

## **CITY OF FORT SMITH SUPPLEMENTAL SPECIFICATION DIVISION 700 - SANITARY SEWER SYSTEM**

**DIVISION 700**, of the Standard Specifications for Public Works Construction, February 2008 Edition, is hereby deleted in its entirety and replaced with the following **DIVISION 700** which includes **SECTIONS 701 through 709 and SECTION 711**:

:

### **SECTION 701 CLEANING AND CLOSED CIRCUIT TELEVISION (CCTV) INSPECTION**

#### **701.01 SCOPE OF WORK**

The work specified in this Section includes furnishing all necessary labor, materials, equipment, services and incidentals required to properly clean and visually inspect, by means of color closed-circuit television (CCTV), all proposed sewer sections, including, but not limited to, all recording and playback equipment, materials and supplies.

Cleaning shall include proper pressure water jetting, rodding, root cutting, bucketing, brushing and flushing of sewers and manholes prior to inspection by CCTV, pipeline rehabilitation or replacement, point repairs, manhole preparation, and testing operations.

The goal of cleaning is to remove debris, roots, intruding services, deposits, and other blockages to a minimum of 95 percent open. Contractor shall perform sewer cleaning work to an acceptable level as necessary to perform a thorough CCTV inspection of sewer. If the pipe condition is such that cleaning may cause a potential collapse, then the pipe shall be televised without cleaning, pending approval by Owner or Engineer.

The Engineer will designate the location of all manhole access points. Unless specified by the Owner, the Contractor shall be responsible for providing all traffic control barricades, signage and flaggers as necessary to access all manhole entry points. See Section 120.

The Contractor shall coordinate all water meter devices with the City of Fort Smith's Meter Department, at 3900 Kelley Highway. The meter shall be installed by the City. The Contractor is responsible for all deposits and service charges for the use of the City's meter, including service fees when the meter is moved. The Contractor is responsible for providing all piping, hoses and connections to use the water.

The Contractor shall properly dispose of all debris removed from the pipe at the City of Fort Smith Landfill, 5900 Commerce Road, Fort Smith. Tipping fees are the responsibility of the Contractor. Any hazardous waste material encountered during this project will be considered as a changed condition.

Each designated sewer section shall be inspected by means of a CCTV camera. The inspection will be done one section at a time and the section being inspected will be suitably isolated from the remainder of the sewer line as required.

Digital recordings shall be made of the CCTV inspections. Two (2) copies of the recordings and printed inspection logs shall be supplied to the Engineer. The Engineer shall provide one (1) copy to the Owner.

## **701.02 SUBMITTALS**

All submittals must be approved by the Engineer unless otherwise noted. The Contractor shall submit the following items for approval:

- A. **SAFETY PLAN.** Prior to performing any on-site work, the Contractor shall submit a safety plan that includes the following at a minimum:
  - (1) Confined Space Entry Procedures
  - (2) Personal Protective Equipment
  
- B. **CERTIFICATIONS.** A copy of all certifications must be submitted to the Engineer. The Contractor evaluating and reporting pipeline defects must be certified through the Pipeline Assessment and Certification Program (PACP) and Manhole Assessment and Certification Program (MACP) as administrated by the National Association of Sewer Service Companies (NASSCO).
  
- C. **CLEANING METHODS.** Proposed cleaning methods and equipment for all sizes of sewer lines and all flow diversion procedures shall be submitted to the Engineer.
  
- D. **TRAFFIC CONTROL PLAN.** Proposed traffic control plan shall be submitted to the Owner. All traffic control plans shall comply with the requirements in Section 120.
  
- E. **WORK SCHEDULE.** Two (2) copies of a work schedule showing the planned cleaning and inspection reaches shall be submitted to the Engineer, which will be updated weekly. The Engineer shall provide one (1) copy to the Owner.
  
- F. **CLOSEOUT DOCUMENTS.**
  - (1) Two (2) copies of the completed sewer inspection reports, digital recordings, photos, and other data must be submitted to the Engineer. Engineer shall provide one (1) copy to the Owner.

- (2) CCTV inspection logs shall be kept by the Contractor and will 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, sags, collapsed sections, presence of scale and corrosion and other discernible features will be recorded and a copy of such records will be supplied to both the Owner and Engineer.
- (3) Video recordings of the data on the television monitor shall be made by the Contractor and copies of which, on an external storage device acceptable to the Utility Department, shall be provided to the Owner. Recordings shall be labeled in such a way to indicate Owner's project number and name, date of CCTV inspection, segment number of line, Contractor's name, and whether pre-installation or final inspection CCTV recording (or both).

### **701.03 QUALITY ASSURANCE**

Contractor shall have a minimum of three (3) years of experience in sewer line and underground structure cleaning. The Contractor shall submit a list of at least three (3) customers who have had similar work completed. The Contractor shall furnish trained and qualified technicians with proper experience to operate all equipment to be used on this project.

The Contractor shall provide sufficient cleaning and inspection equipment, including standby units, to complete all sewer cleaning and inspections within the designated contract time. The Contractor shall allow the Owner or Engineer to become familiar with the Contractor's monitoring and recording equipment before commencement of work.

The Contractor shall provide at all times a competent field supervisor on site who is in charge of the cleaning and inspection. Engineer must be notified of any changes to the field supervisor role. Any change of supervision must also be approved by the Owner or Engineer prior to the change. The field supervisor shall be responsible for the safety of all site workers and site conditions, as well as ensuring that all work is conducted in conformance with these specifications and to the level of quality specified.

### **701.04 CLEANING**

- A. **CLEANING TYPES.** Normal cleaning (included in pre-CCTV): Cleaning accomplished using water jets to scour and remove debris, grease, light roots, etc. from pipe and manhole in 1 to 3 complete passes of the nozzle. This Work shall be classified as light hydraulic cleaning that shall be performed in conjunction with the repair, rehabilitation, pre-construction and post-construction inspections, etc. of existing or new sewer pipe as specified herein.

- B. **HEAVY CLEANING.** Cleaning accomplished using water jets or other mechanical means, to scour and remove debris, mineral deposits, removal of roots larger than fine roots (as defined by PACP), hardened grease, and debris from pipe and manhole in 4 or more complete passes of the nozzle. Heavy Cleaning also includes trimming of intruding sealing ring material, and the trimming of protruding lateral and/or service pipes that extend into the sewer line segment, using a robotic cutter specifically designed for this purpose.
- C. **CLEANING EQUIPMENT.** Hydraulic Sewer Cleaning Equipment: Equipment used shall be of a movable dam type and be constructed so that a portion of the dam may be collapsed at any time during cleaning operation to protect against flooding of sewer. Movable dam shall be same diameter as pipe being cleaned and shall provide flexible scraper around outer periphery to ensure total removal of grease. If sewer cleaning balls or other such equipment which cannot be collapsed instantly are used, take special precautions against flooding of sewers and public or private property.
- D. **GENERAL.** During sewer cleaning operations, satisfactory precautions shall be taken in use of cleaning equipment. When hydraulically propelled cleaning tools (which depend upon water pressure to provide their cleaning force) or tools which retard flow in sewer line are used, precautions shall be taken to ensure that water pressure created does not damage or cause flooding of public or private property being served by sewer.

It is preferred that sewer cleaning shall take place in an order of downstream to upstream. If cleaning is done in a downstream pipe segment in order to facilitate overall cleaning operations, any downstream segments requiring additional cleaning shall be re-cleaned at no additional cost to Owner, after pipes upstream of that segment have been cleaned.

If cleaning of an entire section cannot be successfully performed from one manhole, equipment shall be set up on other manhole and cleaning again attempted. If, again, successful cleaning cannot be performed or equipment fails to traverse entire manhole section, it will be assumed that a major blockage exists. The line shall be CCTV inspected to determine the cause of blockage. With the Engineer's approval the cleaning effort shall be repeated with other types of Utility Department approved equipment. Immediately report any blockages to Owner or Engineer.

No fire hydrant shall be obstructed by unattended equipment.

Remove piping and related equipment from fire hydrant meters at end of each work day. Fire hydrant meters shall only be removed by the Utility Department.

- E. **PERFORMANCE.** Pre-construction CCTV inspection shall be conducted by Contractor and use to evaluate conditions of manholes and sewer lines to select appropriate cleaning scope and equipment.

Contractor shall provide appropriate screening to prevent passage of materials into downstream sewers. Sludge, dirt, sand, rocks, grease, and other solid or semisolid residue, debris, and material resulting from cleaning operations shall be removed at downstream manhole of section of sewer being cleaned.

Debris, residue, and other materials resulting from cleaning operations shall become property of Contractor and shall be removed from site at end of each workday and shall be disposed of in accordance with Section 701.01.

Obtain video proof of heavy cleaning by acquiring a 'before' video of accessible portions of obstructed reach; submit to Owner or Engineer along with completed inspection. A submerged camera does not justify a need for heavy cleaning; proof that submergence was due to a blockage or heavy debris and not a sag in the line will be required.

Flushing of sanitary sewers to facilitate cleaning activities without the capture of solids and debris is expressly prohibited.

Retrieval of equipment lodged in pipes or a wet well is Contractor's responsibility and shall be performed at Contractor's expense.

#### **701.05 CLOSED CIRCUIT TELEVISION INSPECTION (CCTV)**

The Contractor shall inspect sewer pipelines with pan, tilt and zoom conventional television imagery to record relevant pipeline features and defects.

- A. **CCTV EQUIPMENT.** The camera shall be mounted on a tractor or skid such that the central axis of the camera is aligned with the central longitudinal axis of the sewer pipe. The camera shall be kept upright while moving through the sewer.

The camera light head shall include a high-intensity side viewing lighting system to allow illumination of internal sections of lateral sewer connections. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe for a distance of 30 feet ahead of the camera. The lighting system shall minimize reflective glare and be of adjustable intensity.

The camera lens shall be capable of rotating 360 degrees and turning at least 240 degrees (pan and tilt) and of proper height to allow inspection of the sewer, service lateral connections, manhole structure (including cone section and corbel), and all defects. The radial view camera shall be solid-state color and have remote control of the rotational lens. Cameras incorporating mirrors for viewing sides or using exposed rotating heads will not be allowed. The camera lens shall be an auto-iris type with remote controlled manual override.

The camera shall have a minimum resolution of 600 lines and shall be operative in 100 percent (100%) humidity conditions. Camera shall be operative in 100% humidity conditions, have a minimum 10X optical zoom lens, and have a footage counter that indicates travel distance to 1/10 of a foot. The camera shall provide a digital video image with a minimum of 470 H lines of resolution, and a minimum 3.1 megapixel digital photo image, suitable for recording on a digital storage device.

- B. **CCTV OPERATION.** Perform all CCTV inspection using personnel who are trained and certified (current standing) in the use of NASSCO's Pipeline and Assessment Certification Program (PACP) and Manhole Assessment and Certification Program (MACP).

Move the camera through the line in either direction (direction versus flow must however be noted) at less than or equal to 30 feet per minute rate, stopping at all service locations and when necessary to permit proper documentation of the construction features and pipe condition. 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.

Do not float the camera unless permitted by the Owner or their designated representative.

Obstructions that cause a stuck camera are the responsibility of the Contractor, and the retrieval of equipment or cameras is the responsibility of the Contractor and will be performed at the Contractor's expense.

If pre-installation video (CCTV) inspection reveals an obstruction in the existing sewer (heavy solids, dropped joints, protruding service laterals, protruding utility lines, or collapsed pipe) which cannot be removed by conventional sewer cleaning equipment, the Contractor shall remove the obstruction with the Owner or Engineer's approval. Obstruction removal shall be performed by digging an obstruction elimination pit and removing by point repair. Collapsed pipe shall be replaced by pipe replacement or by other measures as approved by the Owner or Engineer.

The camera must be stopped at all service laterals and pan at such an angle that an internal view of the service lateral is available. Digital photographs must be made of every service lateral or deficiency observed in the sewer line and the photograph itself must contain a brief description of the issue. The descriptions must also be noted in the inspection condition record within the database. All digital photos must be cataloged in the CCTV database and linked to the specific length along the inspection via linkage to the defect record in the database.

Provide a complete CCTV inspection for the upstream and downstream manholes in accordance with MACP. The CCTV operator shall pan and zoom up the manhole from the invert for each manhole, and obtain the best possible image of the manhole including

cone and corbel sections. In addition, 3 still digital photos shall be taken for each pipe connection within each manhole. The CCTV operator shall zoom in on each pipe connection so the photos capture each pipe connection's size, location, and approximate elevation.

If, during the inspection operation, the television camera will not pass through the entire pipe section due to obstruction, set up the CCTV equipment so that the inspection can be performed from the opposite manhole. Reverse setups must be noted in the CCTV database submittal in a separate database field to indicate that the inspection was performed in the reverse direction of flow.

- C. DATA DELIVERY. The Contractor shall provide all recording and playback equipment for real-time monitoring of CCTV inspection. The digital inspection files shall be provided to the Owner or Engineer in an external storage device acceptable to the Utility Department.

CCTV videos shall be submitted in one continuous video section from manhole to manhole, and not in multiple files, unless specifically approved by Owner.

If the data is available, the Owner will provide the Contractor information on the location of known active laterals and cleanouts; however, this list may not be interpreted as all-inclusive. The Contractor shall be responsible for verifying active customer service connection prior to rehabilitation. The Contractor shall compare the service connections from the CCTV video with above ground measurements. Any discrepancies between the CCTV data and above ground measurements of laterals shall be brought to the attention of the Owner or Engineer for a determination of lateral reinstatements. If the Contractor discovers an error or addition to the list provided, the Contractor shall notify the Owner or Engineer for additional investigation. Upon completion of the rehabilitation work, a list of all service laterals abandoned or reconnected as part of the work shall be submitted to the Owner in .PDF format. The compiled list shall include the following information:

- (1) Location of each service lateral based on the CCTV inspection logs. Location shall include both accurate distance measured from the wall of starting manhole as well as a notation (by clock-reference) of where on the circumference of the pipe, the service lateral connects.
- (2) Status (Active or Inactive)
- (3) The address of each customer and associated active lateral location

Note in the CCTV database the status of identified laterals as active or inactive. CCTV database information shall include location of each service lateral based on CCTV inspection logs, accurate distance measured from the centerline of the starting manhole

wall as well as the notation (by clock-reference) of where on the circumference of the pipe the service lateral connects in accordance with PACP.

All lateral connections must be identified as reestablished or abandoned in post rehabilitation CCTV. Contractor to provide a digital photo (in '.jpg' file format) at the location of the lateral connection even if lateral connection has been abandoned.

If pre-installation video (CCTV) inspection reveals a sag in the existing sewer that is greater than 1/4 of the existing pipe's diameter or causes the CCTV camera lens to be underwater and is not identified on the Drawings, the Owner or Engineer should be notified to determine if the sag is acceptable or if repair is required. When a sag repair is required, the Contractor shall take the necessary measures to eliminate these sags by pipe replacement, by digging a sag elimination pit and bringing the bottom of the pipe trench to a uniform grade in line with the existing pipe invert, or by other measures as approved by the Owner or Engineer.

#### **701.06 SEWER INSPECTION SOFTWARE**

All software shall be capable of providing complete survey reports in compliance with current PACP standards and the software shall be the latest version of the PACP compliant software available from the software vendor for the particular software package used by the Contractor.

The PACP defect and construction codes shall be pre-programmed in the certified NASSCO CCTV software and grouped in accordance with PACP.

The software shall be capable of customization with the ability to modify or add to the pipeline condition and group them for ease of use.

The footage reading from the camera equipment shall be automatically entered into the database and shall directly correspond to the noted defect location throughout the pipe graphic and tabular reports generated.

All NASSCO PACP mandatory fields and any additional available fields requested by the Owner or his representative shall be populated during the inspections.

The software shall maintain a database of underground pipe and manhole assets referencing the pipe and manhole structure asset identifier codes provided in GIS format by the Owner in accordance with PACP and Utility Department standards. The pipe segment information shall be entered prior to the actual survey based on the numbering convention provided by the Owner. Surveys for pipes found not to be included in the Owner's GIS database will be numbered. The software shall also have the capability to import and export survey results in the current NASSCO PACP Exchange digital format and to manage the database to meet the specifications herein.



## **701.07 DATA DELIVERY REQUIREMENTS**

Contractor shall submit in electronic format digital videos, digital photographs, databases in PACP Exchange format, and evaluation reports to Owner.

If digital photos and videos are of such quality that Owner is unable to evaluate the condition of the sanitary sewer main, locate the sewer service connections, or verify the cleaning, then the Contractor shall be required to CCTV the sanitary sewer and provide new digital photos and videos of good quality, at no additional cost to Owner.

All digital photos and videos will become the property of Owner.

Data is to be delivered to Engineer for review prior to starting any construction. Sections of a single segment of sewer main shall not be delivered on more than one submittal item. Video footage of recorded segments shall be grouped by area and shall be submitted in sequential order relating to the areas agreed upon by the Engineer. Throughout the duration of the project, should the Engineer discover inaccuracies in any of the videos, Contractor shall re-inspect those segments at no additional cost to the Owner.

Contractor shall provide inspection database data in the most current version of PACP Exchange format. The data shall specifically include video indexing for all observations including a direct linkage to Owner's GIS database features (manholes and pipe segments using Owner's numbering convention) and the electronic video and still image files delivered with each delivery data set. Data to be submitted shall include: 1) NASSCO PACP exchange database file, 2) still images of all defects in .jpg image format, 3) .mpg video inspection files for each pipe segment. Files shall be named in accordance with the Owner's requirements provided and agreed to in writing prior to commencing any work.

The CCTV equipment/software shall be capable of producing digital still images of all sewer line defects, and sewer line service connections in .jpg image format. Contractor shall take digital still images of each defect, construction features and service connections to clearly depict it. The screen captures or digital images shall include an onscreen display with date, sewer main reach number, footage, and type of defect/PACP Code. The filename of each .jpg shall be in accordance with this specification.

A final, compiled version of the inspection database in PACP Exchange format must be delivered at the end of the project. The final database must include all inspection records previously delivered in the individual inspections as well as incorporate all requested changes by the Owner. The database filename will use the following format using upper case letters:

- (1) For Contractors:

P\_ABC\_1600C1\_YYYYMMDD.MDB

Where P = PACP database; ABC = Contractor name code, 1600C1 = Contract Number (ex. Contract 16-01-C1), and YYYYMMDD = 8 digit date.

- (2) For Developers:

P\_ABC\_XXXXX\_YYYYMMDD.MDB

Where P = PACP database; ABC = Developer name code, XXXXX = Permit Number, and YYYYMMDD = 8 digit date.

All database inspection records must be linked to the Owner's unique pipe numbering system which is based on the upstream and downstream structure numbers for the pipe end structures (manhole, outfall, cleanout, etc.). The unique pipe identifier must take the form of UPSTREAM STRUCTURE NUMBER followed by DOWNSTREAM STRUCTURE NUMBER separated by a colon (:). For example: S008-2510:S008-2500 would be the pipe between structure numbers S008-2510 and S008-2500. These values will be provided within the Owner's GIS database however, if additional intermediate structures are located the naming convention described below must be used.

During the inspection work, if a previously unknown manhole not shown in the GIS is found, the letter "A" will be added to the end of the upstream manhole ID (no spaces or special characters allowed) to form a new manhole ID in the inspection records. The data / video files shall then be re-named to include the new manhole ID, and a new CCTV inspection shall be started from the new manhole ID. If more than one unnamed manhole is found between two named manholes, subsequent new manhole IDs will be formed using the letters "B", "C" etc. Individual and final deliverables must include database records that link to the Owner's GIS database using unique manhole identification numbers per the Owner's standard manhole identification number (Facility\_ID field in the Owner's GIS) format. The newly located manholes must be documented on a printed map showing the location relative to the existing known up and downstream structures.

Example file names for pipe segments that may be encountered while performing sanitary sewer CCTV inspections include:

Example file name for pipe segment between an Upstream structure and Downstream structure:

- (1) S008-2510\_S008-2500\_YYYYMMDD.MPG

Where S008-2510 = the upstream structure ID, S008-2500= the downstream structure ID, and YYYYMMDD = 8 digit date.

