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
  5. ASTM F1216 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.
  6. ASTM F1743 – Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP).
- B. Where reference is made to one of the above standards, the revision in effect at the time of the bid opening shall apply.

#### 1.05 QUALITY ASSURANCE

- A. The CONTRACTOR shall also be capable of providing crews as needed to complete the work without undue delay and shall begin work within 30 days from receiving a CITY supplied work schedule unless otherwise agreed upon by both the CONTRACTOR and CITY.
- B. The CITY shall approve or disapprove the CONTRACTOR and/or manufacturer based on the submitted information and a follow up interview.
- C. The CIPP liner shall be provided by a single manufacturer. The supplier shall be responsible for the provision of all test requirements specified herein as applicable. In addition, all liner to be installed under this Contract may be inspected at the plant for compliance with these specifications by an independent testing laboratory provided by the CITY, at his own expense. The CONTRACTOR shall require the manufacturer's cooperation in these inspections. The cost of plant inspection will be the responsibility of the CITY.
- D. Inspection of the liner may also be made by the CITY. The liner shall be subject to rejection at any time on account of failure to meet any of the requirements specified, even though sample liner may have been accepted as satisfactory at the place of manufacture. Liner rejected after delivery shall be marked for identification and shall be removed from the job site at once.

#### 1.06 DELIVERY, STORAGE AND HANDLING

- A. Care shall be taken in shipping, handling and storage to avoid damaging the liner. Extra care shall be taken during cold weather construction. Any liner damaged in shipment shall be replaced as directed by the CITY.
- B. Any liner 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. While stored, the CIPP shall be adequately supported and protected. CIPP shall be stored in a manner as recommended by the manufacturer.

#### 1.07 GUARANTEE

- A. All lining work shall be fully guaranteed by the CONTRACTOR and manufacturer for a period of one year from the date of acceptance. During this period, all serious defects discovered by the CITY shall be removed and replaced in a satisfactory manner at no additional cost to the CITY. The CITY may conduct an independent television inspection, at his own expense, of the lining work prior to the completion of the guarantee period.

PART 2 PRODUCTS

2.01 MATERIALS

- A. The CIPP lining shall be a resin-impregnated, flexible polyester felt, or equivalent material tube which is inserted into the sewer to be rehabilitated and cured -in-place by an acceptable curing method. The tube shall have a suitable membrane coating for protection of the interior surface and to provide a uniform, smooth flow surface. When cured, there shall be no film or plastic membrane between the existing inner sewer surface and the resin filled felt liner. The resin shall be a polyester type liquid thermosetting resin and shall be suitable for the design conditions as well as the curing process. The CIPP shall provide a service life of 50 years and shall have the minimum structural properties listed below.

<u>Mechanical Property</u>	<u>Minimum Standard</u>
Flexural Strength	4,500 psi
Flexural Modulus of Elasticity	250,000 psi

- B. The felt content of the liner shall be determined by the CONTRACTOR, but shall not exceed 25 percent of the total impregnated liner volume.
- C. When cured the liner shall form a continuous, tight fitting, hard, impermeable liner that is chemically resistant to chemicals found in domestic sewage and which provides the maximum available abrasion resistance.
- D. The liner shall be fabricated to a size that when reformed will tightly fit the sewer being rehabilitated. Allowance for longitudinal and circumferential expansion shall be taken into account when sizing and installing the liner. All dimensions shall be field verified by the CONTRACTOR prior to delivery of the liner.
- E. The length of the liner shall be that deemed necessary by the CONTRACTOR to effectively carry out installation and seal the liner at the inlet and outlet of each manhole. All lengths shall be verified by the CONTRACTOR prior to construction.
- F. The CONTRACTOR shall be responsible for ensuring that the correct liner is installed in each sewer being rehabilitated.
- G. The thickness of the cured liner shall be as determined by the CONTRACTOR in the design calculations submitted under Paragraph 1.03 of this Section. The actual cured liner thickness shall be +/- 5 percent of the approved design thickness and shall not include the thickness of the inner liner.

- H. The CIPP shall be designed, fabricated, and installed for the actual conditions encountered for this application, in accordance with the applicable provisions of ASTM F1216, and shall meet the following minimum design conditions:
  - 1. AASHTO H-20 live load with one truck passing.
  - 2. Soil Weight 120 pounds per cubic foot. Coefficient of friction  $K_u=0.130$ .
  - 3. Estimated maximum groundwater level at ground surface.
  - 4. Fully deteriorated pipe with 2 percent (min.) ovality. If ovality of existing pipe is found to be worse, use actual percent up to 5 percent (max.).
  - 5. Soil Modulus 1,000 psi.
  - 6. Factor of Safety = 2
- I. The liner shall be manufactured and installed by Insituform Technologies, Inc., St. Louis, MO or equal.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Clean each length of pipe to be lined and dispose of any resulting material as specified in Section 02650, Sewer and Manhole Cleaning.
- B. Conduct a video inspection of each length of pipe to be lined in accordance with Section 02651 to determine if the existing conditions are suitable for the use of the proposed lining and to document the location of all service connections. The CONTRACTOR shall determine, which service connections are active or plugged by visually inspecting the connection with the video camera. The CONTRACTOR shall dye test to verify all active service connections, if necessary. The resulting video inspections and reports shall be submitted to the CITY on DVD format.
- C. The CONTRACTOR shall remove and replace sections of existing sewer manholes for installation access as required. The manholes shall be restored equal to their original conditions as approved by the CITY.
- D. All service connections protruding into the sewer to be lined shall be cut or ground down (from inside the mainline sewer) so as to be flush with the pipe to be lined prior to liner installation (Specification Section 02654).
- E. All mineral deposits shall be removed to allow smooth installation of CIPP lining at the direction of the CITY.
- F. The CONTRACTOR shall provide bypass pumping of sewage flows in accordance with Section 01510 during rehabilitation work.
- G. Notify all property owners who discharge sewage directly into the sewer to be lined that their sewage service will be discontinued while the liner is being installed. Notify each affected

property owner at least 72 hours in advance of commencement of the work, giving the date, start time and time when service will be completely restored. Also provide a telephone number which property CITYs can call for information during the work.

- H. The hydrostatic head and/or steam pressure used during the installation process shall be sufficient to hold the liner tight to the pipe wall, producing dimples at all service connections, and flared ends at the two access manholes. The same pressure shall be great enough to overcome or prevent infiltration from entering the pipeline during the curing process.
- I. For each length of liner installed, remove specimens of at least 24-in length for testing of flexural properties. The specimens shall be cut from a section of installed and reformed liner at an intermediate point or the termination point of the installation.
- J. The installed liner shall be cured by circulating hot water or steam through the resin impregnated tube. Ambient curing shall not be allowed. Curing and cool down of the liner shall be in strict accordance with the manufacturers recommendations. CONTRACTOR is responsible for infiltration/groundwater control. Curing process should account for extraneous infiltration. CONTRACTOR is responsible for any lining defects attributed to insufficient curing due to infiltration.
- K. All cutting and sealing of the liner at manhole connections shall provide watertight pipe and manhole trough seals. All cut edges of the cured liner shall be thoroughly sealed with the same resin as was used in the liner. The catalyst or hardener used shall be compatible with the resin/catalyst used in the liner previously, but shall not require an external heat source to begin the exothermic reaction (curing).
- L. Reopen all of the existing active service connections in each length of sewer following installation of the liner. The active service connections shall be reopened from inside the sewer by means of a television camera controlled cutting device appropriate for the liner material and the rehabilitated sewer pipe. All of the liner penetrations or openings shall be watertight. Each active service connection shall be cut completely open and shall have smooth edges with no protruding material capable of hindering flow or catching and holding solids contained in the flow stream. Service connections shall be pressure tested and sealed with chemical grout following completion of the lining (paid for under Item 24).
- M. Seal all liner terminations at the existing manholes. All terminations shall be free from infiltration and exfiltration. The CONTRACTOR shall utilize isophytic rubber or other materials to provide the seal.
- N. Following installation of the liner and reopening of the service connections, conduct a final video inspection of the completed work. Copies of these video inspections and the video inspections made prior to the liner installation shall be submitted to the CITY on an approved format.
- O. The CONTRACTOR is responsible for obtaining all necessary permits.