There may be situations that require Contractor to televise an individual pipe segment from more than one direction, i.e. the camera is only able to televise 75% of the segment heading downstream, and the remaining 25% is televised heading upstream. The name of additional

database files etc. produced in these circumstances shall be that unique upstream structure ID followed by the unique downstream structure ID followed by “\_1”, “\_2” etc.

Examples:

- (1) Initial file name: S008-2510\_S008-2500\_YYYYMMDD.MPG
- (2) Additional file name(s): S008-2510\_S008-2500\_YYYYMMDD\_1.MPG

Where S008-2510 = the upstream structure ID, S008-2500= the downstream structure ID, YYYYMMDD = 8 digit date, 1 = a subsequent video of the same sewer ID).

The direction of camera pull versus the pipe flow must be noted in the inspection record in the database.

The name of each digital still image shall be based on the video / data file name of the sewer reach in which the image was taken. The name shall be recorded as follows:

Examples:

- (1) S008-2510\_S008-2500\_YYYYMMDD\_HSV-37\_YYYYMMDD\_2.jpg
- (2) S008-2510\_S008-2500\_YYYYMMDD\_1\_MCU-113YYYYMMDD\_7.jpg

Where S008-2510 = the upstream structure ID, S008-2500= the downstream structure ID, HSV and MCU are PACP defect codes, 37 and 113 are the footage counts for the defect locations along the pipe, YYYYMMDD is the 8 digit date, and 2 and 7 are the sequential defect photo numbers along the pipe.

Contractor shall provide a digital summary in Microsoft Excel or Access formats that lists the contents of each delivery of required data. Each delivery must include:

- (1) A single CCTV inspection database in PACP format containing the inspection results for the agreed upon delivery area.
- (2) Digital video records corresponding only to the inspections delivered in the above database.
- (3) Digital photographs of significant features or issues noted during each inspection as specified herein.

At the end of the Project, Contractor shall provide a digital summary listing of all videos provided under this Project in Microsoft Excel or Access formats as well as a final inspection database containing the combined inspection records from all previous deliveries.

#### **701.08 ACCEPTANCE**

Acceptance of sewer line cleaning shall be contingent on satisfactory completion of television CCTV inspection. If television CCTV inspection shows cleaning to be unsatisfactory, sewer line shall be re-cleaned and re-inspected until cleaning is shown to be satisfactory at no additional cost to the Owner.

#### **701.09 OVERFLOWS OR SPILLS**

It shall be the responsibility of the Contractor to schedule and perform the contract work in a manner that does not cause or contribute to incidences of overflows, spills of sewage from the sewer systems, or backup of sewage flow into public or private services/property. In the event that work activities contribute to overflows, spills or backups, the Contractor shall immediately notify the Owner and take all appropriate actions to contain and stop the overflow or backup, clean the spillage, and disinfect the area affected.

The Contractor will indemnify and hold harmless the Owner and Engineer for any fines or third-party claims for personal or property damage arising out of a spill, overflow or backup that is the responsibility of the Contractor, including but not limited to legal, engineering and administrative expenses of the Owner in defending such fines and claims.

#### **701.10 MEASUREMENT AND PAYMENT**

- A. **CCTV SEWER MAIN.** CCTV of the existing sewer pipe of the specified size shall be measured in place on a linear foot basis to the nearest foot. Measurement shall be along the horizontal centerline of the pipe with no deductions for manholes and shall be from wall of manhole to wall of manhole. CCTV of the existing sewer pipe shall include, but not be limited to providing all equipment, materials and labor for inspecting the sewer pipe in accordance with NASSCO PACP standards prior to acceptance; maintenance of flow in existing sewers including bypass pumping and plugs; furnishing and creating copies of the inspections on external hard drives to be delivered to the Owner and Engineer; creating copies of inspection logs to be delivered to the Owner and Engineer; and all else incidental thereto for which separate payment is not provided under other Items.
- B. **NORMAL CLEANING.** Normal cleaning shall be measured by the actual number of linear feet of pipe cleaned as approved by the Owner or Engineer. Pipe shall be measured in place along the centerline of the pipe from the center of manhole to center of manhole of each pipe. Measurement shall be to the nearest tenth of a foot of the actual footage of what was cleaned. Normal cleaning of the existing sewer pipe shall be paid for the

respective quantities as determined at the Contract unit price bid. This price and payment shall be full compensation for locating existing manholes, the removal, transportation, and disposal of debris within the sewers in accordance with these Specifications, for obtaining water, maintenance of flow in existing sewers including bypass pumping and plugs necessary cleaning, and all else incidental thereto for which separate payment is not provided for under other Items.

- C. **HEAVY CLEANING.** Heavy cleaning shall be measured by the actual number of linear feet of pipe cleaned as approved by the Owner or Engineer. Pipe shall be measured in place along the centerline of the pipe from the center of manhole to center of manhole of each pipe. Measurement shall be to the nearest tenth of a foot of the actual footage of what was cleaned. Heavy cleaning of the existing sewer pipe shall be paid for the respective quantities as determined at the Contract unit price bid. This price and payment shall be full compensation for locating existing manholes, the removal, transportation, and disposal of debris within the sewers in accordance with these Specifications, for obtaining water, maintenance of flow in existing sewers including bypass pumping and plugs necessary for heavy cleaning and all else incidental thereto for which separate payment is not provided for under other Items. Pre-CCTV must be performed before Heavy Cleaning payment will be allowed.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
CCTV Sewer Main (Size)	LF
Normal Cleaning	LF
Heavy Cleaning	LF

## **SECTION 702 NEW SANITARY SEWER LINES**

### **702.01 SCOPE OF WORK**

This work shall consist of furnishing all labor, materials, tools, equipment, incidentals, testing and construction methods required to install all gravity sanitary sewer pipe, service pipe, and fittings including sewer testing; cleaning; and collecting GPS data at services; complete and accepted, in accordance with the Contract Documents.

Excavating, trenching, backfilling and sewer appurtenances are specified in Section 205.

### **702.02 QUALIFICATIONS AND SUBMITTALS**

All pipe shall be manufactured by an established manufacturer having at least three (3) years of experience in successfully manufacturing the type of pipe specified.

Certification shall be the basis of all acceptance of materials as required below. The Contractor shall submit two (2) copies of the manufacturer's test report to the Engineer with results or a statement by the seller stating the material has been sampled, tested, and inspected. Each certification shall be signed by an authorized agent of the seller or manufacturer. Engineer shall provide one (1) copy to the Owner. All substituted materials must be submitted and approved in accordance to the process laid out in Section 105.15 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT.

### **702.03 CONSTRUCTION SCHEDULING AND COORDINATION**

Service to sewer customers shall not be disrupted during installation of the sewer line improvements except for the time required to change individual services as specified herein.

No commercial services shall be disrupted during business hours without the approval of the Engineer.

The Contractor shall notify the City of Fort Smith Utility Department at least 48 hours prior to scheduled connections of mains. Scheduling shall be subject to the approval of the Utility Department and the Engineer.

The work of this Section shall be coordinated with the work of other Sections. The Contractor shall make field measurements at the site to verify or supplement indicated dimensions and to ensure proper coordination of all construction items.

## 702.04 MATERIALS

All gasket and joint materials, lubricants, adhesives and other incidental materials shall conform to the pipe manufacturer's recommendations.

- A. **SOLID WALL PVC PIPE.** Solid Wall PVC. Pipe, sizes 6 inch to 15 inch, shall be Poly Vinyl Chloride (PVC) Sewer Pipe conforming to ASTM D3034, latest revision. Solid Wall PVC Pipe, sizes 18 inch to 36 inch, shall be Poly Vinyl Chloride (PVC) Sewer Pipe conforming to ASTM F679, latest revision. Minimum wall thickness shall conform to SDR 35. Joints shall be elastomeric gasket type. Fittings shall be PVC, elastomeric joint, conforming to ASTM D3034 or ASTM F679. All pipe sections shall be straight and true in alignment. All pipe and fittings shall be tested at the factory in accordance with ASTM D2152, D2412 and D2444. Acceptable Manufactures include Diamond Plastics Corp., J-M Manufacturing, National Pipe and Plastics, Inc., North American Pipe Corp., or approved equals.
- B. **PROFILE POLYPROPYLENE PIPE.** Profile Polypropylene Pipe for gravity-flow sanitary sewer applications, sizes 12-inch through 30-inch, shall have a smooth interior and annular exterior corrugations and shall conform to ASTM F2736. Profile Polypropylene Pipe for gravity-flow sanitary sewer applications, sizes 30-inch through 60-inch, shall have a smooth interior and exterior surface with annular inner corrugations and shall conform to ASTM F2746. Profile Polypropylene Pipe shall be joined with a gasketed, watertight integral bell and spigot joint conforming to ASTM D3212. Spigot shall have two gaskets conforming to ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with removable, protective wrap to ensure the gaskets are free from debris. Pipe shall have a reinforced bell with polymer composite band installed by manufacturer. A flexible, water tight connection utilizing pipe manufacturer adaptors for exterior corrugated pipe together with the appropriate water tight connector shall be used at manhole connections. All pipe sections shall be straight and true in alignment.
- C. **DUCTILE IRON PIPE.** Ductile iron pipe shall conform to AWWA C151, latest revision, and shall be pressure class 350, push-on joint, with bituminous interior and exterior coating as detailed in the latest revision of AWWA C111. Fittings shall be gray iron or ductile iron conforming to AWWA C110, latest revision, or compact fittings shall conform to AWWA C153, latest revision. Pipe and fitting shall be protected with a minimum 40-mils Tnemec epoxy interior lining applied by a certified manufacturer, and bituminous exterior coating as detailed in the latest revision of AWWA C111.
- D. **SERVICE LINES.** Service lines shall be Schedule 40 PVC manufactured from Type I, Grade I polyvinyl Chloride compound conforming to ASTM D1785 or approved equal.

- E. **POLYETHYLENE WRAPPING.** Polyethylene material for pipe encasement shall meet the requirements of AWWA C105, latest revision. Wrapping shall completely shield the pipe from contact with the concrete encasement.
- F. **TRACER WIRE.** Tracer wire shall be Trace-Safe type RT1803W or Utility Department approved equal.
- G. **TRACER WIRE BOX.** Tracer wire shall be terminated in magnetized tracer box, Model CD14\*TP as manufactured by Copperhead Industries, LLC. The tracer box cover will be color coded in accordance with APWA uniform color code. The tracer wire shall not be terminated in any other location.

#### **702.05 QUALITY ASSURANCE**

- A. All sewer pipe and fittings of a similar type (e.g., solid wall or profile wall) shall be from a single manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in ASTM D3034, ASTM F1760 or ASTM F789 as applicable. In addition, all sewer pipe to be installed under this Contract may be inspected at the plant for compliance with this Section by an independent testing laboratory provided by the Owner or Engineer.
- B. Inspections of the pipe may also be made by the Owner or Engineer after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein, even though sample pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job at once.

#### **702.06 PIPE HANDLING AND STORAGE.**

Pipe and fittings shall be handled and stored in such a manner as to protect them from damage. The pipe manufacturer's recommendations shall be followed with regard to special storage requirements.

#### **702.07 CONSTRUCTION REQUIREMENTS**

Connections to structures and related work shall be as specified in Section 703.

##### **A. TRENCH EXCAVATION AND BACKFILL**

- (1) **GENERAL.** Trench excavation, bedding, boring, encasement, casing, and backfilling are covered in Section 205.



- (2) **BEDDING.** Pipe bedding for PVC pipe and Ductile Iron pipe shall conform to Class "B" bedding requirement covered in Section 205.02 (D).
- (3) **BELL HOLES.** Bell holes shall be provided at each joint to permit the jointing to be properly made and prevent the joint of the pipe from being a point of support. Each bell hole should be no larger than necessary for joint assembly while still allowing the pipe barrel to lie flat on the trench bottom.
- (4) **OVER EXCAVATION.** Whenever any portion of the trench is excavated below grade, the over excavation shall be corrected as detailed in Section 205.04.

## B. PIPE INSTALLATION

- (1) **GENERAL.** Pipe fittings and accessories shall be unloaded near the place where they are to be laid in the trench. Pipe shall be stored in a manner that allows it to remain clean. They shall at all times be handled with care to avoid damage. Cutting of pipe shall be done by means of a manufacturer approved type of mechanical cutter.
- (2) **PLACEMENT OF PIPE.** Pipe, fittings and accessories shall be cleaned and inspected for damage immediately before and after placement in the trench. Any pipe found to be cracked, damaged or otherwise defective shall be rejected, and plainly marked in such a manner that the markings will not rub or wash off, and the pipe shall subsequently be removed from the site. Pipe, fittings and accessories shall be placed in the trench and shall be positioned utilizing hoisting equipment. Pipe shall be laid true to line and grade, with uniform bearing under the full length of the pipe barrel. The Contractor shall be responsible for maintaining the specified elevations, lines and grades. All sewer pipe installed at incorrect elevations, lines and grades shall be removed and reinstalled by the Contractor at their expense. The Contractor shall furnish and operate laser equipment or other devices required for aligning and grading pipe.

The construction of all sewers shall begin at the outlet or the low point of the line. When the construction involves the installation of lateral branches, the construction of the laterals shall not be started until the main sewer has been completed to the point where the lateral discharges into it.

All changes in sewer line alignments shall be accomplished by the use of manholes.

Jointing of pipe shall be accomplished in accordance with the pipe manufacturers' recommendations. Gaskets and lubricants shall be the type recommended by the pipe manufacturer. The spigot end of the pipe shall be inserted into the bell to the required depth and in such manner as to avoid displacement of the gasket. Bell and

spigot pipe shall be laid with the bell end upstream unless otherwise directed by the Engineer.

At times when pipe laying is not in progress, the open ends of the installed pipe shall be closed by a watertight plug. Plug shall be Petersen Mechanical Hand Tightening Series 141, COB Industries Cast Aluminum Expansion Plug, or approved equal. This provision shall apply during the lunch period, overnight, or any other time when work is not in progress.

No pipe shall be laid in wet trench conditions that preclude proper bedding, on a frozen trench bottom, or when in the opinion of the Engineer, the trench conditions or the weather conditions are unsuitable for proper installation.

- (3) **TRACER WIRE INSTALLATION.** Tracer wire shall be installed in a continuous non-interrupted circuit on all sewer mains. The wire shall be attached to the top center of the pipe every four feet by a method approved by the Engineer. Tracer wire boxes shall be installed at locations shown on the plans or as determined by the Engineer. Tracer wire box spacing shall not exceed 500 feet. Tracer wire boxes shall have concrete collars installed for protection.
  
- (4) **WATER CROSSINGS.** When water and sewer lines are closer than ten (10) feet of each other, sewers must be placed so that the bottom of the water line will be at least 18 inches above the top of the sewer line at its highest point. If this distance must unavoidably be reduced, the water line or the sewer line must be encased in watertight pipe with sealed watertight ends extending at least ten feet either side of the crossing. Any joint in the encasement pipe is to be mechanically restrained. The encasement pipe may be vented to the surface if carrying water or sewer under pressure. Whenever a sewer line must unavoidably pass above a water line, at least 18 inches of separation must be maintained between the outside of the two pipes in addition to the preceding encasement requirement.

## **702.08 SEWER BYPASS**

All sewer bypass operations shall comply with Section 709.

## **702.09 SERVICE LINES**

Service lines including wyes, risers and other fittings shall be installed at the locations and in accordance with the details shown on the plans unless otherwise directed by the Engineer.

Service lines of four (4) inches shall be connected to new sewer mains through a manhole or standard wye or tee fittings that are of the same material used in the main. Service lines greater

than four (4) inches shall connect to mains through a manhole. Service lines of two (2) inches are for pressure applications only and shall tie into manholes. Taps into existing mains shall utilize a gasketed or solvent cement saddle or shall consist of a standard fitting inserted into the main using repair sleeve couplings. Street crossings shall be marked with "SS" etched or stamped into the curb.

Service lines shall be installed on a uniform slope at a minimum grade of two (2) percent for four (4) inch lines and one (1) percent grade for six (6) inch lines and greater unless otherwise directed by the Engineer. Where the depth of the sewer main is greater than eight (8) feet, a riser shall be installed.

A dual clean-out shall be installed consisting of a double sweep tee, riser, metallic cap and concrete collar at the property line for all service lines as shown on the plans. A clean-out system conforming to ASTM F3097-15 is also acceptable.

Service lines shall not be backfilled or covered until they have been inspected, approved and coordinately located by the Engineer. After approval and before backfilling, service stubs shall be capped or plugged and marked with a nylon rope. The nylon rope shall be a minimum size of ¼-inch diameter shall be tied to service stubs and extended vertically while backfilling. After backfilling, the rope shall be tied to an anchor stake. Unless otherwise noted, the stub-out pipe shall extend for a minimum distance of 3 feet from the edge of the manhole and the ends shall be capped with a standard glued fitting.

#### **702.10 CONCRETE ENCASEMENT**

Where shown on the plans or as directed by the Engineer, sewers shall be encased or cradled in concrete in accordance with Section 205 "Trench and Structure Excavation and Backfill". Unless otherwise noted on the plans, concrete encasement shall encircle the pipe and shall be a minimum thickness as shown in the Plans. All sewer mains to be encased in concrete shall be wrapped with polyethylene material meeting AWWA C105, latest revision.

#### **702.11 INSPECTION AND TESTING**

All sewer lines installed shall be tested unless otherwise directed by the Engineer. The Contractor shall furnish all labor, materials and equipment required to perform the specified tests. All testing shall be performed in the presence of the Engineer.

All sewer lines shall be clean prior to performing tests.

The Contractor shall, at his expense, correct and retest all sections of line which fail to pass the tests.

- A. ALIGNMENT TEST. All sewer mains shall be inspected visually using lights and/or mirrors, to verify accuracy of alignment. The full diameter of the pipe shall be visible when viewed between consecutive manholes.
- B. LEAKAGE TEST. A leakage test shall be performed and shall be a low pressure air test. ASTM F-1417 leakage test procedures shall be used for PVC and for Polypropylene Pipe

The Contractor shall temporarily cap or plug mains and service lines as required for testing. Caps and plugs shall be glued securely against blow-off during testing.

The air test shall be performed after the sewer line backfill has been placed and compacted. The sewer line shall be tested in sections between manholes.

All air testing equipment shall be supplied by the Contractor. The pressure gauge shall have minimum divisions of 0.1 psi and shall have an accuracy of at least 0.04 psi. Accuracy and calibration of the gauge shall be certified by a reliable testing firm at 6-month intervals or when requested by the Engineer. The Contractor shall, at his own expense, locate and repair defective pipe and/or joints until leakage or deflection is within the specified allowances.

Air shall be introduced into the line until the internal air pressure is 4.0 psig. Pressure applied to the line shall not exceed 9.0 psig. The line shall be allowed to stabilize between 4.0 and 3.5 psig for a period of no less than 5 minutes. After the stabilization period the pressure shall be decreased to no less than 3.5 psig. When the internal pressure has reached an initial reading of 3.5 psig or greater, a stop watch or other timing device shall be used to determine the time lapse required for the pressure to decrease to 2.5 psig (a pressure drop of 1 psig). If the time lapse required for the air pressure to drop 1.0 psig exceeds the test time specified, the line has passed the test.

If groundwater is present above the top of the pipe, the air pressure shall be adjusted as directed by the Engineer. When directed by the Engineer, the Contractor shall install an observation well to determine the depth of ground water. Immediately before air testing, the groundwater height in feet of water over the invert of the sewer pipe shall be determined. The air pressure correction, which must be added to the 3.5 psig normal test starting pressure, shall be calculated by dividing the average vertical height, in feet of groundwater above the invert of the sewer pipe to be tested, by 2.31. The result gives the air pressure correction in pounds per square inch to be added.

Minimum times for a 1 psig pressure drop for all types of pipe shall be computed by the following equation:

$$T = 0.085 * D * \left[ \frac{K}{Q} \right]$$

Where:

T = time for pressure to drop 1.0 pounds per square inch gauge in seconds

K =  $0.000419 * D * L$ , but not less than 1.0

D = average inside diameter in inches

L = length of line, of same pipe size, being tested in feet

Q = rate of loss, 0.0015 ft<sup>3</sup>/min/ ft<sup>2</sup>

- C. DEFLECTION TEST. A deflection test shall be performed on all PVC sewer mains. All deflection testing equipment shall be supplied and operated by the Contractor. The test shall consist of pulling a rigid mandrel through the pipe. The cross section of the mandrel shall have a diameter equal to 95 percent of the inside diameter of the pipe, and the minimum length of the circular portion of the mandrel shall be equal to the diameter of the pipe.

The test shall not be made sooner than 30 days after the line has been installed and backfilled.

All sections of the line which exceed five (5) percent deflection shall be reconstructed and retested.

## **702.12 ABANDONED LINES**

Lines designated to be abandoned shall be plugged at the locations shown on the plans. Plugging of lines shall consist of placing concrete or mortar inside the line to form a watertight plug. Remaining pipe ends of abandoned lines shall be filled with a concrete plug. The concrete plug length shall be 3 times the diameter of the pipe.

Sewer lines which are to be abandoned shall remain in place except where removal is required for construction of improvements or removal is specifically called for on the plans. Any existing asbestos cement (AC) pipes are to be avoided if at all possible unless directed to be removed by the Engineer or connection to it is required according to the plans. Removal and disposal of AC pipe shall be in accordance with standard construction practices for asbestos removal and the applicable OSHA Standards and State of Arkansas regulations. Any crushed AC pipe is to be removed and disposed of properly and shall not be placed into the fill. AC pipe shall be cut using a chain cutter.

The abandoned manhole rings and lids shall remain the property of the Owner. Materials designated on the plans for Owner salvage shall be delivered to the Fort Smith Utility Department located at 3900 Kelley Highway.

## **702.13 DATA DELIVERY REQUIREMENTS**

Data delivery requirements shall conform to Section 150, data delivery requirements, and Section 709, GIS Database Update.

## **702.14 MEASUREMENT AND PAYMENT**

The measurement and payment of the work included in this section of the specifications shall be at the contract unit prices listed in the proposal for the items of work. Payment at the contract unit price for each item shall be considered full compensation for furnishing all materials, labor, equipment, tools, supplies and incidentals necessary to complete each item of work. Data collection shall be considered incidental to construction.

- A. **SEWER PIPE.** Sewer pipe will be measured by the linear feet of the various sizes of pipe installed and will be measured along the center lines of the pipe from center to center of manholes. Payment for furnishing and installing sewer lines measured as specified above, will be made at the contract unit prices per linear foot for the applicable sizes of pipe listed in the bid form. Payment will constitute full compensation for furnishing and installing pipe, including joints, testing, removal of existing pipe, maintenance of sewage flows, tracer wire, tracer wire boxes, and for all incidental labor and materials necessary to complete the work.

All removal, salvage, plugging, and disposal of sewer lines shall be considered incidental to the project, except for AC pipe which will be paid for under the bid item listed in the proposal for "Removal and Disposal of AC sewer pipe".

Rock excavation and select backfill will be paid for under Section 205 "Trench & Structure Excavation and Backfill." Flowable Fill will be paid for under Section 206, "Flowable Fill Material".

Connection of sewer lines to existing manholes will be paid for under Section 706, "Existing Sewer Structures". No separate payment will be made for tying into and reinstating existing sewer service lines.

- B. **SEWER SERVICE LINE.** Service lines will be measured by the linear foot of the size of line installed and method of installation, either open-cut or pipe burst. The length of line measured will be the actual length of pipe laid from the wye to the plug or connection. Payment for service lines will be made at the contract unit price per linear foot for the sizes of lines listed in the bid form. Payment shall be full compensation for furnishing and installing service lines including fittings, risers, plugs, connections, excavation, trenching, gravel bedding, backfilling and related work. Connection of sewer service lines to existing manholes shall be paid for under Section 706, Existing Sewer Structures. Surface restoration shall be paid for separately under applicable pay item. No separate payment will be made for tying into and reinstating existing sewer service lines.

- C. **SEWER SERVICE WYES.** Service wyes will be measured by the number of furnished and installed wyes. Payment for service wyes will be made at the contract unit price per each listed in the bid form. Payment shall be full compensation for furnishing and installing service wyes, connections, riser pipe, concrete, excavation, gravel bedding, backfilling, GPS data collection as stated in Section 710, and for all incidental labor and materials necessary to complete the work.
  
- D. **SEWER SERVICE CLEAN-OUTS.** Clean-outs will be measured by the number of furnished and installed clean-outs. Payment for sewer service clean-outs will be made at the contract unit price per each listed in the bid form. Payment shall be full compensation for furnishing and installing clean-outs, connections, riser pipe, concrete, excavation, gravel bedding, backfilling, GPS data collection as stated in Section 710, and for all incidental labor and materials necessary to complete the work. Surface restoration shall be paid for separately under applicable pay item
  
- E. **REMOVAL AND DISPOSAL OF AC SEWER PIPE.** Removal and disposal of AC sewer pipe will be measured and payment made according to the lineal foot of sewer line directed to be removed by the Engineer and acceptably removed. Payment for the removal and disposal of AC sewer pipe at the contract unit price listed in the proposal shall be considered full compensation for the removal and disposal of the AC sewer pipe in accordance with applicable OSHA and State of Arkansas regulations and standards, and backfilling of trench, including all labor, materials and miscellaneous items required to complete the work.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Sewer Pipe (Size, Type, Class)	LF
Sewer Service Line (Size, Type, Class, Method)	LF
Sewer Service Wyes (Size)	EA
Sewer Service Clean-Outs (Size)	EA
Removal and Disposal of AC Sewer Pipe	LF

## **SECTION 703 NEW SEWER STRUCTURES**

### **703.01 SCOPE OF WORK**

This work shall consist of furnishing all labor and materials required for the construction of new manholes, concrete cradles, other structures, appurtenances, and connections.

Excavating, trenching, and backfilling of sewer appurtenances are specified in Section 205.

### **703.02 QUALIFICATIONS AND SUBMITTALS**

Certification shall be the basis of acceptance of materials as required below. The Contractor shall submit two copies of the manufacturer's test report with results or a statement by the seller, that the material has been sampled, tested and inspected. Each certification shall be signed by an authorized agent of the seller or manufacturer. All manufacturers shall have at least three (3) years of experience in successfully manufacturing the materials specified, unless approved otherwise by the Owner.

### **703.03 MATERIALS**

- A. **CONCRETE.** All concrete and concrete work shall be in accordance with Section 401 "Concrete." Concrete shall be a minimum of Class "A", unless noted otherwise.
- B. **MORTAR.** Mortar shall consist of one part Type II Portland cement and two parts clean sand with only enough water for workability.
- C. **NEW PRECAST MANHOLES.** Precast reinforced concrete manholes shall be of the concentric cone type unless eccentric cone type is shown on the plans. All precast reinforced concrete manholes shall conform to ASTM C478, latest revision. Lifting lugs shall be EZ Lift Pins or approved equal. No holes will be allowed for lifting precast manholes. Joints and Neoprene O-ring gaskets shall conform to ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets. All pipe entrances through manhole wall shall utilize a flexible waterstop pipe connector conforming to ASTM C-923. The pipe connector shall be A-LOK as manufactured by A-LOK Products Inc., NPC Kor-N-Seal as manufactured by Trelleborg Pipe Seals Milford, Inc. or an approved equal. All new manholes shall be precast unless specified otherwise by the Owner.
- D. **MANHOLE FRAMES AND COVERS.** Manhole frames and covers shall be made of cast iron and shall conform to ASTM A48-76 Class 30. Concrete adjusting collars are not allowed. Manhole covers shall be 23½ inches in diameter; frame height shall be 6 inches. All casting shall be free from cracks, holes and swells. Frames and covers shall have machined bearing surfaces to prevent rocking of the cover. Manhole covers and frames



shall be of heavy duty type as manufactured by EJ Corp. 1348-1, Deeter Foundry 1266 from Neenah, or approved equal.

Manhole frames and covers located in the 100-Year Floodplain, creek beds, river beds, or drainage channels/ditches shall be ERGO SELFLEVEL Assemblies with Cam-Lock systems, or approved equal. Bolt-down manhole frames and covers shall not be allowed.

- E. **CONCRETE COLLARS.** Concrete collars, used for protecting the manhole frames and covers, shall be made of Class "AA" Concrete, shall have a minimum height of eight (8) inches and dimensions of six (6) feet by six (6) feet. The collar shall be centered over the manhole frame and reinforced with fiber mesh.
- F. **MANHOLE ADJUSTING RINGS.** Manhole adjusting rings shall be cast iron conforming to ASTM A48 or ductile iron conforming to ASTM A536. Adjusting rings shall be R-1979 series manufactured by Neenah Enterprises, Inc., or approved equal. The maximum height of individual rings shall not exceed 24-inches. The Contractor shall determine all dimensions and shall ensure correct sizing of the adjusting rings.
- G. **ELASTOMERIC WATERSTOP GASKETS.** Elastomeric waterstop gaskets for pipe entrances into cast-in-place manholes shall be made of elastomeric PVC and shall be Fernco Concrete Manhole Adapters (CMA's) for pipe diameters 12-inches and smaller or Fernco Large-Diameter Waterstops for pipe diameters larger than 12-inches or approved equal.
- H. **FLEXIBLE PLASTIC GASKETS.** Flexible plastic gaskets used for connecting cast iron frames to top of manhole shall conform to ASTM C990 and shall be Ram-Nek or Rubr-Nek LTM as manufactured by Henry Company, or approved equal.
- I. **JOINT SEALING MATERIAL.** Sealing material for sealing exterior joints in precast manhole section and cast iron frames shall be Wrapidseal manufactured by Canusa, Infi Shield manufacture by Sealing Systems, Inc., or approved equal.

#### **703.04 QUALITY ASSURANCE**

- A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Owner. Such inspection may be made at the place of manufacture, or on the work after delivery, or at both places and the materials shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein; even though samples may have been accepted as satisfactory at the place of manufacture. Material rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All materials which have been damaged after delivery will be rejected, and if already installed, shall be

acceptably repaired, if permitted, or removed and replaced, entirely at the Contractor's expense.

- B. Imperfections in manhole sections may be repaired, subject to the approval of the Owner, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Repairs shall conform to the specifications outlined in Section 706 Cement mortar used for repairs shall be Class AAA, as specified in in Section 401. Epoxy mortar may be utilized for repairs subject to the approval of the Owner.

### **703.05 EXCAVATION AND BACKFILLING**

Trench excavation, bedding, encasement, casing, and backfilling are covered in Section 205 "Trench and Structure Excavation and Backfill."

### **703.06 CONSTRUCTION REQUIREMENTS**

Manholes shall be constructed at locations shown on the plans and shall be of the type and depth indicated thereon. Detailed drawings of the various types of manholes to be employed in the work are included in the plans and each manhole shall be constructed in strict accordance with these detailed drawings. Manholes may be constructed of precast concrete segments or cast-in-place concrete. Manholes constructed of fiber-glass or other non-approved material may be allowed with written consent of the Owner. Concrete collars shall be installed around all manhole rings located within street pavement.

The finished manhole shall have a minimum inside diameter of 4 feet from the base to the sloping cone section at the top of the manhole. The inside diameter at the opening in the top of the cone section shall not be less than 24 inches for 4-foot diameter manholes. The inside diameter and corresponding lid diameter for manholes greater than 4-foot in diameter shall be as indicated on the plans. The sloping cone section may be of the concentric or eccentric type, unless otherwise specified on the plans, and shall have a height not less than 24 inches and not more than 36 inches.

Manholes installed on existing sewer lines shall be constructed in a manner which will not disturb the alignment and grade of the existing pipe except for required alterations. Existing pipes within the manhole shall be removed as required to permit construction of the manhole invert. When authorized by the Owner, the manhole may be constructed with the sewer pipe in place and the upper half of the pipe removed after the invert has been placed.

Where shown on the plans or where directed by the Owner, pipe stub-outs shall be installed in manholes as a connection for future extensions or for service stub-outs. Unless otherwise noted, the stub-out pipe shall extend for a minimum distance of 3 feet from the edge of the manhole and the ends shall be capped with a standard glued fitting. Manhole penetrations for pipe stub-outs added in the field shall be cored.

- A. **MANHOLE BASE.** The bottom of the concrete base of the manhole base shall be level.
- (1) Regardless of the type of manhole construction, manholes shall be provided with invert channels at the bottom of the manhole. The invert channels shall be smooth, shall be accurately shaped to a semi-circular bottom conforming to the inside shape of the adjacent sewer section, shall have a uniform slope from the inlet to the outlet pipe, shall extend up to at least half of the diameter of the pipe, shall have smooth curves with radii as large as the size of the manhole will permit. Unless indicated on the plans, a minimum 0.1 foot drop from the inlet invert to the outlet invert of each manhole shall be maintained.
  - (2) All manholes shall contain a concrete shelf on each side of the invert channel. The top of the shelf at the edge of the channel shall be a minimum of  $\frac{1}{2}$  of the largest diameter of the connecting pipe above the invert of the channel. The shelf shall rise a minimum of one inch per foot from the edge of the channel to the wall of the manhole. Dips or projections capable of holding water or solid materials will not be permitted.
- B. **CAST-IN-PLACE MANHOLES.** The concrete foundation for cast-in-place manholes shall be placed as soon as practicable after the sewer pipe has been installed through the manhole location. The concrete for the base of the manhole shall be placed on a 6-inch minimum thick gravel bed. Invert channels shall be formed in the concrete base during or immediately after the placing of the manhole base and shall have a brush finish as soon as the concrete has sufficiently set. Where required to correct deficiencies in the constructed concrete invert, invert channels shall be shaped and smoothed with cement mortar, as detailed in Section 703.04B.
- (1) In manholes where there is only one inlet and one outlet pipe and the sewer pipe does not change direction, the invert through the manhole shall be of split pipe or the pipe may be laid through the manhole and the upper half of the pipe removed. The pipe shall be cut in a neat and workmanlike manner prior to removing the top section of the pipe. The concrete shall set for 24 hours before any pipe inside the manhole is trimmed.
  - (2) The minimum thickness of the base below the invert of the channel shall be 12 inches of concrete.
- C. **PRECAST MANHOLES.** Where precast manholes are used that include a bottom section containing the invert flow channel, the flow channel and shelf shall be formed during the manufacturing process of the precast manholes. Flexible waterstop pipe connectors, as specified in paragraph 703.03-G, shall be installed at locations where sewer main pipe and sewer service pipe enter the manhole.

- (1) The bottom of the base section shall be level and shall be placed on a 6-inch minimum thick gravel bed.
- (2) Where the manhole base is not constructed as part of the precast manhole assembly, the base shall be constructed as previously set forth for Cast-In-Place Manholes and shall extend a minimum of 4 inches beyond the edge of the precast manhole walls. A minimum of 3 inches of the bottom precast manhole wall section shall be embedded in the concrete base. The bottom precast section shall be in place prior to pouring the base or shall be set in the base prior to initial set of the concrete.

**D. MANHOLE WALLS**

- (1) **CAST-IN-PLACE MANHOLES.** Cast-in-place manholes shall have minimum wall thickness as shown below. The wall shall be poured monolithically with the base or the base shall be provided with a construction joint and waterstop gasket.

<u>Manhole Depth</u>	<u>Minimum Thickness of Wall</u>
Up to 12 feet	6 Inches
Over 12 feet	8 Inches

The forms used for construction of the barrel shall be of such fabrication and set so that the walls of the manhole constructed are to the minimum thickness noted previously and shall be smooth with no form marks on the interior or exterior wall exceeding 1/4 inch. The concrete shall be placed uniformly around the manhole in 2 feet maximum lifts. Each lift shall be thoroughly vibrated prior to placement of succeeding lifts. All concrete shall be free of honeycomb or other defects. The Contractor shall correct all defective areas as directed by the Owner.

- (2) **PRECAST MANHOLES.** Precast manhole sections shall have minimum wall thickness of 5 inches or as specified by the manufacturer to conform to the requirements of ASTM C478, latest revision, "Precast Reinforced Concrete Manhole Sections". Any precast section which has been damaged such that the water tightness of the section or joint is affected shall not be utilized.
  - a. Pre-formed neoprene O-ring gaskets shall be used in the joint between precast manhole wall sections. The exterior of the joint shall be grouted as necessary to form a smooth and uniform surface. Joint sealing material, as specified in section 703.03-I and having a minimum width of 12 inches, shall be wrapped around the outside of the manhole and centered over the joint. The installation of the joint sealing material shall conform to the manufacturer's written recommendations.

- b. Prior to ordering any precast manhole units, the Contractor shall verify the location and depth of all existing and proposed pipe connections to the manhole. The Contractor shall also verify that existing sewer services, connected to an existing manhole to be replaced, are active.
- E. **CAST IRON FRAME AND COVERS.** All manholes shall have cast iron frame rings cast into the cone of the manhole and covers installed on the top of the manhole. Cast iron frames and covers shall be centered over the manhole cone section and shall be carefully leveled and placed to the elevations shown on the plans or to an elevation as directed by the Owner. The maximum allowable height adjustment using manhole adjustment rings shall be 24 inches. Unless otherwise directed by the Owner, the top of the frame and cover shall conform to the following general requirements:
  - (1) **WITHIN OR ADJACENT TO PAVED STREET OR DRIVE SURFACES.** The top is to be at the same elevation and slope as the adjacent paved surface. Where precast manholes are used and sloping of the frame and cover is required, a cast iron grade adjusting ring shall be used. Within paved areas, a concrete collar shall be constructed around the manhole frame and cover unless otherwise indicated on the plans.
  - (2) **WITHIN MAINTAINED LAWN AREAS.** The top is to be level with the adjacent ground.
  - (3) **WITHIN PASTURE LAND OR OPEN AREAS EXCEPT NEAR DRAINAGE CHANNEL OR DITCHES.** The top is to be a minimum of six (6) inches above the adjacent ground.
  - (4) **NEAR DRAINAGE CHANNEL, DITCHES, CREEK RIVER BEDS, AND BELOW 100-YEAR FLOODPLAIN.** The top is to be a minimum of 12-inches above the adjacent ground or as indicated on the plans. Manhole frames and covers shall be ERGO SELFLEVEL Assemblies with Cam-Lock systems, or approved equal. Bolt-down manhole frames and covers shall not be allowed.
  - (5) **MANHOLE DROPS.** Manhole drops shall be constructed at locations where the invert of the inlet sewer main pipe enters a manhole at a greater depth than two (2) feet above the invert of the outlet pipe. Internal drops shall not be allowed, unless approved by the Owner. The pipe and fittings for the drops shall be of the same material, type, and size as the horizontal inlet pipe. The drops shall be constructed to the dimensions and in accordance with the details shown on the plans. The horizontal sewer pipe shall extend through the manhole wall. Class B concrete shall be used to backfill around the vertical pipe drops and fittings from the bottom of the excavation to 6 inches above the top of the horizontal inlet pipe.

### **703.07 PIPE CONNECTIONS TO MANHOLES**

- A. **NEW PRECAST MANHOLES.** Flexible waterstop pipe connectors shall be used for all pipe connections to the precast manhole. The connectors shall be installed during the manufacturing process of the precast manholes. The pipe shall be inserted through the connector to the depth recommended by the manhole manufacturer. After the pipes have been installed, the invert channel shall be grouted to provide a smooth flow through the manhole. The grout shall be applied up to the spring line of the pipe. Grout shall not be applied at the pipe connection on the outside of the manhole.
- B. **NEW CAST-IN-PLACE MANHOLES.** All pipes extending through manhole walls shall have an elastomeric waterstop gasket, installed around the pipe and centered in the manhole wall to insure a watertight connection. The pipe with gasket shall be in place prior to placing of the concrete and the concrete shall be placed around the pipe during the construction of the manhole base.
- C. **PIPE CONNECTIONS TO EXISTING MANHOLES.** Pipe connections to existing manholes must conform to specifications in Section 706.

### **703.08 CONCRETE STRUCTURES**

All piers, collars, anchors and other reinforced concrete structures shall be constructed as shown on the plans and in accordance with Section 401 "Concrete."

### **703.09 INSPECTION AND TESTING**

Each new manhole shall be vacuum tested prior to acceptance. The vacuum test shall be performed after all pipe connections have been made and prior to backfilling. The vacuum test shall be conducted in accordance with ASTM C1244, "Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test". All pipes connected to the manhole shall be temporarily plugged using suitable sized pneumatic or mechanical plugs.