### 3.02 FIELD TESTING

- A. Hydrostatic testing (exfiltration test) of the completed liner shall be performed after liner curing and cool down in accordance with ASTM F1216. Hydrostatic testing shall be performed prior to reinstatement of the active services.

- B. Groundwater infiltration of the liner shall be zero.
- C. All active service connections shall be open, clear and watertight.
- D. All pipe to manhole connections shall be watertight and free of infiltration.
- E. There shall be no evidence of splits, cracks, breaks, lifts, kinks, delamination or crazing in the liner.

### 3.03 CERTIFICATION TESTING

- A. The CONTRACTOR shall provide sufficient specimens from each length of CIPP lining installed to allow an independent laboratory to conduct their separate tests for each of the flexural properties of the liner as specified below. The specimens shall be cut from each installed liner at an intermediate point, the termination point or from the downtube after the liner has been cured and cooled. Each specimen shall be clearly marked to indicate the installed location of the liner, the date of installation, the pipe diameter and the resin used.

The following tests shall be performed for each length of CIPP lining installed.

1. Short-Term Flexural (Bending) Properties - The initial tangent flexural modulus of elasticity and flexural yield strength shall be measured in accordance with ASTM D790.
- B. Copies of the test results shall be sent directly to the CITY by the laboratory. The certified results shall report the actual test results for each of the properties being tested.
  - C. Each individual reported value shall meet or exceed the value of that property as specified in Section 2.01 or as used in the design calculations, whichever is higher.
  - D. All the expenses for the certified testing of the CIPP lining furnished under this contract shall be paid for by the CONTRACTOR.

### 3.04 ACCEPTANCE

- A. Acceptance of the liner shall be based on the CITY's evaluation of the installation, including video inspections and review of certified test data for the installed pipe samples.
- B. If any defective liner is discovered after it has been installed, it shall be removed and replaced with either a sound liner or a new pipe at no additional cost to the CITY.

END OF SECTION

## SECTION 2

### SEWER LINE AND MANHOLE CLEANING

#### PART 1 GENERAL

##### 1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to perform high pressure water jetting of designated sewer lines and manholes prior to internal inspection by closed circuit television, and cured-in-place lining operations.

##### 1.02 RELATED WORK

- A. Television Inspection of Sewers is included in Section 3.
- B. Removal of protruding taps is specified in Section 4.
- C. Maintenance of sewer flow is included in Section 5.
- D. Cured-in-place pipe lining is included in Section 1.

#### PART 2 PRODUCTS

##### 2.01 EQUIPMENT

- A. High Velocity Jet (Hydrocleaning) Equipment
  - 1. All high velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 degrees to 45 degrees in all size lines to be cleaned. Equipment shall also include a high velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a long distance solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps and hydraulically driven hose reel. All controls shall be located so the equipment can be operated above ground.

#### PART 3 EXECUTION

##### 3.01 PREPARATION

- A. Selection of cleaning equipment shall be based on the conditions of the sewer lines at the time the work commences. The equipment and methods selected shall be acceptable to the CITY, however acceptance of proposed method of cleaning does not relieve the CONTRACTOR of his responsibility to adequately clean the pipe and manholes to allow performance of other work. The CONTRACTOR shall use high pressure water jetting equipment wherever possible.