A metal cover, with suitable gasket, shall be placed over the top of the manhole frame. The metal cover shall be provided with valved pipe connections for attaching the vacuum pipe and a vacuum gage reading inches of mercury or psi. A vacuum pump shall apply a vacuum of 10 inches of mercury (5 psi). For the manhole to pass the test, the time it takes for the vacuum to drop to 9 inches of mercury (4.5 psi) shall not be less than the value listed in the following Table.

The Contractor shall provide all vacuum pumps, gauges, testing equipment and plugs necessary for the testing of manholes. The vacuum test shall be performed by the Contractor in the presence of the Owner, Engineer, or his representative. Any manholes which do not pass shall be repaired and/or resealed and shall be retested.

#### **MINIMUM TEST TIME FOR MANHOLE VACUUM TEST**

Manhole Inside Diameter (in.)				Manhole Inside Diameter (in.)			
Depth	48	60	72	Depth	48	60	72
(ft.)	Time (sec.)			(ft.)	Time (sec.)		
4	10	13	16	18	45	59	73
6	15	20	24	20	50	66	81
8	20	26	33	22	55	72	89
10	25	33	41	24	59	78	97
12	30	39	49	26	64	85	105
14	35	45	57	28	69	91	113
16	40	52	65	30	74	98	121

**703.10 DATA DELIVERY REQUIREMENTS**

Data delivery requirements shall conform to Section 710, GIS Database Update.

**703.11 MEASUREMENT AND PAYMENT**

The measurement and payment of the work included in this section of the Specifications shall be based on the units and the contract unit prices listed in the Bid Proposal for such work. Payment for the actual completed work, as measured in the field, will be paid at the contract unit price bid for each appropriate item listed in the Bid Proposal which price shall be considered full compensation for furnishing all materials, labor, equipment, tools supplies, data collection, and incidentals necessary to complete each item of work including maintenance of sewage flows and control of drainage water.

The payment for all excavations and backfilling with excavated material required to construct the manhole and other structures and the construction of gravel beddings shall be included with the payment for the manhole or structure and no additional compensation will be made. The measurement and payment for pavement removal, disposal, and replacement, the backfilling within streets and drives, and related items are set forth in other sections of these Specifications.

No separate payment will be made for connection of sewer lines to new manholes. No separate payment will be made for stub-outs.

- A. **STANDARD DEPTH MANHOLE (6 FEET AND LESS).** Measurement for construction of new manholes of the diameter specified up to a maximum depth of 6 feet, as measured from the top of the manhole cover to the invert of the outlet pipe, will be based on the number each of such manholes actually constructed. Such measurement shall include excavation and backfill, construction of the manhole base, construction of cast-in-place walls and cone section or furnishing and installing precast units, furnishing and installation of new cast iron frame and cover, furnishing and installation of manhole grade adjusting rings, furnishing and installing joint sealing material, connections of all pipes (main and service laterals), vacuum testing and GPS data collection as stated in Section 703.10. Surface restoration shall be paid for separately under applicable pay item
- B. **ADDITIONAL DEPTH FOR MANHOLE.** Measurement for construction of that portion of new manholes of the diameter specified greater than 6 feet deep, as measured from the top of the manhole cover to the invert of the outlet pipe, will be based on the vertical feet of manhole that is over 6 feet deep. Such measurement shall include the items required to complete the work as stated above for Standard Manholes.
- C. **MANHOLE DROPS (4 FEET AND LESS).** Measurement for construction of manhole pipe drops, up to a maximum height of 4 feet, as measured from the external invert of the upper horizontal pipe to the invert at the entrance to the manhole, will be based on the number each of such drops actually constructed. Such measurement shall include the installation of vertical drop pipe, all required fittings, extension of horizontal pipe through manhole wall, and backfilling drop pipe with concrete. Only external drop manholes are allowed.
- D. **ADDITIONAL HEIGHT FOR MANHOLE DROPS.** Measurement for construction of that portion of manhole drops greater than 4 feet deep, as measured from the invert of the upper horizontal pipe to the invert at the entrance to the manhole, will be based on the vertical feet of drop that is over 4 feet high. Such measurement shall include the 9 foot concrete encasement, PVC pipe for drop, and all other items required to complete the work as stated above in Section 703.14C.
- E. **SEWER LINE PIERS, COLLARS, AND ANCHORS.** Measurement of piers, concrete collars, anchors, and other reinforced concrete structures will be based on the cubic yards of class "AA" concrete required to construct such structure to the lines and dimensions shown on the plans. Such measurement shall include the forming, concrete, reinforcing steel, and related work necessary for a complete facility.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Standard Depth Manhole (Size, 6 Feet and Less)	EA



Additional Depth for Manhole (Size)	VF
Manhole Drops (4 Feet and Less)	EA
Additional Height for Manhole Drops	VF
Sewer Line Piers, Collars, and Anchors	CY

## **SECTION 704 SEWAGE FORCE MAINS**

### **704.01 SCOPE OF WORK**

This work shall consist of the furnishing of all labor, materials, tools, equipment, incidentals, testing and construction methods to install sewer force mains as required by the Plans, Special Conditions and these Specifications.

Excavating, trenching, backfilling and sewer appurtenances are specified in section 205.

### **704.02 QUALIFICATIONS AND SUBMITTALS**

All pipe shall be manufactured by an established manufacturer having at least three (3) years of experience in successfully manufacturing the type of pipe specified, unless approved otherwise by the Owner.

Certification shall be the basis of acceptance of materials as required below. The Contractor shall submitted a copy of the manufacturer's test report with results or a statement by the seller, that the material has been sampled, tested and inspected. Each certification shall be signed by an authorized agent of the seller or manufacturer.

### **704.03 MATERIALS.**

Materials for pressure sewage force mains shall conform to the following requirements:

- A. **DUCTILE IRON PIPE.** Ductile iron pipe shall be push-on joint, pressure, bituminous exterior coated and shall conform to AWWA C151, latest revisions. For 12-inch and smaller pipe provide minimum Pressure Class 350. For piping from 14-inch to 20-inch provide minimum Pressure Class 250 and for 24-inch and larger piping provide Pressure Class 200. Where pipe laying conditions require greater strengths than the minimum pressure class, Thickness Design shall be according to AWWA C150. Pipe shall have an internal polyethylene lining with a minimum thickness of 0.035 inch. Polyethylene material shall conform to ASTM D1248.
  - (1) For any installation requiring polyethylene encasement for corrosion protection of ductile-iron pipe, the encasement shall be in accordance with AWWA C105.
  - (2) Restrained, push-on joint pipe shall be similar and equal to one of the following: American Ductile Iron Pipe's FLEX-RING JOINT pipe or U.S. Pipe's TR FLEX pipe.

- B. **PVC PIPE.** Polyvinyl chloride (PVC) pressure pipe shall conform to AWWA C900, latest revision for piping 12-inch and smaller. PVC pipe shall have cast iron outside diameter, elastomeric-gasket type joints and shall have a minimum working pressure rating of 235 psi. Pipe manufacturer shall furnish certification of compliance with the reference standards.
- C. **FITTINGS.** Fittings shall be gray-iron or ductile-iron conforming to AWWA C153 Standard for Ductile Iron Compact Fittings. Fittings shall be mechanical joint, polyethylene lined, exterior bituminous coated and shall have a minimum working pressure rating of 250 psi. Polyethylene lining shall conform to ASTM D1248 and shall be 0.035 inch minimum thickness.
- D. **MISCELLANEOUS FITTINGS.** Couplings, adapters and related fittings shall conform to Section 601 of these specifications.
- E. **TRACER WIRE.** Tracer wire shall be Trace-Safe type RT1803W or Utility Department approved equal.
- F. **TRACER WIRE BOX.** Tracer wire shall be terminated in magnetized tracer box, Model CD14\*TP as manufactured by Copperhead Industries, LLC. The tracer box cover will be color coded in accordance with APWA uniform color code. The tracer wire shall not be terminated in any other location.
- G. **GRAVEL BEDDING.** Gravel bedding shall conform to Section 205 "Trench and Structure Excavation and Backfill."
- H. **CONCRETE.** Concrete shall conform to Section 401 "Concrete." Concrete shall be Class B (2500 psi), unless noted otherwise.
- I. **COMBINATION AIR VALVES.** Combination air valves shall be of the size shown on the plans and shall be Model D-020 as manufactured by A.R.I. Flow Control Accessories or an approved equal.

#### **704.04 QUALITY ASSURANCE.**

It is a requirement of these Contract Documents to have all of the force main pipe under this section designed and supplied by a single manufacturer rather than have selection and supply of these items by a number of different manufacturers. Similarly, it is a requirement of these Contract Documents to have all of the fittings under this section designed and supplied by a single manufacturer rather than have selection and supply of these items by a number of different manufacturers. All connections between the pipe and fittings shall be compatible.

#### **704.05 HANDLING AND STORAGE**

- A. Materials, if stored, shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt, excessive corrosion or foreign matter at all times.
- B. Pipe shall not be stacked higher than the limits recommended by its manufacturer. The bottom tier shall be kept off the ground on timbers, rails, or concrete. Stacking shall conform to manufacturer's recommendations.

#### **704.06 CONSTRUCTION REQUIREMENTS**

- A. **TRENCH EXCAVATION AND BACKFILL.** Trench excavation, bedding, boring, encasement, casing, and backfilling are covered in Section 205.

Pipe bedding for PVC pipe and Ductile Iron pipe shall conform to Class "B" bedding. Bell holes shall be provided at each joint to permit the jointing to be properly made and prevent the joint of the pipe from being a point of support. Whenever any portion of the trench is excavated below grade, it shall be corrected with thoroughly compacted material approved by the Engineer.

- B. **PIPE INSTALLATION.** Pipe fittings and accessories shall be unloaded near the place where they are to be laid in the trench. They shall at all times be handled with care to avoid damage. Cutting of pipe shall be done by means of an approved type of mechanical cutter.

Section of pipe, fittings and accessories shall be cleaned and inspected for damage immediately prior to placement in the trench. All defective materials shall be rejected. Pipe, fittings and accessories shall be placed in the trench and shall be positioned utilizing hoisting equipment. Pipe shall be laid true to line and grade, with uniform bearing under the full length of the pipe barrel.

Field bending of PVC pipe or Ductile Iron pipe will not be allowed. Fittings shall be used to accomplish radius bends. Pipe deflections will be allowed up to the degree specified by the manufacturer, but shall not exceed this amount.

Jointing of pipe shall be accomplished in accordance with the pipe manufacturers' recommendations. Gaskets and lubricants shall be the type recommended by the pipe manufacturer. The spigot end of the pipe shall be inserted into the bell to the required depth and in such manner as to avoid displacement of the gasket. Jointing of mechanical-joint pipe shall be accomplished such that the gland is positioned evenly by tightening alternately the bolts spaced 180 degrees apart.

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug. Plug shall be Petersen Mechanical Hand Tightening Series 141, COB Industries Cast Aluminum Expansion Plug, or approved equal. This provision shall apply during the lunch period, overnight, or any other time when work is not in progress. No pipe shall be laid in wet trench conditions that preclude proper bedding, or on a frozen trench bottom, or when in the opinion of the Engineer, the trench conditions or the weather are unsuitable for proper installation.

- C. **CONCRETE THRUST BLOCKING.** Concrete thrust blocking shall be installed only at the locations shown on the plans. Restrained joints shall be used unless concrete blocking is authorized by the Engineer. The concrete shall be placed between undisturbed soil and the fitting to be anchored. Care shall be taken to place the thrust block that the pipe and fitting joints will be accessible for repair.

The shape and contact area of the concrete thrust blocks shall be as shown on the plans and as directed by the Engineer. The contact area of backing shall be as required to prevent movement of the joint, but in no case shall the contact area be less than one square foot.

- D. **TRACER WIRE INSTALLATION.** Tracer wire shall be installed in a continuous non-interrupted circuit on all sewer force mains. The wire shall be attached to the top center of the pipe every four feet by a method approved by the Engineer. Tracer wire boxes shall be installed at locations shown on the plans or as determined by the Engineer. Tracer wire box spacing shall not exceed 500 feet.

- E. **STREET CROSSINGS.** . All liner pipe shall be installed within casing using restrained joints and shall be installed in accordance with the requirements in Section 205.06.

#### **704.07 INSPECTION AND TESTING**

All force main piping shall be subject to a hydrostatic and leakage test.

These tests shall be performed by the Contractor in the presence of the Engineer. The Contractor shall furnish all necessary pressure gauges, meters and pumps and make all taps and connections.

Each valved section of pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. Before applying the test pressure, all air shall be expelled from the pipe by permanent taps or corporation cocks where necessary.

It shall be the Contractor's responsibility to locate and repair any and all leaks and defects that may develop. Even though the pipe line may pass the leakage test, any leaks apparent at the ground's surface, any leaking joints, fittings or appurtenances, or any other visible defects shall be repaired to the satisfaction of the Engineer.

The hydrostatic and leakage tests may be performed simultaneously, but the duration of the test shall be not less than 2 hours. A pressure equal to, or exceeding, 1.5 times the working pressure of the pipe and never less than 150 psig at the point of testing shall be maintained throughout the test. Test pressure shall not be less than 1.25 times the working pressure at the highest point along the test section. No pipe installation will be accepted until the leakage is less than the number of gallons per hour, permitted by AWWA C600 as determined by the formula:

$$L = \frac{S * D * \sqrt{P}}{133200}$$

Where:

L = the allowable leakage, in gallons per hour;

S = the length of pipe line tested in feet;

D = the nominal diameter of the pipe, in inches;

P = the average test pressure during the leakage test, in pounds per square inch gage.

If testing results in leakage greater than the allowed maximum; the defective pipe and joint(s) shall be located and repaired. When repair work is complete, tests shall be performed again to determine that leakage is within the allowable limit.

#### **704.08 MEASUREMENT AND PAYMENT.**

The measurement and payment of the work included in this section of the specifications shall be at the contract unit prices listed in the proposal for the items of work. Payment at the contract unit price for each item shall be considered full compensation for furnishing all materials, labor, equipment, tools, supplies and incidentals necessary to complete each item of work.

- A. **SEWER PRESSURE PIPE.** Force main will be measured by the linear foot along the centerline of the pipe from point of connection to lift station, manhole or other designated location. Payment for force main at the contract unit price for the size and type of pipe listed in the proposal shall be full compensation for furnishing and installing pipe and fittings, and for excavation, trenching, backfilling, gravel bedding, tracer wire, concrete blocking, testing and related work.

Rock excavation and select backfill will be paid for under Section 205 "Trench & Structure Excavation and Backfill." Flowable Fill will be paid for under Section 206, "Flowable Fill Material".

Street and highway crossings and driveway and sidewalk removal and replacement will be measured and payment made as specified in other sections of these specifications.

- B. **FORCE MAIN FITTINGS.** Ductile iron fittings will be measured by the listed weight in pounds, excluding glands, bolts and accessories, as given in AWWA C153, latest revision.

No separate payment will be made for miscellaneous fittings, adapters, repair clamps, couplings or other appurtenances.

- C. COMBINATION AIR VALVE. Combination air valves will be measured and payment made according to the number of each size and type furnished and installed. Valve vaults and appurtenances will not be measured separately, but will be included as a portion of the payment for combination air valves.
- D. RESTRAINED JOINT. Restrained joints will be measured and payment made according to number of joints furnished and installed. Any thrust blocking required shall be considered incidental to this item.
- E. POLYETHYLENE WRAP. Polyethylene wrap will be measured by the linear foot along the centerline of the pipe wrapped. Payment for polyethylene wrap at the contract unit price for the size of pipe wrapped listed in the proposal shall be considered full compensation for all labor and materials required to complete the work.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Sewer Pressure Pipe (Size and Type)	LF
Force Main Fittings	LBS
Combination Air Valve (Size)	EA
Restrained Joint	EA
Polyethylene Wrap	LF

**SECTION 705**  
**REHABILITATION OF EXISTING SEWER LINES WITH CIPP**

**705.01 SCOPE OF WORK**

This work shall consist of furnishing all labor, materials, tools, equipment, incidentals, testing and construction methods or processes required to rehabilitate existing sewer lines including cleaning; removal and disposal of debris; bypass pumping; performing sample testing; cured-in-place pipe (CIPP) lining of existing sanitary sewer lines and services; point repairs; CIPP short liners; installing end seals; reconnecting active property connections; removing protruding taps by remote methods as detailed in Section 701; stopping active leaks that might interfere with the integrity of the liner to be installed; providing water; complete and accepted, in accordance with the Contract Documents.

Excavation, trenching, backfilling, sewer structures, and other sewer appurtenances are specified in other sections of these specifications.

**705.02 QUALIFICATIONS AND SUBMITTALS**

- A. **WORK PLAN.** Prior to the preconstruction conference, the Contractor shall submit a work plan to the Owner and Engineer for review and approval. The work plan shall address the following minimum preparations and/or steps: safety, pre-installation television inspection, bypassing sewage, line obstructions, proposed materials, installation procedures, finished pipe, post-installation television inspection, and restoration of services. Additional items to be addressed in the work plan may be added as directed by the Owner or Engineer. Contractor shall follow all recommendations by Manufacturers.
- B. **MANUFACTURE TEST REPORT.** Certification shall be the basis of acceptance of materials and methods required below. The Contractor shall submit a copy of the manufacturer's test report(s).
- C. **APPROVAL.** Owner or Engineer reserves the right to approve or disapprove Contractor, Superintendent, and/or manufacturer based on submitted qualifications and a follow-up interview.
- E. **SUBMITTAL ITEMS.** Contractor required to submit the following:
  - (1) Work Plan
  - (2) Shop Drawings
  - (3) List of Materials



- (4) Technical Data
  - (5) CIPP System Data
  - (6) Design Calculations
  - (7) Manufacturers Resin Data Test Results
  - (8) Resin Enhancer Manufacturers Data
  - (9) Certification of Applicability of Resin
  - (10) Experience Record of Contractor
  - (11) List of Subcontractors with Experience
  - (12) Locations of Additional Access Points
  - (13) Installation and Bypass Pumping Plan (including emergency plans)
  - (14) Pre/Post-Installation CCTV
  - (15) Installation and Resin Curing Schedule
  - (16) Tap Cut Sheets
  - (17) Copies of Quality Control Tests
  - (18) CIPP Repair Methods (if required)
  - (19) Point Repair Methods (if required)
  - (20) Physical Samples
  - (21) Temperature and Cook Logs
- F. **FIBERGLASS CURED LINER.** If a fiberglass cured liner is used, the Contractor shall provide third party test results that document styrene residual levels are within acceptable levels defined by the manufacturer, without flushing.
- G. **REPORT FORMAT AND LABELING.** Reports shall be submitted on 8-1/2" x 11" paper. Larger drawings shall be folded to this format. Submittals shall be stamped by

Contractor to indicate Contractor, date of submittal, Owner's project title and number, applicable Section of Specifications to be referenced, and signature of preparer.

CCTV recordings shall be submitted to the Owner in accordance with Section 701.02.

- H. BYPASS PLAN. The Contractor shall submit a bypass plan for any proposed bypass or dewatering activity within seven (7) days of any planned bypass, in accordance with Section 709.

### **705.03 MATERIALS**

- A. FELT TUBES (CIPP). The tube shall be fabricated to a size that when installed will neatly fit the internal circumference of the conduit specified by the Owner. Allowance shall be made for circumference stretching during insertion. Folds or abnormal wrinkles in the tube after installation will not be acceptable.

The Contractor shall furnish a general purpose, unsaturated, polyester resin and catalyst system compatible with the utilized process that provides cured physical strengths.

The liner shall have a uniform thickness such that when compressed at installation, pressures will meet or exceed the design thickness specified by the Manufacturer.

An "inner liner" or "outer liner" film used for resin control may be used, provided the liner film is made an integral part of the carrier tube by bonding or fusing to the carrier tube. Any plastic coatings on the tube that will become the inside surface of the finished CIPP shall be a translucent flexible material that is compatible with the resin system used, and must be fully bonded to the absorbent tube material.

The wall color of the interior pipe surface of the CIPP after installation shall not be of a dark or non-reflective nature that could inhibit proper CCTV inspection.

The tube shall contain no intermediate or encapsulated elastomeric layers. No materials that are subject to delamination in the cured state shall be included in the tube.