##### 3.02 PERFORMANCE

- A. Each designated sewer manhole section shall be cleaned using high velocity jet equipment. The equipment selected for cleaning shall be capable of removing dirt, grease, rocks, sand and other deleterious materials and obstructions from the sewer lines and manholes. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted. If successful cleaning cannot be performed from the second manhole, or the equipment fails to traverse the entire length between manholes, it will be assumed that a major blockage exists and the cleaning effort shall be abandoned. Blockages or any structural differences from the existing TV inspection, if any, shall be reported to the CITY immediately.
- B. During all sewer cleaning operations, satisfactory precautions shall be taken to protect the sewer lines from damage that might be inflicted by the improper use of cleaning equipment. Whenever hydraulically propelled cleaning tools which depend upon water pressure to provide their cleaning force or any tools which retard the flow of water in the sewer line are used, precautions shall be taken to ensure that the water pressure created does not cause any damage or flooding to public or private property being served by the manhole section involved. The flow of sewage in the sewer lines shall be used to provide necessary pressures for hydraulic cleaning devices whenever possible. When additional quantities of water from fire hydrants are necessary to avoid delay in normal working procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed so as to prevent its use in case of a fire in the area served by the hydrant, nor shall a hydrant be used for the purpose described unless a vacuum break is provided. The CITY must be notified and the proper fire hydrant permit must be obtained prior to the opening of any fire hydrants.
- C. All sludge, dirt, sand, rocks, grease and other solid or semisolid residue, debris, and material resulting from cleaning operations shall be removed at the downstream manhole of the section of sewer being cleaned. Passing material from manhole section to manhole section which could cause line stoppages, accumulations of sand in wet wells, or damage to pumping equipment shall not be permitted.
- D. All debris, residue and other materials resulting from cleaning operations shall be removed from the site at the end of each workday and shall be disposed of in an approved manner at the LRWWU Duck Island Treatment Facility. Under no circumstances will the accumulation of debris, residue, etc., on the site of Work beyond the stated time be permitted, unless prior written authorization is given for storage in totally enclosed containers.
- E. The CONTRACTOR shall not be responsible for heavy sewer line cleaning or root removal. The CITY will perform any necessary heavy sewer line cleaning or root removal prior to the CONTRACTOR starting the work. Heavy cleaning includes the removal of any debris which cannot be removed with the standard equipment specified in this section. This includes the use of any necessary mechanical and hydraulic equipment, such as bucket and power rodding machines. The determination between normal and heavy cleaning will be made by the CITY.

### 3.03 FIELD TESTING

- A. Acceptance of sewer line cleaning shall be contingent on satisfactory completion of the television inspection. If television inspection shows the cleaning to be unsatisfactory, the sewer line shall be re-cleaned and re-inspected until the cleaning is shown to be satisfactory.

END OF SECTION

## SECTION 3

### TELEVISION INSPECTION

#### PART 1 GENERAL

##### 1.01 SCOPE OF WORK

- A. All field locations of designated sewer pipe rehabilitation, including sewer services, shall be verified by television inspection prior to starting any sewer rehabilitation work.
- B. Each designated pipe section shall be visually inspected by means of closed-circuit television. The inspection shall be done one sewer line section (i.e. manhole to manhole) at a time and the section being inspected shall be suitably isolated from the remainder of the sewer system as required.
- C. Each designated sewer (i.e., manhole to manhole) identified for lining shall be inspected by television for acceptance.
- D. Video recordings shall be made of the television inspections and copies of both the video recordings and printed inspection logs shall be supplied to and retained by the CITY.

##### 1.02 RELATED WORK

- A. Removal of protruding taps is specified in Section 4.
- B. Maintenance of sewer flow is included in Section 5.
- C. Cured-in-place pipe lining are specified in Section 1.
- D. Sewer Line and Manhole Cleaning is included in Section 2.

#### PART 2 PRODUCTS

##### 2.01 EQUIPMENT

- A. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. The camera shall be operative in 100 percent humidity conditions. The television camera shall be equipped with a pan and tilt head. The camera, television monitor and other components of the video system shall be capable of producing a minimum 500-line resolution video picture. Picture quality and definition shall be to the satisfaction of the CITY and if unsatisfactory, equipment shall be removed and no payment made for an unsatisfactory inspection.
- B. All television work shall be video recorded in an approved format as the work is being conducted.

## PART 3 EXECUTION

### 3.01 PROCEDURE

- A. The camera shall be moved through the line in either direction at a uniform rate, stopping when necessary to ensure proper documentation of the sewer's condition but in no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire sewer line section, the equipment shall be removed and repositioned in a manner so that the inspection can be performed from the opposite manhole. Obstructions caused by protruding taps shall be removed as specified in Section 02654.
- B. Whenever non-remote powered and controlled winches are used to pull the television camera through the line, telephones, radios, or other suitable means of communication shall be set up between the two manholes of the sewer line being inspected to ensure that good communications exist between members of the crew.
- C. The accuracy of the measurements cannot be stressed too strongly. Measurement for location of defects shall be below ground by means of a meter device. Marking on cable, or the like, which would require interpolation for depth of manhole, shall not be allowed. Measurement meters shall be accurate to two-tenths of a foot over the length of the sewer line section being inspected. Accuracy of the measurement meters shall be checked daily above ground by use of a walking meter, roll-a-tape, or other suitable device.

### 3.02 RECORDING OF FIELD OBSERVATIONS

- A. Television Inspection logs
  1. Printed location records shall be kept which shall clearly show the location, in relation to adjacent manholes, of each source of infiltration discovered. In addition, other data of significance including the locations of building and house service connections, along with an estimation of infiltration from such services, joints, unusual conditions, roots, storm sewer connections, cracked or collapsed sections, presence of scale and corrosion, sewer line sections that the camera failed to pass through and reasons for the failure and other discernible features shall be recorded and a copy of such records shall be supplied to the CITY.

### 3.03 RECORDING OF TELEVISION INSPECTIONS

- A. General
  1. The CONTRACTOR shall submit to the CITY, two copies of digital recordings (images and video) of the pipeline television inspections and summary data in DVD format. The label shall correspond to a schedule of every sewer reach contained on the DVD.
  2. The digital recordings shall be in accordance with NASSCO PACP. The software used for the digital recordings shall have the capability of performing multiple summaries, queries, and analysis. The software shall also have the capability of recording, digitizing and storing

single frames of video images and full time live video, as well as collecting, storing and printing pipe line inspection data for display and report generation.

3. Video Capture

- a. Full time live color video and audio files shall be captured for each pipe inspected. The files shall be stored in industry standard MPEG (Moving Pictures Expert Group) format and can be transferable by DVDR to an external personal computer that utilizes standard MPEG viewers. The MPEG video shall be defined as ISO-MPEG Level 1 (MPEG-1) coding with a resolution of 352-pixel (x) by 240-pixel (y) and an encoded frame rate of 29.97 frames per second. The recordings shall identify the location both within the pipe segment (physical location) and within the digital recording (video frame location) for each defect or observation. Video recording shall be at the same speed that it was recorded.
- b. The digital recordings and inspection data shall be cross-referenced to allow instant access to any point of interest within the digital recording. A user defined, pipeline search mechanism shall be provided.
- c. The video inspection shall include segment information (start and ending manholes, station footage, date, time, client, address, etc.). A pointer shall be provided from each observation to the digital recording and any accompanying digital still images.