No glass fiber reinforcement shall be used without Engineer's authorization. If glass fiber reinforcement is used in the tube, there must be layers of unreinforced, resin absorbent material on the inside and outside of the tube to protect the fibers from being exposed to the pipe flow and external water.

Sewing of pieces of the liner together to form the length desired for a particular run will not be allowed without the approval of the Engineer.

Holes made in the felt liner shall be identified with an identifiable marker and repaired before delivery to the job site. Repaired puncture marks or tears must be approved by the Engineer before insertion into the pipe line.

- B. RESINS. The liquid resin used in this rehabilitation project shall produce a properly cured tube which will be resistant to abrasion caused by solids, grit, and/or sand. The cured tube shall also be resistant to corrosion due to acids or gases such as sulfuric acid, carbonic acid, hydrogen sulfide, methane, and carbon monoxide. The resin used shall have proven resistance to municipal sewage.

The resin system to be used shall be manufactured by an approved company selected by the CIPP process manufacturer. Only corrosion resistant polyester, vinyl ester and epoxy resins shall be used:

Any resin enhancers, bond enhancers, and other additives must be compatible with material used and submitted, reviewed, and approved by the Engineer.

- C. GLASS REINFORCED PLASTIC (GRP) UV CURED LINER. The GRP UV cured liner shall be a resin-impregnated fiberglass material tubing impregnated with a UV light-setting resin to seal against the internal circumference of the pipe.

The resin shall be a chemically resistant UV cured vinyl ester resin as reviewed by the Engineer, and shall withstand the elevated pH conditions at the site.

The resin used to impregnate the liner shall produce a cured liner pipe resistant to shrinkage, corrosion, abrasion and shall have a proven resistance to conditions at the site.

The liner shall be fabricated from materials which, when cured, will be chemically resistant to chemicals and gases typically found in sanitary sewer collection systems.

Individual insertion runs can be made over one or more manhole sections.

The liner shall consist of an innerfilm and outerfilm material that are impervious to airborne styrene. The outerfilm shall be UV light resistant and translucent to allow visual inspection of the impregnation of the resin within the glass fibers.

The cured liner shall meet the following initial structural properties:

- (1) Flexural Strength (ASTM D790) 30,000 psi min.
- (2) Flexural Modulus (ASTM D790) 1,500,000 psi min.

The liner shall be fabricated to a size which will neatly fit the internal circumference of the pipe in accordance with the manufacturer's requirements. The tube shall not have a longitudinal seam. The Subcontractor shall verify all inside dimensions of the pipe to be lined.

The finished liner shall maintain the flow carrying capacity of the original pipe.

D. **HYDROPHILIC END SEALS.** The use of Hydrophilic end seals shall be for all liners.

Contractor shall install hydrophilic pipe end seals at all manhole penetrations prior to mainline CIPP rehabilitation. The end seals shall be composed of hydrophilic rubber and molded as a one-piece cylinder with a minimum width of three (3) inches. When installed, the end seal shall form a 360 degree seal between the host pipe and the newly installed liner.

Hydrophilic end seals shall be Insignia End Seal Sleeve by LMK technologies, or approved equal.

**705.04 QUALITY ASSURANCE**

A. **CURED-IN PLACE PIPE.** Contractor performing CIPP lining work shall be fully qualified, experienced and equipped to complete this work expeditiously and in a satisfactory manner and shall be certified and/or licensed as an installer by CIPP lining manufacturer. Contractor's personnel shall have successfully installed a minimum of 50,000 feet (total) of proposed CIPP liner within the last three (3) years in pipe of a similar size, length and configuration as contained in this contract as documented by verifiable references.

Full-time, on-site superintendent/foreman that will supervise CIPP lining installation shall have successfully installed a minimum of 50,000 feet (total) of proposed size range of CIPP liner within the last three (3) years as documented by verifiable references.

CIPP felt and resin manufacturer(s) shall have successfully supplied a minimum of 500,000 feet of proposed liner and one million pounds of resin as documented by verifiable references.

B. **CIPP SHORT LINERS.** The Contractor or subcontractor to furnish and install short liner shall be fully qualified, experienced and equipped to complete the work in a timely and satisfactory manner. The following information shall be submitted to the Owner or Engineer for review and approval before short liner work is performed:

- (1) The number of years of experience in performing this type of specialized work.

- (2) Name of the short liner manufacturer and supplier for this work and previous work performed. The Contractor shall be certified by the manufacturer to install the short liner patches.
- (3) A list of all municipal installations performed over the past 5 years along with the contact name, telephone number, and brief description of work performed.
- (4) The Owner or Engineer reserves the right to disapprove the use of the short liner Contractor based on the submitted qualifications.

All short liner spot repairs, regardless of pipe size or length, shall be furnished, fabricated and installed by a single manufacturer.

As directed by the Owner or Engineer, Contractor shall replace all short liner that utilized materials or methods of installation other than that approved. Remove and replace the short liner section or replace the affected pipe with new pipe at no cost to the Owner.

#### **705.05 NOTIFICATION**

Refer to Section 711 for notification details and information.

#### **705.06 HANDLING AND STORAGE**

Care shall be taken in shipping, handling and storage to avoid damaging the CIPP liners and short liners. Any liner damaged in shipment shall be replaced as directed by the Engineer.

B. Any liner or short 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. The liner or short liner shall be maintained at a proper temperature in refrigerated facilities to prevent premature curing at all times and shall be protected from UV light prior to installation. Any liner or short liner showing evidence of premature curing will be rejected for use and will be removed from the site immediately.

#### **705.06 FIELD MEASUREMENTS.**

All pipe sizes will be stated on the Contract Documents. Contractor shall verify lengths and sizes in field prior to ordering any rehabilitation materials, to ensure that all materials will have sufficient length to extend the entire length of the run, which is defined as the length of the existing host pipe measured from the interior walls of the manholes, and/or from the ends of the pipe when/if the pipe extends into the manholes. Contractor shall also measure inside diameter and circumference of existing pipelines at face of each manhole in field prior to ordering liner so that liner can be installed in a tight-fitted condition with little or no wrinkling.

**705.07 GENERAL**

Work performed under this Specification shall be done in accordance with Municipal, State, and Federal standards. Warning signs, barricades (lighted after dusk), and flaggers shall be provided by the Contractor for safety and traffic control. All traffic control is the responsibility of the Contractor, and must be in accordance with Section 120 MAINTENANCE OF TRAFFIC AND TRAFFIC CONTROL. All signage for work on state highway rights-of-way shall conform to the state highway department requirements.

All water used during rehab processes shall be collected and disposed of at the City of Fort Smith waste-water treatment facility.

The Contractor shall provide whatever measures are required to prevent the movement or discharge of gases, liquids or solids associated with the rehabilitation materials and processes into any adjacent buildings upstream or downstream of the sewers being rehabilitated. The Contractor shall be responsible and liable for any damages or violations associated with such actions. The Contractor shall also be responsible for monitoring and protecting the discharge of any by-products caused by the installation of any rehabilitation materials or processes.

**705.08 CURED IN PLACE PIPE (CIPP) DESIGN PARAMETERS**

CIPP Design Parameters are as follows:

- A. **STRUCTURAL REQUIREMENTS.** The CIPP design shall assume no bonding to the original pipe wall. The bond between all CIPP layers shall be strong and uniform. All layers, after cure, must form one, uniform structural pipe wall with no part of the tube left unsaturated by resin.

Design parameters in the following table shall be used:

*Table 1. CIPP Design Parameters*

<u>Parameter</u>	<u>CIPP System</u>
Pipe Condition	Fully deteriorated
Soil Type	Saturated/unsaturated
Design Thickness	The output product thickness needs to meet the minimum design thickness
Groundwater Depth	Ground surface level
Ovality of Pipe	2% of circumference (min.)

Soil Load	120 lbs./cf
Traffic Loads	AASHTO HS-20 live load
Modulus of Soil	Max 1,000 psi
Long Term Flexural Strength	50% of initial (ASTM D790)
Long Term Flexural Modulus of Elasticity	50% of initial (ASTM D790)
Maximum Deflection (vertical axis)	7.5% (for standalone purposes)
Minimum Safety Factor	2.0

Liner thicknesses for the work specified, will be calculated by the Contractor for each specific line segment shown in the Contract Documents. The Contractor shall verify depth of cover for all line segments shown as part of the CIPP design. Contractor’s design shall be based on actual depth of cover for each pipe segment shown. It shall be the Contractor’s responsibility to ensure that infiltration does not affect the curing or strength of the final product.

The cured tube shall conform to the minimum structural standards, as listed below.

**Table 2. Cured Liner Minimum Structural Standards**

<u>Property</u>	<u>ASTM</u>	<u>Initial Value (psi)</u>	<u>Long Term (psi)</u>
Tensile Strength	D-638	4,000	4,000
Flexural Strength	D-790	4,500	4,500
Flexural Modulus	D-790	350,000	175,000
Maximum Pipe Deflection Allowed is 7.5%			
Strength values are Median Values for temperature Ranging from 40°F (4°C) - 70°F (21°C)			

**705.09 CONSTRUCTION REQUIREMENTS**

Updated copies of the log shall be submitted to the Owner after each Crew-day is completed.

- A. **INSTALLATION OF FLET LINER.** By beginning the installation of the liner, the Contractor implies, by their actions, the line is an acceptable candidate for lining.

The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss

of resin through cracks and irregularities in the original pipe wall. The resin shall be uniformly distributed throughout the tube.

The Contractor shall designate a location where the fiber tube will be impregnated ("wet out") with resin to thoroughly saturate the fiber tube prior to its dispatch for installation. The Contractor shall inform the Engineer in advance of the materials and wet out procedure to be used. A catalyst system or additive(s) compatible with the resin and tube may be used for viscosity control as provided by the resin manufacturer.

No absorbent layers of tube shall be inserted into the existing pipe without being fully impregnated with resin.

Tube installation forces or pressures shall be limited so as to meet manufacturer's recommendation for maximum longitudinal stretching.

Any bladders or tubes used to inflate the tube material against the original pipe that were not fully bonded to the tube material prior to insertion into the original conduit shall be completely removed after CIPP installation.

The existing pipe must be dewatered per manufacturer's specification.

The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supply. Another such gauge shall be placed between the impregnated tube and the pipe invert at the remote manhole to determine the temperature during cure. Water temperature in the line during the cure period shall be recommended by the resin manufacturer.

Initial cure shall be deemed to be completed when the exposed portions of CIPP appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of a duration recommended by the resin manufacturer, as modified by the designated process during which time the recirculation of the water and cycling of the heat exchanger to maintain the temperature continues.

The Contractor shall cool the hardened CIPP to a temperature below 100° F before relieving any bladders or tubes used to inflate the tube material against the original pipe. Water temperature must be less than 100<sup>0</sup>F prior to disposal into sewer collection system.

The finished CIPP shall be continuous over the entire length of the run and be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes and delamination. It shall also meet the leakage or pressure test requirements for the main line and lateral connections.



If the Contractor fails to make a tight seal due to broken or misaligned pipe at the manhole wall, the Contractor shall apply a seal at that point. The seal shall be of a resin mixture compatible with the CIPP and at no additional cost to the Owner.

For CCTV inspection, the Contractor is responsible for adhering to the same requirements as noted in Section 701 within this specification.

Video CCTV inspections and tap reopening shall be performed as specified in Section 701. Cutting and trimming equipment shall be able to satisfactorily perform the operations. Satisfactory operation of cameras and other equipment must be demonstrated and approved before lining operations begin. After the tube has been cured in place, the Contractor shall reconnect all the existing service connections. The Owner reserves the right to use means such as dye testing to confirm activity, as necessary at the cost of the Owner. Opening the lateral connections shall be done without excavation, and in the case of non-man entry pipes, from the interior of the pipeline by means of CCTV and a cutting device that re-establishes them to not less than 90% capacity. The cuts shall be trimmed to a neat, clean, circular opening concentric with the service line pipe, free of jagged edges, "sawteeth", resin plugs or resin shelves. All cuts shall be brushed with a like resin or wire brush to form a smooth opening, so as not to catch floatables in the sewage.

The CIPP shall make a tight seal at the manhole opening with no annular gaps using hydrophilic end seals as specified herein. Where the liner continues through the manhole, the upper portion of the liner will be removed and the bottom half to remain, resulting in a smooth, continuous flowline through the manhole. Inverts may be rebuilt using epoxy grout or the CIPP liner material should be sealed to the invert and bench with quick-set epoxy mortar or high viscosity epoxy. These procedures shall be completed before proceeding to the next manhole section.

The Contractor shall make sure through CCTV inspection that each active lateral connection is opened, free to discharge and is not plugged or backed up as a result of the lining operation.

**B. INSTALLATION OF GLASS REINFORCED PLASTIC (GRP) UV CURED LINER.**

By beginning the installation of the liner, the Contractor implies, by their actions, the line is an acceptable candidate for lining.

It is the intent of this Article of the specifications to provide for the lining of sewer by the installation of a GRP UV cured resin -impregnated tube, inserted into the existing sewer from an approved access point and fully extended to the next designated manhole or termination point in accordance with ASTM F2019, utilizing a winch.

A slip sheet may be installed on the bottom half of the pipe prior to liner insertion, for the purpose of smoothing out the bottom of the liner and bridging any missing areas of the host pipe.

The winch must have the capability of documenting the amount of tension and speed used to pull the liner into the pipe. The Manufacturer's maximum pulling tension and speed shall not be exceeded. Care shall be exercised not to damage the tube during the pulling phase.

Once the liner is inserted, end plugs shall be used to cap each end of the fiberglass liner to prepare for pressurizing the liner to form an air tight seal. The end plugs shall be secured with straps to prevent them from being expelled due to pressure. Liner restraints shall be used as necessary.

The fiberglass liner shall be cured after insertion with a UV light source at a constant inner pressure as specified by the Manufacturer. The resin shall cure into a hard impermeable pipe liner in accordance with applicable ASTM F2019. A camera shall be located on the ultraviolet light assembly to enable the video inspection of the liner and to ensure that the liner has been properly inflated and any liner problems can be identified before curing begins.

For the liner to achieve the required water tightness and specified mechanical properties, curing speed, UV bulb wattage, inner air pressure, and exothermic (curing) temperatures must be controlled during the entire curing process, and are defined in the quality protocol issued by the Manufacturer. The Owner or Engineer shall be given a record of the curing parameters over every segment of the entire length of the liner. This shall be accomplished using a computer and database that are tamper proof. During the curing process, infrared (IR) sensors shall be used to record curing data that will be submitted to the Owner or Engineer with a post CCTV inspection on DVD.

The inner film material shall be removed and discarded after curing.

Flushing of the GRP UV cured liner is not required if 3rd party test results document styrene residual levels are within acceptable defined levels without flushing.

The finished liner shall be continuous over the entire length of the insertion run, and as free as commercially practicable from visual defects such as folds, foreign inclusions, dry spots, pinholes, and delamination.

- (1) Any defect which the Owner or Engineer determines will affect the flow channel, capacity, integrity or strength of the liner shall be repaired or the entire liner replaced at the Contractor's expense.
- (2) All inlets and outlets of the cured liner shall be cut flush at the inlet and outlet points in the manhole or other access point, and sealed with an epoxy or resin mixture compatible with the liner/resin system, providing a watertight seal per

Manufacturer's recommendation. Sealing material and installation method shall be submitted and approved by the Owner or Engineer prior to start of construction.

(3) Connecting manholes shall be rehabilitated in accordance with Section 706.

C. CLEAN-UP OPERATIONS. All materials removed from the pipe line and from the pipe lining process shall be satisfactorily disposed of offsite by the Contractor.

Prior to final acceptance, the Contractor shall demonstrate, in the presence of the Owner, the capability of the liner to perform as specified. Any deficiencies found in the liner shall be corrected at no additional cost to the Owner.

### **705.10 INSPECTION AND TESTING**

A. INSPECTION. For each continuous length designated by the Owner in the Contract Documents or each production run of liner utilized (in the case where resins are applied as part of the manufacturing process), one liner sample shall be prepared from a section of the cured pipe at an intermediate manhole or at the termination point. (Note: In areas with limited space and larger diameter pipes, other sampling techniques may be required).

The liner samples shall be tested in accordance with the applicable ASTM procedures for the resin being used (i.e. ASTM F1216).

A final CCTV inspection shall be made following installation of the CIPP to document all work performed and copies shall be submitted to the Owner and Engineer, as specified in Section 701. Visual inspection of the CIPP shall be made in accordance with ASTM F1743 and Section 701.

If the liner fails to meet the test criteria, it will be repaired as necessary by the Contractor, and retested, at no additional expense to the Owner. The pipe line will not be considered acceptable until it successfully passes the requirements of this test.

The Contractor shall be responsible for all costs, and delays incurred due to efforts to locate and repair any leaks in any sewer pipeline which fails the test, regardless of whether the failure is due to workmanship, material failure or the result of improperly installed equipment.

All testing will be conducted by the Contractor or approved Subcontractor in the presence of the Owner's representative. The Contractor or Subcontractor shall keep a written record that will show the results of the tests conducted. The records shall include sufficient data on length of line, time, and related features noted during the testing of each segment of the line. A copy of records shall be given to the Owner or Engineer.

B. TESTING. Testing of the completed liner consists of:

- (1) Field testing
- (2) Laboratory testing

The Contractor will pay for all initial tests and retests described herein.

The following samples shall be taken from the field setup, discussed below. Similar lined sewer segments shall be sampled at the discretion of the Owner, but not more frequently than once every 5 runs.

- (1) Samples: Samples removed for testing will be individually labeled and logged to record the following:
  - a. Owner's project number and title
  - b. Sample number
  - c. Segment number of line as noted on plans
  - d. Date and time of sample
  - e. Name of Contractor
  - f. Date, location, and by whom tested
  - g. Results of the test

Samples shall be taken once (1) in every five (5) runs with a minimum of one (1) sample per day per CIPP pipe size per crew. The sample shall be a restrained sample at one of the pipe ends. Two cured plates, 6" x 16" in size, shall be taken from the cook down tube, not the liner in the pipe. No destructive test will be allowed to liner that is to be left in place. The samples shall be numbered as follows:

- a. Sample #/A: resin sample
  - b. Sample #/B: flat plate sample
  - c. Sample #/C: upstream thickness test
  - d. Sample #/D: downstream thickness test
  - e. Additional samples will be lettered consecutively after "D".
- (2) Field Test (Thickness): The liner shall be run through a 24" long section of similar line-size to act as a mold for the liner and cured. One such sample shall be taken from liner at the ending manhole of the section being lined. One core sample shall be taken from the middle of each molded section and thickness determined per the method above. Cost for any excavating, sampling, and backfill shall be included in the bid.
  - (3) Laboratory Testing (Resin, Physical Properties): Samples obtained for these tests will be sent by the Contractor to an approved laboratory for the following tests.

- a. Resin: Using the cured resin sample, an infrared spectrography chemical fingerprint shall be run and compared to the submitted fingerprint to verify the resin used is the resin submitted for use on this project. Unapproved resins or resins not submitted with the approved submittals are rejected and any liner installed with unapproved resin will be removed and replaced at Contractor's expense.
  - b. Physical Properties: The cured 6" x 16" plate will be used to test modulus of elasticity and flexural strength and to verify the requirements have been met.
- (4) Chemical Resistance: The CIPP shall meet the minimum chemical resistance for standard domestic sewer applications unless directed otherwise by the Owner. Chemical resistance tests should be completed in accordance with Test Method D 543. Exposure should be for a minimum of one month at 73.4° F (23° C). During this period, the CIPP test specimens should lose no more than 20% of their initial flexural strength and flexural modulus. A makeup of the chemical solutions is as defined below.

**Table 3. CIPP Chemical Resistance**

<b>Chemical Solution</b>	<b>Concentration %</b>
Tap water (pH 6-9)	100
Nitric Acid	5
Phosphoric Acid	10
Sulfuric Acid	10
Gasoline	100
Vegetable oil	100
Detergent	0.1
Soap	0.1

- (5) Long-Term Reduction in Physical Properties: Long-term creep data in accordance with ASTM D2990 shall be submitted by each manufacturer and/or CIPP product. Duration of creep testing shall be a minimum of 10,000 hours. As an option, documentation for a minimum of 10,000 hours of pipe long term modulus evaluation by an outside test lab may be provided.