END OF SECTION

## SECTION 4

### REMOVAL OF PROTRUDING SEWER TAPS

#### PART 1 GENERAL

##### 1.01 SCOPE OF WORK

- A. Furnish all equipment, labor and materials necessary to internally remove protruding taps in those sewers scheduled to be rehabilitated by cured-in-place pipe lining.
- B. Remove all taps that interfere with the cured-in-place lining.
- C. Remove only those taps that protrude sufficiently to interfere with the lining process.
- D. Where possible, removal of protruding taps shall be completed before sewer line cleaning and TV inspection is conducted. Where this is not possible, the CONTRACTOR shall ensure that the sewer is clean of all dirt and debris before sewer joint testing and sealing is begun.
- E. The CONTRACTOR shall maintain wastewater flows as required in Section 01510 at all times during performance of this work.
- F. Dirt and debris caused by protruding tap removal shall not be allowed to enter the wastewater flow and be carried to downstream reaches. This material shall be removed and properly disposed.

##### 1.02 RELATED WORK

- A. Maintenance of sewer flow is included in Section 5.
- B. Cured-in-place pipe lining is specified in Section 1.
- C. Sewer Line and Manhole Cleaning is specified in Section 2.
- D. Television inspection of sewers is specified in Section 3.

#### PART 2 PRODUCTS

##### 2.01 EQUIPMENT

- A. Protruding taps shall be removed using an internal, remote-controlled intruding pipe remover. Excavation and replacement of protruding taps will not be allowed except under special situations authorized by the CITY.
- B. The equipment shall consist of a main body containing a rotating head assembly equipped with carbide cutting edges. The rotating cutting head shall be driven by air or by electricity and shall be capable of cutting concrete, vitrified clay pipe or other materials commonly used for pipe construction with the exception of cast iron or steel.

- C. The equipment shall be pulled through the sewer using winches and a cable set up between adjacent manholes.
- D. If necessary, the equipment shall be accurately positioned using a TV camera in conjunction with the cutter assembly.

### PART 3 EXECUTION

#### 3.01 PERFORMANCE

- A. The CONTRACTOR shall remove all protruding taps from sewers to receive cured-in-place pipe lining.
- B. The CONTRACTOR shall maintain a complete record of all taps that were removed, and furnish two (2) copies of this record at the completion of the testing and sealing portion of this project.
  - 1. The list shall show the date, sub-area, street, sewer reach (by manhole numbers), station and location (left, right or top) of each tap removed.
  - 2. The list shall also show similar data for any taps that were not successfully removed, as well as the reason why removal was unsuccessful.
- C. The CONTRACTOR shall protect existing sewer lines and service connections from damage caused by improper use of the equipment.
  - 1. Damage to a sewer or service connection caused by removal of a tap shall be repaired immediately, as directed by the CITY, at the CONTRACTOR's own expense.
- D. The CONTRACTOR shall remove all dirt and debris from the sewer following completion of tap removal in that reach.

END OF SECTION

## SECTION 5

### MAINTENANCE OF FLOW IN EXISTING SEWERS AND DRAINS

#### PART 1 GENERAL

##### 1.01 SCOPE OF WORK

- A. CONTRACTOR shall be responsible for maintaining wastewater and storm drainage flow in all public and private pipes during construction including individual house service connections. The CONTRACTOR shall man all bypass pumping systems during non-working hours, 7 days per week.
- B. Provide all labor, equipment, power and materials necessary to maintain flow in existing sewers (including individual house services), drains and manholes, and handle existing wastewater and stormwater flows. Construct and maintain all temporary bypass sewers and drains and be responsible for all bypass pumping of sewage and drainage that may be required to prevent backing up of sewage or drainage during installation of all new pipe and manhole and catch basin structures and to allow proper inspection and testing of the new Work. The CONTRACTOR shall immediately remove and dispose of all offensive matter spilled during the bypass pumping at his own expense. Note that some pipes have a continuous base flow and some sewers are force mains, which must be handled.
- C. When bypass pumping is required, the CONTRACTOR shall supply pumps, conduits, power, and other equipment to safely divert the flow of sewage or drainage around the section in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flows plus additional flows that may occur during a rain event. The CONTRACTOR shall determine the minimum bypass system capacity for each street assuming non-surcharged full pipe flow and manning coefficient of  $n=0.013$  and using the existing pipe sizes and inverts shown on the plans.
- D. The CONTRACTOR shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. Standby pump(s), of equal or greater capacity than the largest pump utilized, shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.
- E. Bypass pumping system shall be capable of bypassing the flow around the work area and of releasing any amount of flow up to full available flow into the work area as necessary for satisfactory performances of work.
- F. The CONTRACTOR shall be required to repair at his own expense any damage to property, public or private, caused by his operations.
- G. The CONTRACTOR shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, or damage to sewer, and that will protect public and private property from damage and flooding.
- H. Wastewater flows from existing sewers shall not be allowed to enter the new facilities, unless specified or approved by the CITY, until the new facilities have been cleaned and tested as required in the Specifications.

- I. Should damage of any kind occur to the existing drains or sewers, the CONTRACTOR shall at his own expense make repairs to the satisfaction of the CITY.
- J. The CONTRACTOR shall not be permitted to overflow, bypass, pump or by any other means convey drainage to any brook or water course without permission of the CITY.
- K. Work area open trenches for sewer pipe shall not be used for bypassing flows. Work area open trenches for drainage pipe shall not be used for bypassing flows, unless otherwise directed by the CITY.
- L. Sewage shall be bypassed only to existing sewers, as directed by the CITY.
- M. The CONTRACTOR shall perform leakage and pressure test of the bypass pumping discharge piping using clean water prior to actual operations. The CITY will be given 24-hour notice prior to testing.
- N. The CONTRACTOR is responsible for locating any existing utilities in the area the CONTRACTOR selects to locate the bypass pipeline. The CONTRACTOR shall locate his bypass pipelines to minimize any disturbances to existing utilities and shall obtain approval of the pipeline locations from the CITY. The CONTRACTOR shall pay all costs associated with relocating utilities and obtaining all approvals.
- O. The installation of the bypass pipelines is prohibited in all wetland areas, unless given prior approval from the CITY. The pipeline must be located off streets and sidewalks and on shoulders of the roads. When the bypass pipeline crosses local streets and private driveways, the CONTRACTOR may be required to bury the bypass pipelines. Upon completion of the bypass pumping operations, and after the receipt of written permission from the CITY, the CONTRACTOR shall remove all the piping, restore all property to pre-construction condition and restore all pavement. The CONTRACTOR is responsible for obtaining any approvals for placement of the temporary pipeline within public ways from the City.

## 1.02 SUBMITTALS

- A. All procedures for maintaining flows must meet the approval of the CITY and the CONTRACTOR shall be required to submit to the CITY, for approval, a detailed written plan of all methods of flow maintenance ten (10) days in advance of flow interruption, in accordance with Section 01300.
- B. The plan shall include but not limited to details of the following:
  - 1. Number, size, material, location and method of installation of suction piping;
  - 2. Number, size, material, method of installation and location of installation of discharge piping;
  - 3. Bypass pump sizes, capacity, number of each size to be on site and power requirements;
  - 4. Standby power generator size, location;
  - 5. Downstream discharge plan;

6. Calculations for selection of bypass pumping pipe size;
  7. Schedule for installation of and maintenance of bypass pumping lines;
  8. Plan indicating location of bypass pumping line.
- C. Submit name(s) of proposed restoration/cleanup companies to be used in the event of sewer backups into homes or businesses caused by CONTRACTOR work operations.

1.03 RELATED WORK

- A. Submittals are included in Section 01300.
- B. Connections to and work on the existing gravity system is included in Section 02658.