If glass fiber reinforcement is used, CIPP strain-corrosion testing in accordance with D3681 must be submitted.

- C. ACCEPTANCE CRITERIA. Field acceptance of the liner shall be based on the Owner or Engineer's evaluation of the installation including inspection videos and a review of certified test data for the installed pipe samples.

Groundwater infiltration of the liner shall be zero. All service connections shall be open and clear. There shall be no evidence of splits, cracks, breaks, lifts, kinks, delaminations or crazing in the liner.

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 Owner. Repair methods shall be submitted to the Owner or Engineer for approval. Any liner failure that requires excavation work to repair shall be initiated within two (2) hours of failure observation.

#### **705.11 LINE OBSTRUCTIONS.**

Refer to Section 701 for specifications on cleaning of sewer lines.

#### **705.12 MAINTENANCE OF FLOW / BYPASS SEWAGE**

Refer to Section 708 for specifications on by-pass pumping.

#### **705.13 MEASUREMENT AND PAYMENT**

The measurement and payment of the work included in this section of the specifications shall be at the contract unit prices listed in the proposal for the items of work. Payment at the contract unit price for each item shall be considered full compensation for furnishing all materials, labor, equipment, tools, supplies and incidentals necessary to complete each item of work.

Payment for work will not be considered until post-construction CCTV videos are received, reviewed, and accepted by the Owner. The Owner reserves the right to re-review tapes after payment for final acceptance. The post video shall include full mainline surveillance as well as the viewing of all laterals for adequate cutting of openings.

All pre- and post-construction television inspection and cleaning for lateral liners shall be paid for as set forth in Section 701. All by-pass pumping shall be paid for as set forth in Section 708.

- A. CIPP SEWER MAIN. CIPP for the mainline and short liners shall be measured by the actual number of linear feet of CIPP installed, measured in place along the centerline of the pipe from center of manhole to center of manhole of the various sizes indicated. Measurement shall be to the nearest tenth of a foot. CIPP for the mainline and short liners shall be paid for by the respective quantities, at the sizes defined, as determined in the Contract unit bid price. This price and payment will be full compensation for furnishing all materials, labor, tools, equipment and appurtenances required or otherwise necessary to satisfactorily complete the Work, stopping of active leaks that would interfere with the integrity of the line to be installed, obtaining water, repairs to private property, public notification, any excavations and backfilling, sewer flow control;

hydrophilic end seals; acceptance testing, sampling and testing, preconstruction video of project site, care and protection of property; and all costs, labor, materials, and equipment incidental thereto, for which separate payment is not provided under other Items.

- B. SERVICE LATERAL REINSTATEMENT AFTER CIPP OF MAIN. Reconnection of active service laterals of the size installed shall be measured by the actual number of laterals reconnected as determined by the Owner or Engineer. Reconnection of active service laterals shall be paid for each building lateral reconnected as determined above at the Contract unit price bid.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
CIPP Sewer Main (Size and Type)	LF
Service Lateral Reinstatement After CIPP of Main (Size)	EA

## **SECTION 706 EXISTING SEWER STRUCTURES**

### **706.01 SCOPE OF WORK.**

This work shall consist of furnishing all labor, materials, tools, equipment, incidentals, testing and construction methods or processes required to rehabilitate existing manholes including eliminating infiltration and exfiltration; providing corrosion protection; cleaning of existing manholes; repairing of voids and restoration of the structural integrity off the existing manholes by applying monolithic fiber-reinforced structural/structurally enhanced cementitious liner to the wall and bench surfaces; installing fiberglass manholes; removing existing chimneys and replacing with new chimneys; identifying correct sizes of and installing new frames and covers; repair or rebuild invert channels, sealing pipe connections and stopping active infiltration with chemical sealant in manholes.

Work performed under this Specification shall be done in accordance with Municipal, State, and Federal standards. Traffic control and safety shall be in accordance with Section 120.

All materials shall conform to the standards referenced. All lubricants, adhesives and other incidental materials shall conform to the pipes manufacturer's recommendations.

### **706.02 QUALIFICATIONS AND SUBMITTALS**

Contractor and manufacturer of the selected manhole monolithic lining system shall furnish engineering data covering the design and installation. Submittals shall include:

- (1) Manufacturers' product data, including physical properties, surface preparation, repair, application, curing, and field control procedures.
- (2) Material Safety data sheets (MSDS) for any material brought on-site including all resurfacing system materials, solvents, and abrasive blast media. Supplement MSDS information with manufacturer's application and safety procedures for all coating system materials.
- (3) Manufacturer and applicator qualifications as specified.
- (4) Type of lining system for each manhole.
- (5) Diameter, depth (rim to invert), and material for each manhole.
- (6) All design calculations shall be stamped by a Registered Professional Engineer of the State of Arkansas.
- (7) Method of rebuilding bench and invert and sealing pipe at manholes.



- (8) Sewer flow control plug and/or bypass plan.
- (9) Written instructions and drawing details for treatment of lining materials at terminations in the structures to be lined including pipe penetrations, metal embedments, metal frames, and other terminations to be determined from the Drawings. This information should include detailed treatment for corrosion resistant lining systems at all joints in the concrete.

Per Section 105, the Contractor shall submit to the Owner or Engineer, within 10 days of the Effective Date of the Agreement, the name of the supplier (manufacturer), name of the installer, and a list of materials to be furnished before work may commence.

The Contractors shall submit a step-by-step description of methods, practices, intervals, etc. to be used in all rehabilitation systems to meet requirements of this specification Section.

Prior to each shipment of materials, the Contractor shall submit certified test reports that the materials for this Contract were manufactured and tested in accordance with the ASTM Standards specified herein.

Refer to Section 708 for by-pass pumping requirements. Refer to Section 709 for GIS and Data Delivery requirements.

A database or spreadsheet must be delivered by the Contractor describing the work performed and the structure asset attributes involved (cover, frame, depth, lining type, internal diameter). The digital data will be delivered in a format as required by the Owner. Prior to beginning work the Owner shall provide template databases or spreadsheets to be used by the Contractor to document structure rehabilitation work and structure attributes.

The Contractor or Subcontractor performing the manhole rehabilitation shall be fully qualified, experienced and equipped to complete this work expeditiously and in a satisfactory manner. The Contractor shall submit the following information to the Owner or Engineer for review and approval before any work is performed:

- (1) Be certified by manufacturer to install monolithic lining systems or fiberglass manholes.
- (2) Have a minimum of 5 years' experience or 500 manholes in performing this type of specialized work. This may be waived by the Owner through their product approval process with documentation demonstration projects.
- (3) Name of the manufacturer and supplier for this work and previous work listed below. The Contractor shall be an approved installer as certified and licensed by the manufacturer.

- (4) A list of municipal clients that the Contractor has performed this type of work over the past 5 years.
  - (a) The list shall contain names and telephone numbers of persons who can be called to verify previous satisfactory performance.
  - (b) Installation dates and a description of the actual work performed.
  - (c) The manufacturer shall provide an installation list of his product used for similar sewer manhole rehabilitation projects. The list shall provide the same information as required in paragraphs 3.a. and 3.b. above.
- (5) All manhole monolithic lining systems shall be from a single manufacturer. The supplier shall be responsible for the provisions for all test requirements specified in the referenced ASTM Standards as described herein as applicable for manhole monolithic lining. Inspections of any materials required for manhole monolithic lining may be made by the Owner or Engineer. All materials shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though sample materials may have been approved. Any materials rejected after delivery shall be marked for identification and shall be removed from the job site.

### **706.03 MATERIALS**

- A. **JOINT SEALING MATERIAL.** Sealing material for sealing exterior joints in precast manhole sections, concrete adjusting collars, cast iron adjusting rings, and cast iron frames shall be Wrapidseal manufactured by Canusa, Infi-Shield manufactured by Sealing Systems, Inc. or an approved equal.
- B. **MANHOLE PATCHING MATERIAL.** Manhole patching material for filling voids and repairing walls and inverts of concrete, brick, or other masonry structures shall be a rapid-setting (10-15 minutes), fiber-reinforced, high-early strength, corrosion-resistant, hand-mixed, hand-applied, calcium aluminate based cementitious material conforming to Strong-Seal QSR as manufactured by Strong Company, Octocrete as manufactured by IPA Systems, Inc., or approved equal. The patching material shall have a minimum compressive strength of 1,400 psi at 6 hours and shall be factory blended requiring only the addition of water at the job site.
- C. **MANHOLE LEAK-STOP MATERIAL.** Manhole Leak-Stop material shall be used where the infiltration flow rate through the manhole wall or pipe connection is greater than can be controlled with manhole patching material. Manhole Leak-Stop material shall be specifically formulated for leak control, rapid-setting (60 seconds), fiber-

reinforced, high-early strength, corrosion-resistant, hand-mixed, hand-applied, calcium aluminate based cementitious material conforming to Strong-Plug as manufactured by Strong Company or approved equal. The leak stop material shall have a minimum compressive strength of 1,000 psi at 24 hours and shall be factory blended requiring only the addition of water at the jobsite.

- D. **CONCRETE ADJUSTING COLLARS.** Concrete adjusting collars, used for setting the cast iron frame and covers to the required elevation, shall be made of concrete, shall have a minimum wall thickness of 6 inches and shall have an inside diameter the same as the existing inside diameter of the top of the manhole.
  
- E. **FIBERGLASS MANHOLES.** Fiberglass manholes shall be manufactured from commercial grade polyester resin or vinyl ester resin, with fiberglass reinforcements. The resin system shall be suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with wastewater collection systems. The manhole liner shall be a one piece unit manufactured to meet or exceed all specifications of ASTM D-3753, latest edition, and HS-20 load requirements, as manufactured by L.F. Manufacturing, Inc. or approved equal.
  
- F. **CEMENTITIOUS MANHOLE MONOLITHIC LINING SYSTEM (CMML):**  
 Cementitious lining system shall provide a minimum service life of 25 years. The system shall be:
  - (1) Type 1: Portland-based Cementitious Liner [no sulfide conditions (substrate surface of pH 4.0 or higher)].
    - (a) Acceptable Manufacturers and Products are Strong-Seal; MS-2A; MS-2C; Quadex QM-1s Restore; Standard Cement Re-liner MSP; Permacast MS-10,000; Mainstay ML-72; Dinjer CMS 10K; or approved equal.
    - (b) Portland-based cementitious liner product shall be used to form a structural monolithic liner covering interior substrate surfaces and have following minimum requirements:

***Table 4. Minimum Requirements for Portland-Based Cementitious Liners***

<b><u>Property</u></b>	<b><u>Specification</u></b>	<b><u>Timeframe</u></b>	<b><u>Pressure</u></b>
Compressive Strength	ASTM C 109	28 days	>9,000 psi
Tensile Strength	ASTM C 496	28 days	>800 psi
Flexural Strength	ASTM C 293	28 days	>1,200 psi
Shrinkage @90% R.H.	ASTM C 596	28 days	0%
Bond	ASTM C 882	28 days	>2,000 psi

Density, When Applied			134 ± 5lbs/ft3
Freeze/Thaw	ASTM C 666	N/A	300 cycles no visible damage

- (c) Portland-based liner shall be made with Type I Portland Cement and shall be used according to manufacturer’s recommendations in applications where there are no sulfide conditions (substrate surface of pH 4.0 or higher). Material shall meet or exceed industry standards and shall not have any basic ingredient that exceeds EPA maximum allowable limits for heavy metals. Water used to mix product shall be clean and free from contaminants. Questionable water shall be tested by a laboratory per ASTM C 94 procedure. Potable water need not be tested.
- (2) Type 2: Calcium Aluminate Cementitious Liner [mild sulfide conditions (substrate surface of pH 2.0 or higher)].
  - (a) Acceptable Manufacturers and Products are Strong MS-2C; Quadex Aluminaliner; Standard Cement Maximum CA; Permacast CR-9,000; Mainstay ML-CA; SewperCoat; or approved equal.
  - (b) Calcium aluminate cementitious liner product shall be used to form a structural monolithic liner covering interior substrate surfaces and shall have the following minimum requirements:

**Table 5. Minimum Requirements for Calcium Aluminate Cementitious Liners**

<u>Property</u>	<u>Specification</u>	<u>Timeframe</u>	<u>Pressure</u>
Compressive Strength	ASTM C 109	28 days	>9,000 psi
Tensile Strength	ASTM C 496	28 days	>800 psi
Flexural Strength	ASTM C 293	28 days	>1,200 psi
Shrinkage @90% R.H.	ASTM C 596	28 days	0%
Bond	ASTM C 882	28 days	>2,000 psi
Density, When Applied			134 ± 5lbs/ft3
Freeze/Thaw	ASTM C 666	N/A	300 cycles no visible damage

- (c) Calcium aluminate cementitious liner shall be made with calcium aluminate cement and shall be used according to manufacturer’s recommendations in applications where there are mild sulfide conditions (substrate surface of pH 2.0 or higher). Liner product shall be reinforced with alkaline resistant

fiberglass rods or other similar fibers not less than 1/2 inch in length. Material should meet or exceed industry standards and shall not have any basic ingredient that exceeds EPA maximum allowable limits for heavy metals. Water used to mix product shall be clean and free from contaminants. Questionable water shall be tested by a laboratory per ASTM C 94 procedure. Potable water need not be tested.

- G. **CURED-IN-PLACE MANHOLE LINER (CIPM):** The cured-in place lining system shall provide a minimum service life of 25 years. CIPM system shall be Poly-Triplex Liner System, Terre-Hill, or pre-approved equal.

Liner design and selection of materials shall be suitable for specified design conditions and shall meet minimum requirements outlined in the table below. Thicker liners may be required based on design conditions. Liner shall be custom designed to fit each manhole and basis of design shall be submitted to Owner or Engineer. It is Contractor’s responsibility to supply a CIPM liner that is most suitable for existing conditions and that meets requirements of this specification. Contractor shall assume groundwater at grade for all sites for purposes of liner thickness design unless otherwise instructed by Owner or Engineer.

<u>Manhole Depth (Grade to Invert)</u>	<u>Minimum Liner Thickness * (inch)</u>	<u>Minimum Pre-Saturated Fabric Weight (ounces)</u>	<u>Minimum Flexural Modulus of Elasticity (psi)</u>	<u>Minimum Compressive Strength (psi)</u>	<u>Chemical Resistance Testing</u>
	ASTM D5813		ASTM D790	ASTM D695	ASTM F1216 Appendix X2
0 to 10 ft	0.117	56	1,000,000	11,000	PASS
10.1 to 15 ft	0.117	56	1,000,000	11,000	PASS
15.1 to 20 ft	0.158	68	1,000,000	11,000	PASS
*Minimum liner thickness includes only the strength portion of the liner. Non-structural layers are not included in minimum thickness requirements.					

**706.04 QUALITY ASSURANCE**

All material shall be new and unused.

Material quantity, manufacturing process and finished sections are subject to inspection and approval by the Owner or Engineer. Inspection may be made at place of manufacture, at work site following delivery, or both.

Materials will be examined for compliance with ASTM standards, this Section and approved manufacturer's drawings. Additional inspection criteria include: appearance, dimension(s), blisters, cracks and soundness.

Materials shall be rejected for failure to meet any requirements specified herein. Rejection may occur at place of manufacture, at work site, or following installation. Mark for identification any rejected materials and removed from work site immediately. Rejected materials shall be replaced at no cost to the Owner.

Repair minor damage to precast concrete sections by approved methods, if repair is authorized by the Owner or Engineer.

### **706.05 CONSTRUCTION REQUIREMENTS**

Refer to Section 711 for notification details and information.

Materials shall be stored, shipped, and handled according to their material safety data sheet and manufacturer's recommendations.

The Contractor shall accurately field measure and size each individual manhole prior to ordering materials. All field measurements shall conform to the requirements of the required manufacturer.

Refer to Section 709 for maintenance of flow and bypass pumping.

- A. **REMOVE AND REPLACE FRAME AND COVER.** Set frames and covers in a full mortar bed. Utilize grade adjustment rings brick and mortars to assure frame and cover are set to the finished grade. Set the manhole frame and cover to finished grade prior to placement of final paving.

See Section 703 for the specified manhole frame and cover types and proper installation.

- B. **REMOVE EXISTING CHIMNEY AND REPLACE WITH NEW FIBERGLASS MANHOLE.** The Contractor shall remove brick or concrete chimneys as required to complete manhole rehabilitation work, including completely dismantling the existing chimney and all bricks or materials that comprise the chimney, and removal of the existing frame and cover. If the entire manhole is to be disassembled, the manhole shall be replaced using a pre-cast concrete manhole. If only the chimney is to be replaced, the chimney shall be replaced with a fiberglass manhole inserted into the host manhole, and extending to the bottom of the host manhole.

- C. **MANHOLE GRADE ADJUSTMENT.** Existing manholes shall be adjusted to grade using concrete or cast-iron adjustment rings; by removal and replacement of the frame and cover; or by reconstruction, modification or replacement of the top portion of the structure as shown on the plans or directed by the Engineer. Any portion of the remaining manhole structure damaged due to the negligence of the Contractor shall be repaired by the Contractor without compensation. The top of the frame and cover shall conform to the general requirements as previously set forth in this Section. All brick manholes shall be removed and replaced; no grade adjustment will be performed.

Backfill and compaction shall be as specified in Section 205 of these Specifications.

At locations where the existing manhole is buried, the Fort Smith Utility Department will assist the Contractor in locating the manhole.

- (1) **RAISING TOP LESS THAN 4 INCHES.** Where the top of the manhole is to be raised less than 4 inches, cast iron grade adjustment rings shall be installed in the existing frame. The rings shall be firmly seated in the existing manhole frames and shall be non-rocking. Manholes in pavement areas which are to be overlaid shall be adjusted to finish grade prior to the start of the pavement overlay operation, and shall include the construction of a concrete collar around the manhole frame and cover.
- (2) **RAISING TOP BETWEEN 4 AND 24 INCHES.** Where the top of the manhole is to be raised between 4 and 24 inches, the existing frame and cover is to be removed. Concrete adjusting collars and mortar shall be used as required to set the top of the frame to the correct elevation and slope. The existing frame and cover shall be reinstalled as previously set forth in this Section. New flexible plastic gaskets and joint sealing material shall be installed, and shall conform to the specifications in Section 703. Where directed by the Owner or Engineer, a new cast iron frame and cover shall be installed and the existing frame and cover delivered to the Fort Smith Utilities Department. If manhole is located within asphalt pavement areas, the top of the manhole shall be raised as set forth in this section, and shall include the construction of a concrete collar around the manhole frame and cover.
- (3) **RAISING TOP OVER 24 INCHES.** Where the top of the manhole is to be raised over 24 inches, a new fiberglass manhole is to be inserted into the existing manhole and extend to the bottom of the manhole. The existing cast iron frame shall be removed. The cone shaped portion of the manhole is to be removed and disposed of. All existing laterals shall be re-tapped and sealed. If manhole is located within asphalt pavement areas, the top of the manhole shall be raised as set forth in this section, and shall include the construction of a concrete collar around the manhole frame and cover.

- (4) **LOWERING TOP.** Where the top of the manhole is to be lowered, the existing frame and cover is to be removed. Depending on the elevation and condition of the existing manhole cone section and the depth to which the manhole needs to be lowered, the existing manhole cone and portions of the wall may also have to be removed to the required elevation as directed by the Owner or Engineer. If this is required, a new fiberglass manhole shall be inserted into the existing manhole and extend to the bottom of the manhole. The installation of the new fiberglass manhole and the installation of the frame and cover to grade shall be as set forth in this Section. If manhole is located within asphalt pavement areas, the top of the manhole shall be lowered as set forth in this section, and shall include the construction of a concrete collar around the manhole frame and cover.

- D. **REPAIR AND REBUILD EXISTING MANHOLE INVERTS.** Where shown on the plans or as directed by the Owner or Engineer, broken or damaged manhole inverts shall be repaired using manhole patching material. Prior to performing any work on the manhole invert, the pipes entering the manhole shall be plugged to prevent foreign material from entering the sewer pipe and the wastewater shall be pumped around the manhole. All foreign material shall be removed from the manhole invert. Loose and protruding brick, mortar, and concrete shall be removed. All holes, cracks, and other defective areas in the manhole invert shall be filled or repaired using hand-applied manhole patching material.

A coating of manhole patching material shall be troweled uniformly onto the entire invert to a minimum thickness as specified by the Manufacturer. Extra care shall be taken to ensure complete filling of the void at the pipe connection with manhole patching material. The coating shall extend out onto the bench to the walls of the manhole or, if shown on the plans, a sufficient distance to tie into the Manhole Grout liner which will be sprayed applied. The finished coated surfaces shall be smooth and free of ridges. The mixing, handling, and application of the patching material shall be in accordance with the manufacturers written recommendations. The patching material shall be allowed to cure as specified by the Manufacturer prior to allowing wastewater to flow across it.

- E. **SEWER MANHOLE MONOLITHIC CEMENTITIOUS LINING.** Where shown on the plans or as directed by the Owner or Engineer, monolithic manhole lining systems shall be installed to protect concrete, brick, mortar, and other manhole surfaces from corrosion. Design products to stop infiltration, root intrusion, and further deterioration in manhole. Interior surfaces to be protected shall include walls, benches, inverts, pipe junctions and chimney (corbel). The table below outlines different monolithic manhole lining systems and respective product specification for each lining system. The pH limits listed below are typical. Type of manhole lining used shall be as shown on the drawings or as directed by Owner or Engineer.

- (1) **Portland Based Cementitious Liner:** No or very mild hydrogen sulfide conditions, pH of 4.0 or higher.



- (2) Calcium Aluminate Cementitious Liner: Mild to harsh hydrogen sulfide conditions, pH of 2.0 or higher.
- (3) CIPM: Harsh hydrogen sulfide conditions, pH of 1.0 or higher. This includes structures with severe infiltration, structural integrity issues, or structures with very turbulent flow, such as pump station wet wells and force main discharge structures.

**Table 6. Monolithic Manhole Lining Systems**

<b><u>Monolithic Manhole Lining System Type</u></b>	<b><u>Type</u></b>
Portland Based Cementitious Liner	1
Calcium Aluminate Cementitious Liner	2
Cured-In-Place Manhole (CIPM )	3

- (1) CEMENTITIOUS MANHOLE MONOLITHIC LINING SYSTEM (CMML) – Types 1 & 2. CMML system shall be a monolithic, Portland based or calcium aluminate cementitious liner system suitable for use as a trowel- or spray-applied monolithic surfacing in sewer manholes. Material specifications shall conform to Section 706.03.

Minimum thickness of Portland based cementitious lining shall be 1-inch thick. Minimum thickness of calcium aluminate based cementitious lining shall be 1-inch thick.

When cured, CMML shall form a continuous, tight-fitting, hard, impermeable surfacing which is suitable for sewer system service and chemically resistant to chemicals or vapors normally found in domestic sewage.

CMML shall cover complete interior of existing sewer manhole including benches (shelves). Lining shall effectively seal interior surfaces of sewer manhole and prevent any infiltration.

Lining shall be compatible with thermal condition of existing sewer manhole surfaces. Surface temperatures will range from 40 degrees F to 100 degrees F. Provide test data on shrinkage of cementitious lining based on ASTM C 596.

Termination of and surface of lining shall be suitable for proper installation of manhole frame-chimney seal when specified.

Cured system shall be continuously bonded to all surfaces inside sewer manhole.

Chemical sealants, grouts or patching materials used to prevent infiltration, to patch cracks, to fill voids and to otherwise prepare manhole surface prior to application of system shall be fully compatible with the system.

When cured, CMML shall form a continuous, tight-fitting, hard, impermeable surfacing which is suitable for sewer system service and chemically resistant to chemicals or vapors normally found in domestic sewage.

CMML shall cover complete interior of existing sewer manhole including benches (shelves). Inverts shall not be covered. Lining shall effectively seal interior surfaces of sewer manhole and prevent penetration or leakage of groundwater infiltration.

Lining shall be compatible with thermal condition of existing sewer manhole surfaces. Surface temperatures will range from 40 degrees F to 100 degrees F. Provide test data on shrinkage of lining based on ASTM C 596.

Place covers over invert to prevent extraneous material from entering the sewer lines.

Clean sewer manhole to be surfaced and dispose of resulting material properly.

Conduct a visual inspection of manhole after it is cleaned. Infiltration shall be plugged or sealed with grout. Remove loose mortar and rubble of existing benches and inverts. Remove protruding rubber gaskets between wall seams.

Cracks and other voids shall be repaired and filled with suitable non-shrinking cements, sealants or grouts.

Surfaces shall be clean and structurally sound.

Manhole rungs/steps shall be removed, ground smooth and patched and not replaced. Step removal shall be incidental to manhole restoration costs.

- (2) CURED-IN-PLACE MANHOLE LINER (CIPM) – Type 3. Manhole liner system shall be a cured-in-place system suitable for use as a monolithic surfacing in sewer manholes.

CIPM shall be installed on benches, walls, channels, and inverts of existing manholes. Cured surface shall be smooth and continuous with proper sealing connections to unsurfaced areas. CIPM shall be sealed at frame/liner interface using an epoxy per the Manufacturer's recommendation.

CIPM shall be continuously bonded to all surfaces inside sewer manhole. CIPM shall form a continuous, tight-fitting, hard, impermeable surfacing which is suitable for sewer system service and chemically resistant to chemicals or vapors normally found in domestic sewage. Liner shall effectively seal interior surfaces of sewer manhole and prevent any infiltration.

Finished liner shall be repairable at any time during life of structure

Prior to placing liner, Owner or Engineer will inspect and approve surface preparation work. Contractor is responsible for ensuring proper installation conditions, including temperature and moisture.

Liner tube shall be fully saturated at a site to be designated by Contractor for approval. When fully saturated with selected resin, liner shall be inserted into manhole per manufacturer's instructions.

Once properly inserted and oriented, liner shall be cured strictly according to manufacturer's instructions for that liner system. Heat cure time, cool down time, and temperatures shall be recorded in a log for Owner or Engineer's review.

- F. **FIBERGLASS MANHOLE LINER.** Fiberglass manhole liners can be installed within existing concrete, brick or precast manholes.

Fiberglass manholes must be installed according to the manufacturer's instructions.

Prior to ordering any products, the Contractor shall confirm the inside diameter, depth, and roundness of the existing host manhole. In determining the proper insert length, provide the ring and cover casting height. Contractor shall notify owner if liner will not work in given manhole.

Prepare excavation around the existing manhole. Remove existing ring and cover, cone sections, or chimneys.

Use a non-shrinking grout to seal the area between the bottom of the liner and the existing bench area. Fill the area between the liner and the existing manhole using a concrete grout poured evenly in one foot lifts. Bottom of liner shall match existing contour of bench.

Bring the manhole to final grade as detailed in Section 706.05. Backfill according to Section 205 using sand or crushed stone.

- G. **REPAIR PIPE CONNECTIONS TO MANHOLE.** Where shown on the plans or directed by the Engineer new or existing pipe connections shall be repaired. Prior to performing

any work on the manhole invert, the pipes entering the manhole shall be plugged to prevent foreign material from entering the sewer pipe and the wastewater shall be pumped around the manhole. All foreign material shall be removed from the manhole invert using a minimum 1500 psi water spray. The concrete, brick, or mortar around the pipe connection to the manhole shall be removed to a minimum distance of 3 inches beyond the outside edge of the pipe and to a minimum depth of 5 inches from the inside edge of the manhole wall. An

Elastomeric Waterstop Gasket shall be placed around the sewer pipe, and the hole and damaged manhole invert repaired with Manhole Patching Material.

- H. **CONNECT SEWER MAIN PIPE TO EXISTING MANHOLE.** At locations where a new sewer pipe is to join an existing manhole, the Contractor may temporarily block and/or divert sewage flows to facilitate construction operations. No bypassing of sewage flows to ditches, streams, storm sewers, or the ground will be permitted. The work shall consist of making the opening in the manhole wall, inserting the new pipe and Elastomeric Waterstop Gasket to the elevation shown on the plans, constructing necessary drop connections, and remodeling manhole invert. Openings in the manhole for the pipe shall be cored; the use of hammers will not be permitted. An Elastomeric Waterstop Gasket shall be installed in the cored opening between the manhole and the pipes. The hole in the concrete wall is to be repaired with Manhole Patching Material. The patching material shall extend a minimum of 1 inch beyond the inside and outside surface of the wall and a minimum of 3 inches beyond the edge of the hole. The patch material shall cure for a minimum of one hour prior to wastewater flowing across it. If the connecting pipe requires modification to the existing invert channel, the existing channel shall be removed to the extent necessary for a new invert channel to be constructed to provide a smooth flow through the manhole.
- I. **CONNECT SEWER SERVICE PIPE TO EXISTING MANHOLE.** Connecting sewer services to existing manholes shall include the cutting of the hole in the existing manhole wall, removal of existing service pipe as required, inserting the new service pipe into the manhole, the installation of all required fittings for connecting to the existing sewer service pipe, and repairing the manhole wall with Manhole Patching Material. Openings in the manhole for the service line shall be cored; the use of hammers will not be permitted. An Elastomeric Waterstop Gasket shall be installed in the cored opening between the manhole and the pipes. The hole in the concrete wall is to be repaired with Manhole Patching Material. The patching material shall extend a minimum of 1 inch beyond the inside and outside surface of the wall and a minimum of 3 inches beyond the edge of the hole. The patch material shall cure for a minimum of one hour prior to wastewater flowing across it. If the connecting pipe requires modification to the existing invert channel, the existing channel shall be removed to the extent necessary for a new invert channel to be constructed to provide a smooth flow through the manhole.

- J. REMOVE EXISTING MANHOLE. Prior to the removal of an existing manhole, the frames and covers shall be removed and delivered to the Fort Smith Utility Department located at 3900 Kelley Highway. All pipes entering the manhole shall be plugged with concrete for a minimum thickness of 12 inches.

Manholes designated to be removed shall be removed in their entirety including foundation or base unless otherwise noted on the plans or directed by the Engineer. All materials removed shall be disposed of off-site and the hole backfilled with compacted borrow.

- K. ABANDON EXISTING MANHOLE. Prior to abandonment of an existing manhole, the frames and covers shall be removed and delivered to the Fort Smith Utility Department located at 3900 Kelley Highway. All pipes entering the manhole shall be plugged with concrete for a minimum thickness of 12 inches.

Manholes designated to be abandoned shall have the top portion of the manhole removed to a depth of three feet below the adjacent surface and disposed off-site. The remaining portion of the manhole shall be filled with sand compacted by means of vibratory equipment. On-site material shall be used to complete the backfilling. Flowable Fill or other special backfill material shall be used where noted on the plans or directed by the Engineer.

- L. ABANDON SEWER MAIN CONNECTION TO EXISTING MANHOLE. At locations where an existing pipe is to be abandoned at an existing manhole, the end of the pipe at the manhole shall be plugged by packing the pipe with a low slump, non-shrink concrete for a minimum distance of 12 inches from the inside wall of the manhole. The manhole invert shall be re-shaped using Manhole Patching Material. Prior to performing any work on the manhole invert, the remaining pipes entering the manhole shall be plugged to prevent foreign material from entering the sewer pipe and the wastewater shall be pumped around the manhole. All foreign material shall be removed from the manhole invert using a minimum 1500 psi water spray.

The invert shall be re-shaped with Manhole Patching Material to form a new smooth channel flow through the manhole and a new bench as required. The minimum thickness of the patching material shall be ½ inches. The finished surfaces shall be smooth and free of ridges. The mixing, handling, and application of the patching material shall be in accordance with the manufacturers written recommendations. The patching material shall be allowed to cure for a minimum of 30 minutes prior to allowing wastewater to flow across it.

## **706.06 INSPECTION AND TESTING**

- A. **FIELD INSPECTION.** Owner or Engineer may enter manholes to inspect benching, invert channels, manhole wall/pipe connections, surface preparation, and other parts of the work. Contractor shall provide forced air ventilation, gas monitors and detectors, harnesses, lights, etc. for Owner or Engineer to enter manhole and perform inspection in complete accordance with OSHA requirements at no additional cost to Owner.

Finished manhole surface shall be continuous and as free as commercially practicable from significant defects. Defects which will affect, in foreseeable future or warranty period, the integrity or strength of manhole shall be repaired at Contractor's expense, in a manner mutually agreed upon by Owner or Engineer and Contractor.

There shall be no cracks, voids, pinholes, uncured spots, dry spots, lifts, delaminations or other type defects in liner. If any defects are discovered after liner has been installed, it shall be repaired or replaced in a satisfactory manner within 72 hours and at no additional cost to Owner. This requirement shall apply for entire warranty period.

Active Infiltration through lining system shall be zero.

Contractor is responsible for coordinating testing times with Owner or Engineer.

Connections to be abandoned shall be determined in the field by the Owner or Engineer and shall be plugged with bricks and mortar cement prior to rehabilitating the manhole.

The Contractor shall accurately field measure and size each individual manhole. The Contractor is reminded that each existing sewer manhole designated to receive a monolithic surfacing may have a different configuration and varying field dimensions.

- B. **TESTING.** Each lined manhole shall be vacuum tested prior to acceptance. The vacuum test shall be performed after all pipe connections have been made and prior to backfilling. Test rehabilitated manholes using vacuum test method, following manufacturer's recommendations for proper and safe procedures. Vacuum testing of manholes and structures shall be performed after curing of linings. Vacuum testing will not be required on manholes with sewer lines greater than 16-inches in diameter due to safety concerns. Any visible leakage in manhole or structure, before, during, or after test shall be repaired regardless of test results. Vacuum test shall be performed in accordance with ASTM C 1244. All pipes connected to the manhole shall be temporarily plugged using suitable sized pneumatic or mechanical plugs. All vacuum tests shall conform to the requirements specified in Section 703.09.

All manholes with grade adjustments greater than 24 inches shall be re-tested. The Contractor shall be responsible for testing the grade-adjusted manhole, and for correcting any test failures at no cost to the Owner.

Cementitious lining shall provide a continuous monolithic surfacing with uniform thickness throughout manhole interior.

For testing of uniform thickness, the Contractor shall install pins (such as masonry nail) at four quadrants around manhole spaced every 4 feet vertically. Pins shall protrude slightly less than 1 inch from wall. Lining shall be installed to cover pins. The Contractor may develop other methods to be approved by Engineer or Owner.

If thickness of lining is not uniform or is less than specified, it shall be repaired or replaced at no additional cost to Owner.

Field acceptance of CIPM shall be based on Owner or Engineer's evaluation of proper monolithic lining of manhole. Field acceptance shall also be based on the Owner or Engineer's evaluation of appropriate installation and curing test data along with review of manhole inspections.

CIPM shall provide a continuous monolithic lining with uniform thickness throughout manhole interior. If thickness of CIPM is not uniform or is less than specified, it shall be repaired or replaced at no additional cost to Owner.

Owner or Engineer will measure CIPM cured thickness by a suitable non-destructive type of thickness measurement, i.e., measuring pipe penetration thickness. A minimum of two thickness measurement locations in each CIPM manhole shall be taken.

There shall be no cracks, voids, pinholes, uncured spots, dry spots, lifts, delaminations or other type defects in CIPM.

If approved by the Engineer or Owner, ultrasonic testing shall conform to ASTM D 6132.

### **706.07 MEASUREMENT AND PAYMENT**

The measurement and payment of the work included in this section of the specifications shall be at the contract unit prices listed in the proposal for the items of work. Payment at the contract unit price for each item shall be considered full compensation for furnishing all materials, labor, equipment, tools, supplies and incidentals necessary to complete each item of work.

- A. **REMOVE AND REPLACE MANHOLE FRAME AND COVERS.** Sewer manhole frames and covers for removal of existing sewer manhole frames and covers and replacement with new sewer manhole frames and covers, shall be measured by the actual number of new sewer manhole frames and covers installed. Sewer manhole frame and covers shall be paid for the respective quantities as determined above at the Contract unit price bid. This price and payment shall be full compensation for saw-cutting of pavement and/or concrete, excavation (except for rock and boulder removal), disposal of non-regulated excavated material, support of excavation, removal and disposal of the existing manhole frame and cover; furnishing and installing the new sewer manhole frame and cover; furnishing and installing backfill materials, compaction; delivery of the existing frame and cover to the Fort Smith Utility Department and all costs, labor, materials, and equipment incidental thereto, for which separate payment is not provided under other items. Concrete collars shall be paid for as specified in Section 703. Surface restoration shall be paid for separately under applicable pay item
- B. **REMOVE AND REPLACE EXISTING CHIMNEY.** Removal of existing sewer manhole chimneys shall be measured by the total number of inches of chimney removed. Removal of existing sewer manhole chimneys and replacement with new fiberglass manhole shall be paid for the respective quantities as determined above at the Contract unit price bid. This price and payment shall be full compensation for saw-cutting of pavement and concrete, excavation (except for rock and boulder removal), disposal of non-regulated excavated material, support of excavation, removal and disposal of the existing manhole chimney, furnishing and installation of new fiberglass manhole extending to the bottom of the host manhole; and all work incidental thereto for which payment is not provided under other items. Surface restoration shall be paid for separately under applicable pay item
- C. **MANHOLE GRADE ADJUSTMENT – ADJUSTING RINGS.** Manholes adjusted to grade by the installation of 24-inch grade adjusting rings will be measured based on the size and number of such manholes adjusted to grade. Such measurement shall include the furnishing and installing the adjusting rings. Concrete collars shall be paid for as specified in Section 703. Surface restoration shall be paid for separately under applicable pay item
- D. **MANHOLE GRADE ADJUSTMENT – FRAME AND COVER.** Manholes adjusted to grade by the removal and replacement of the existing frame and cover will be measured based on the size and number each of such manholes adjusted to grade. Such measurement shall include the removal of the existing frame and cover, the furnishing



and installation of flexible plastic gaskets, mortar, reinstalling the existing frame and cover, and installing joint sealing material. Concrete collars shall be paid for as specified in Section 703. Surface restoration shall be paid for separately under applicable pay item

- E. **MANHOLE GRADE ADJUSTMENT – MANHOLE WALL.** Manholes adjusted to grade by the removal and replacement of existing manhole cone and wall sections will be measured based on the size and number of such manholes adjusted to grade. Such measurement shall include the removal of the existing frame and cover, the removal of the manhole cone and wall sections, the furnishing and installation of manhole wall sections, flexible plastic gaskets, mortar, reinstalling the existing frame and cover, and installing joint sealing material. Concrete collars shall be paid for as specified in Section 703. Surface restoration shall be paid for separately under applicable pay item
- F. **REPAIR AND REBUILD EXISTING MANHOLE INVERTS.** Repair or rebuild of existing manhole inverts shall be measured by the actual number of manhole inverts repaired or rebuilt. Repair or rebuild of existing manholes inverts shall be paid for at the Contract unit price bid. This price and payment shall be full compensation for all labor, materials, equipment, cleaning, maintenance of flow in existing sewers including bypass pumping and plugs, repair and rebuild manhole inverts as directed by the Owner or Engineer, cleaning of the existing manhole invert; the removal of loose, broken, or unsound portion of the existing invert; and the application of the manhole patching material and all incidentals thereto, for which separate payment is not provided under other items.
- G. **MANHOLE LINING UP TO 6 FEET DEEP.** Sewer manhole monolithic lining for sealing of existing sewer manholes using monolithic surfacing system, shall be measured in place on a size and vertical foot basis from the invert of the lowest pipe of the manhole to the top of the manhole and chimney interface. Sewer manhole monolithic lining for sealing of existing manholes using monolithic lining system, shall be paid for the quantity as above determined at the Contract unit price bid. This price and payment shall be full compensation for preparatory cleaning of the manhole walls and invert; sealing pipe connections and stopping active leaks in manhole; maintenance of flow in existing sewers including bypass pumping and plugs; furnishing and installing the manhole monolithic lining system; reopening all active manhole connections; proper disposal of cleaning solvents; materials testing; environmental protection; plugging of abandoned lines; costs associated with measuring liner thickness; final acceptance testing and all else incidental thereto for which separate payment is not provided under other Items. Surface restoration shall be paid for separately under applicable pay item
- H. **ADDITIONAL DEPTH FOR MANHOLE LINING.** Additional manhole liners for that portion of the manholes greater than 6 feet deep, as measured from the invert of the outlet pipe to the top of the frame and cover, will be based on the vertical feet and size of manhole that is over 6 feet deep. Such measurement shall include the items required to complete the work as stated above for manhole liner.