END OF SECTION

## SECTION 6

### TRAFFIC REGULATION

#### PART 1 GENERAL

##### 1.01 REQUIREMENTS

- A. The CONTRACTOR shall furnish, install, operate and maintain equipment, services and personnel, with traffic control and protective devices, as required by an accepted traffic plan from the City Traffic Engineer.
- B. The CONTRACTOR shall submit to the CITY a traffic plan, done in accordance with the Lowell Traffic Engineer, detailing all temporary changes in traffic control equipment, street or road closures, detours, etc. The plan shall address the coordination with other contractors working within the area of work. No work shall commence until this plan has been reviewed and approved by the CITY. After approval, copies of this plan shall be submitted to the Lowell Regional Wastewater Utility (LRWWU). The CONTRACTOR shall make every effort to adhere to this plan. When necessary, the CONTRACTOR shall update this plan and forward these changes to the CITY and the City agencies for approval. The CITY reserves the right to modify the plan through the course of the Contract.
- C. The CONTRACTOR shall remove temporary equipment and facilities when no longer required and restore grounds to original or to specified conditions.
- D. The CONTRACTOR shall notify all property CITYs in writing at least 48 hours in advance of any work that will interfere with access to their residence or place of business.
- E. No road shall be closed to traffic without the prior consent of the CITY, the Lowell Public Works and Lowell Regional Wastewater Utility and the Lowell Police Department.
- F. Traffic control, including but not restricted to signing and devices, shall be provided for all openings in roads by the CONTRACTOR in accordance with City and State standards.

##### 1.02 MINIMUM REQUIREMENTS OF THE TRAFFIC PLAN

- A. Traffic plan shall provide for access to all buildings including businesses and parking areas at all times.
- B. Plan shall illustrate traffic detours as approved by the Lowell Public Works and Lowell Regional Wastewater Utility, location, type and size of signage.
- C. Plan shall include schedule for traffic control in relation to construction.

END OF SECTION

SECTION 7  
POLICE DETAILS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. All necessary policing will be coordinated and supplied by the CITY. The CITY will arrange, documentation, and pay the costs of police required for traffic control.
- B. The intent is to insure public safety by police direction of traffic. Police are not to serve as watchmen to protect the Contractor's equipment and materials, or to warn pedestrians of such hazards as open trenches.
- C. Nothing contained herein shall be construed as relieving the Contractor of any of his/her responsibilities for protection of persons and property under the terms of the Contract.

END OF SECTION

## SECTION 8

### HEALTH, SAFETY, AND EMERGENCY PROCEDURES

#### PART 1 GENERAL

##### 1.01 SCOPE OF WORK

- A. It is the intent of this specification to ensure the general health and safety of contractors, workers and the public conducting maintenance and construction activities within the City of Lowell (CITY).
- B. The CONTRACTOR shall notify all applicable local and state agencies and appropriate utilities prior to the onset of work. The CONTRACTOR must also notify Dig Safe at 811 or 888-DIG-SAFE.
- C. The CONTRACTOR shall comply with all OSHA safety regulations (specifically 29 CFR 1926 and 1910). Additionally, the CONTRACTOR shall be knowledgeable of and compliant with the Lowell Regional Wastewater Utility Confined Space Entry Program and Lock-Out Tag-Out LO/TO procedures.
- D. The CONTRACTOR shall provide fences, barriers, warning lights, signs CITY provided police officers, and any other safety features as may be necessary for the protection of the public. These precautions shall apply particularly to open excavations and structures.
- E. Where the CONTRACTOR performs work on any public roads or thoroughfares, he shall first obtain approval from the CITY and then perform his work in accordance with all CITY requirements. He shall be responsible for maintaining traffic control with flagman, signs, CITY provided police, etc. If roads are to be disturbed, he shall maintain the work until such time that he restores the road base and surface to the satisfaction of the local controlling government agency, in accordance with the specifications herein or as detailed on the approved plan.
- F. The CITY retains the right to immediately cease work at any time if proper safety protection standards are not being maintained.

END OF SECTION