- I. **FIBERGLASS MANHOLE UP TO 6 FEET DEEP.** Fiber Glass Manhole Liner of existing manholes up to a maximum depth of 6 feet shall be measured from the invert of the outlet pipe to the top of the frame and cover, will be based on the number and size each of such liners actually constructed. Such measurement shall include the cleaning of the manhole, the repairs to the manhole walls, plugging of abandoned lines, and applying the grout liner material to the manhole walls and bench. Surface restoration shall be paid for separately under applicable pay item
- J. **ADDITIONAL DEPTH FOR FIBERGLASS MANHOLE.** Additional fiber glass manhole liners for that portion of the manholes greater than 6 feet deep, as measured from the invert of the outlet pipe to the top of the frame and cover, will be based on the vertical feet and size of manhole that is over 6 feet deep. Such measurement shall include the items required to complete the work as stated above for fiber glass manhole liner.
- K. **REPAIR PIPE CONNECTIONS TO MANHOLE.** Repair of a new or existing pipe connection to a manhole, at locations shown on the drawings or as directed by the Owner or Engineer, will be based on the number each of such connections actually repaired. Such measurement shall include temporarily blocking and/or diverting sewage flows, cleaning around the existing connection; the removal of loose, broken, or unsound concrete or mortar from around pipe connections to the manhole, furnishing and installing elastomeric waterstop gasket and the application of the manhole patching material.
- L. **CONNECT SEWER MAIN PIPE TO EXISTING MANHOLE.** Measurement for the connection of a sewer pipe to an existing manhole will be based on the number each of such sewer service pipe connections installed. Such measurement shall include temporarily blocking and/or diverting sewage flows, the cutting of hole in the existing manhole wall, inserting the new pipe with Elastomeric Waterstop Gasket into the manhole, repairing the manhole wall with Manhole Patching Material, constructing necessary drop connections, and remodeling of manhole invert.
- M. **CONNECT SEWER SERVICE PIPE TO EXISTING MANHOLE.** Measurement for the connection of a sewer service pipe to an existing manhole will be based on the number each of such sewer service pipe connections installed. Such measurement shall include the cutting of hole in the existing manhole wall, removal of existing service pipe as required, inserting the new service pipe into the manhole, the installation of all required fittings for connecting to the existing sewer service pipe, and repairing the manhole wall with Manhole Patching Material.
- N. **REMOVE EXISTING MANHOLE.** Measurement for removal of existing manhole will be based on the number each of such manholes actually removed. Such measurement shall include the removal and delivery of the frame and cover to the Utility Department.

Measurement for removal of manholes shall include removal in its entirety including foundation and base, off-site disposal of all materials, and backfilling with compacted borrow to match existing grades. Work shall also include the use of flowable fill or other special backfill material if so noted on the plans. Surface restoration shall be paid for separately under applicable pay item

- O. ABANDON EXISTING MANHOLE. Measurement for abandonment of existing manhole will be based on the number each of such manholes actually abandoned. Such measurement shall include the removal and delivery of the frame and cover to the Utility Department. Measurement for abandoned manholes shall include removal and disposal of the top portion of the manhole, the plugging of existing connection pipes with concrete, and the filling of the manhole with compacted sand. Work shall also include the use of flowable fill or other special backfill material if so noted on the plans.
  
- P. ABANDON SEWER MAIN CONNECTION TO EXISTING MANHOLE. Measurement for the abandonment of a sewer main pipe connection to an existing manhole will be based on the number each of such abandonments made. Such measurement shall include the plugging of the existing connection pipe with concrete, cleaning existing manhole invert, and re-shaping of the invert channel with Manhole Patching Material.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Remove and Replace Manhole Frame and Covers (Type)	EA
Remove and Replace Existing Chimney	INCH
Manhole Grade Adjustment - Adjusting Rings (Size)	EA
Manhole Grade Adjustment - Frame and Cover (Size)	EA
Manhole Grade Adjustment - Manhole Wall (Size)	EA
Repair and Rebuild Existing Manhole Inverts	EA
Manhole Lining Up to 6 Feet Deep (Size & Type)	VF
Additional Depth for Manhole Liner (Size & Type)	VF
Fiberglass Manhole Up to 6 Feet Deep (Size)	EA

Additional Depth for Fiberglass Manhole (Size)	VF
Repair Pipe Connections to Manholes	EA
Connect Sewer Main Pipe to Existing Manhole	EA
Connect Sewer Service Pipe to Existing Manhole	EA
Remove Existing Manhole	EA
Abandon Existing Manhole	EA
Abandon Sewer Main Connection to Existing Manhole	EA

## **SECTION 707 PIPE BURSTING**

### **707.01 SCOPE OF WORK**

This work shall consist of furnishing all labor, materials, tools, equipment, incidentals, testing and construction methods or processes required to install and test high density polyethylene (HDPE) or C900 PVC restraint joint sewer pipe and appurtenances using pipe bursting/crushing/reaming systems including services necessary for traffic control, bypass pumping and/or diversion of sewage flows, connecting the new pipe to existing manholes, modifying existing manhole bases as needed, reinstatement of service lateral connections, quality control, testing of the pipe burst lines, and warranty of all work.

The term pipe bursting that is used throughout the construction plans is intended to include other similar pipe enlargement systems such as pipe crushing, pipe reaming, etc.

The pipe bursting system is defined as the reconstruction of gravity sewer pipe by installing an approved pipe material. The process involves the use of a static, hydraulic or pneumatic hammer “moling” device, suitably sized to break out the old pipe or using modified boring “knife” with a flared plug that implodes and crushes the existing sewer pipe. Forward progress of the “mole” or the “knife” may be aided by the use of the hydraulic equipment or other apparatus, as specified in the approved methods. The replacement pipe is either pulled or pushed into the bore. The method allows for replacement of pipe sizes from 8-inch through 36-inch and/or upsizing in varying increments up to 48-inch.

### **707.02 QUALIFICATIONS AND SUBMITTALS**

Submit to the Owner or Engineer in accordance with the contract documents shop drawings, product data, materials of construction, design calculations, and details of installation. The Contractor shall provide this information without delay or claim to any confidentiality.

Submittals shall include but are not limited to the following:

- (1) Shop drawings and product data to demonstrate compliance with these specifications and identify materials of construction.
- (2) Design data and specification data sheets listing all parameters used in the pipe design and thickness calculations based on HDPE or PVC. Additional calculations shall include the anticipated pulling forces, equipment pull capability, and maximum pulling forces that can be applied to the pipe, and stresses and strains at manhole connections. All pipe design calculations shall be sealed and signed by an Engineer licenses in the State of Arkansas.

- (3) Detailed construction method procedures for installing the pipe including a detail for the proposed pipe-to-manhole connection method.
- (4) Drawing and layout plans showing the size and location for all proposed pits and excavations required to complete the work. All access pits shall be within the easement limits defined on the Drawings. It is assumed the excavations will occur primarily at or near existing manhole locations.
- (5) A written plan and working drawings showing sewage flow bypass and maintaining sewage service flows, in accordance with Section 709.
- (6) Qualifications for personnel trained in using butt-fusion equipment and their training in the proper methods for handling and installing the HDPE or PVC pipe. The Contractor or subcontractor shall have a minimum of one (1) year of experience in the installation of sewer pipe by the pipe reaming method. Those with less than one (1) year of experience shall request preapproval from the Owner.
- (7) Project specific Contingency Plan that accounts for obstructions, heave and/or settlement, damage to laterals and other utilities, loss of line and grade, and loss of bursting head.
- (8) A list of all service laterals that were abandoned or reconnected as part of the work as further defined herein.
- (9) Pre-rehabilitation and post-rehabilitation closed-circuit television (CCTV) inspection data. See Section 701.
  - a. Provide results from all testing requirements specified herein to Owner and Engineer.

### **707.03 CONSTRUCTION SCHEDULING AND COORDINATION**

Construction scheduling and coordination shall conform to Section 702.03.

### **707.04 MATERIALS**

All substituted materials must be submitted and approved in accordance to the process laid out in Section 105.15 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT.

All materials shall conform to the standards referenced. All gasket and joint materials, lubricants, adhesives and other incidental materials shall conform to the pipe manufacturer's recommendations.

- A. POLYETHYLENE PIPING. Replacement pipe shall be manufactured from a high density, high molecular weight polyethylene resin which conforms to ASTM D1248 and meets the requirements for Type III, Class B, Grade P34, Category 5, and has a PPI rating of PE 3408, when compounded. The pipe produced from this resin shall have a minimum cell classification of 345434D or E (inner wall shall be light in color) under ASTM D3350.

The inside pipe diameter shall be as shown on the construction plans and specifications. Pipe dimensions shall be for Standard Pipe Sizes and shall be measured in accordance with ASTM D2122. Unless otherwise noted, the minimum Standard Dimension Ratio (SDR) of the HDPE pipe shall meet the following requirements:

<u>HDPE Pipe Minimum SDR</u>	<u>Maximum Depth (feet)</u>
17	20
11	Over 20

Pipe couplings and/or fittings shall be ASTM D3261 HDPE.

Use round pipe with a smooth, even outer surface, which has joints that allow for easy connections between pipes. Pipe ends shall be designed so the bursting loads are evenly distributed around the entire pipe joint, and so point loads will not occur when the pipe is installed. Pipe used for pipe bursting shall be able to withstand all forces that will be imposed by the installation process and the final in-place loading conditions.

The pipe bursting equipment may include a bentonite or polymer slurry lubrication system in accordance with the pipe bursting equipment manufacturer's recommendations to reduce friction developed on the replacement pipe surface during insertion.

Electrofusion couplings shall be manufactured by Central, Frialen, Friatec, or approved equal.

- B. C900/RJ RESTRAINED JOINT PIPE. The pipe couplings shall be made from unplasticized PVC compounds having a minimum cell classification of the 12454-B, as defined in ASTM D1784. The compound shall qualify Hydrostatic Design Basis (HDB) of 4,000 psi for water at 73.4 degrees Fahrenheit, in accordance with ASTM D2837.

Nominal outside diameters and wall thicknesses shall conform to the requirements of AWWA C900. Thrust-restrained pipe shall be furnished in sizes 4-inch, 6-inch, and 8-inch, Class 150 and 200, and 10-inch and 12-inch, Class 150. Pipe shall be furnished in standard lengths of 20 feet.

Pipes shall be joined using non-metallic couplings, which, together, have been designed as an integral system for maximum reliability and interchangeability, high-strength flexible thermoplastic splines shall be inserted into mating precision-machined grooves in the pipe and coupling to provide full 360 degree restraint with evenly distributed loading. No external pipe-to-pipe restraining devices which clamp onto or otherwise damage the surface as a result of point-loading shall be permitted.

Couplings shall be designed for use at the rated pressures of the pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F477. Joints shall be designed to meet the leakage requirements of ASTM D3139.

Every pipe and machined coupling shall pass AWWA C900 hydrostatic proof test requirements (4X rated pressure for 5 seconds).

Pipe shall be legibly and permanently marked with the manufacturer/trade name, nominal size, DR rating/pressure class, hydrostatic proof pressure, [NSF-61], manufacturing data code and the mark of the certifying agency(s) which have tested and approved the product for use in the fire protection applications.

Restrained Joint PVC Pipe shall be the CertainTeed Certa-Lok C900/RJ system or approved equal.

- C. SERVICE LATERALS. Connections to the existing service lateral pipe shall be made using reinforced flexible couplings that conform to ASTM C425, such as Fernco Inc. or approved equal. Joint deflection limits and lateral connections shall meet the maximums indicated in ASTM C12 and C425.

Connection of the new service lateral to the sewer main shall be accomplished by use of a watertight, compression-fit service connection. The service connection shall be specifically designed for connection to the HDPE or PVC sewer main being installed, and shall be an INSERTA TEE as manufactured by the Inserta Fittings or approved equal.

- D. TRACER WIRE. Tracer wire shall be Trace-Safe type RT1803W or Utility Department approved equal.
- E. TRACER WIRE BOX. Tracer wire shall be terminated in magnetized tracer box, Model CD14\*TP as manufactured by Copperhead Industries, LLC. The tracer box cover will be color coded in accordance with APWA uniform color code. The tracer wire shall not be terminated in any other location.
- F. TESTING. The pipe manufacturer shall provide certification that samples of the production product meets these specifications. The certification will state that production



product has been tested in accordance with ASTM D2837, and validated in accordance with the latest version of PPI TR 3.

The pipe manufacturer shall provide certification that stress regression testing has been performed on the specific product. Certification shall include a stress life curve per ASTM D2837 and testing shall have been performed in accordance with ASTM D2837.

Polyethylene plastic or restrained joint PVC pipe and fittings may be rejected for failure to meet any of the requirements of this specification.

### **707.05 QUALITY ASSURANCE**

Contractors shall be certified as a licensed installer by the selected pipe reaming trenchless system manufacturer.

Polyethylene pipe jointing shall be performed by personnel trained in the use of thermal butt-fusion equipment and recommended methods for new pipe connections. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the polyethylene pipe. Training shall be performed by a qualified representative.

The manufacturer shall furnish a certified statement that all pipe materials have been manufactured and tested in accordance with the referenced standards.

No pipe bursting restoration shall be accepted that has created a sag in the restored line greater than  $\frac{1}{4}$  of the installed pipe diameter or not previously inherent to the existing line. The Contractor shall be responsible for correcting any sags in the line that are created by his operations.

### **707.06 GENERAL**

The pipe bursting method shall be determined by the Contractor and coordinated with the pipe bursting equipment suppliers.

All materials shall conform to the standards referenced. All gasket and joint materials, lubricants, adhesives and other incidental materials shall conform to the pipe manufacturer's recommendations.

- A. **MAINTAINING FLOW.** The Contractor shall be responsible for continuity of sanitary sewer service to each facility connected to the section of sewer main during the execution of the work. All by-pass pumping operations shall be in accord with Section 708.
- B. **FIELD MEASUREMENTS.** Field measurement shall be taken at the site to verify or supplement indicated dimensions and to ensure proper coordination of all other construction items.

If the pipe configuration in the field is different than shown, or if a new asset is found, the notification shall include a diagram clearly indicating the location of structures in relation to immediately adjacent structures. Contractor shall provide updated information to Owner and Engineer.

- C. DELIVERY, STORAGE, AND HANDLING. Delivery, storage, and handling of pipe and materials shall conform to section 702.06.

### **707.07 PREPARATION FOR PIPE BURSTING OPERATIONS**

- A. SERVICE CONNECTION AND OTHER EXISTING UTILITIES. The Contractor shall conduct a pre-rehabilitation CCTV inspection for all sewers to be replaced by pipe bursting methods. The inspection shall be to identify pipe defects, to document all service lateral connection locations, and to confirm additional needed point repair locations other than those indicated on the Drawings. The Owner or Engineer will review pre-rehabilitation inspection videos to confirm point repair locations to be performed by the Contractor. The Contractor may not proceed with pipe bursting until the Owner or Engineer has reviewed and approved the Owner or Engineer has reviewed and approved the Contractor's pre-rehabilitation CCTV inspection data. All CCTV work shall conform to Section 701.

If the data is available, the Owner will provide the Contractor information on the location of known active laterals and cleanouts; however, this list may not be interpreted as all-inclusive. The Contractor shall be responsible for verifying active customer service connection prior to rehabilitation. The Contractor shall compare the service connections from the CCTV video with above ground measurements at the approximate location of center of each house or building. Any discrepancies between the CCTV data and above ground measurements of laterals shall be brought to the attention of the Owner or Engineer for a determination of lateral reinstatements. If the Contractor discovers an error or addition to the list provided, the Contractor shall immediately notify the Owner or Engineer for additional investigation. Upon completion of the rehabilitation work, a list of all service laterals abandoned or reconnected as part of the work shall be submitted to the Owner. The compiled list shall include the following information:

- (1) Location of each service lateral based on the CCTV inspection logs. Location shall include both accurate distance measured from the centerline of the starting manhole as well as a notation (by clock-reference) of where on the circumference of the pipe, the service lateral connects.
- (2) Status (Active or Inactive)

- (3) The address of each customer and associated active lateral location.

Prior to pipe bursting, locate, excavate, expose, and completely disconnect all active service connections. Exercise due diligence when excavating to sufficiently allow the existing pipe to uniformly circumferentially expand through the service connection pit.

The Contractor shall be responsible for all costs resulting from damage to utilities during pipe bursting operations.

- B. **EXISTING MANHOLES.** See Section 703 for specifications on existing manholes and structures.
- C. **ACCESS PIT LOCATIONS.** The size, location, and number for pits shall be determined to facilitate the pipe bursting insertion, minimize excavation and traffic disruption, and shall be submitted prior to construction. All access pits and excavation shall be within the limits defined on the Drawings. Provide the minimum number of pits necessary to satisfactorily complete the work. Pits shall be a sufficient size to allow equipment access and new pipeline installation. Pits shall be centered over the existing sewer, and are generally anticipated to occur at each existing manhole location, at manhole construction points, at service connections, or at points where spot repairs need to be performed.

Submit any pit relocations and reasons for pit relocation for review. Include any appropriate sketches deemed necessary by the Owner or Engineer. The Contractor shall be responsible for obtaining all necessary permits as they relate to the relocation should they be approved by the Owner or Engineer.

- D. **CLEANING & TELEVISION INSPECTION.** Perform the cleaning prior to televising. Cleaning activities shall conform to Section 701.04.
- E. **LINE OBSTRUCTIONS.** Line obstructions and cleaning activities shall conform to Section 701.05.
- F. **SAGS IN LINE.** Sags in the line being inspected shall be repaired per Section 701.

#### **707.08 PIPE BURSTING OPERATIONS**

- A. **GENERAL.** Though the installation process may be licensed or proprietary in nature, no change to any material, thickness, design, values, or procedural matters stated in the submittals shall be allowed without the Owner or Engineer's prior knowledge and approval.

Pipe bursting operations, including instances where pipe upsizing is required, shall not cause excessive disruption or heaving to the above ground terrain or improvements.

Upon commencing the bursting process, pipe insertion shall be continuous and without interruption from one entry point to another, except as approved by the Owner or Engineer.

If pipe spans between manholes are fused ahead of bursting operations, transport of the pipe to the site by using rollers and/or other means that will not damage the pipe's exterior. Contractor shall not drag the pipe to the insertion pit locations.

Protect the pipe and joints driving ends from damage by installing pulleys, rollers, bumpers, alignment control devices, and any other equipment required to protect existing manholes and to protect the pipe from damage during installation. Lubrication may be used as recommended by the manufacturer. Under no circumstances shall the pipe be stressed beyond its elastic limit.

- B. PIPE BURSTING MACHINE & REPLACEMENT PIPE.** The specific type of replacement pipe material described above for HDPE or PVC shall be installed in the locations as shown on the drawings and detailed per these specifications.

All sharp edges shall be removed from the exposed pipe opening.

The bursting head shall be sized so the maximum diameter of the temporary void created by the bursting operation shall not exceed the replacement pipe's maximum outside diameter by greater than 20 percent. The new sewer shall be installed straight along the existing pipeline centerline following the same line and grade.

The Contractor shall be responsible for replacing any existing utilities, streets, curb and gutter, storm drains, sidewalks, or structures that are damaged as a result of the pipe bursting activity. This replacement shall be in-kind, and at no cost to the City.

If the pipe reaches the rejection point (seizes in place) and it is elected to construct a recovery access pit, the Contractor shall obtain Owner or Engineer's approval and then coordinate property access, traffic control measures, and utility adjustments as necessary prior to commencing work. Excavations within delineated wetlands shall be avoided when possible.

If a pipe section is damaged during the bursting operation or joint failure occurs as evidenced by inspection, visible groundwater infiltration or other observations, the Contractor shall submit methods for repairing or replacing the pipe to the Owner or Engineer for approval. Repairing pipe sections damaged during bursting operations shall be made at no additional cost to Owner.

Allow the new HDPE or PVC pipe to return to its original length and shape in the unstressed state, and then trim the excess pipe in the manholes. The replacement pipe manufacturer's recommendations shall be followed regarding relieving and normalizing stress and strain due to temporary stretching and elongation after pulling operations have been completed. Time allowed for stress and strain relief shall not be less than 24 hours.

- C. **WORK IN EXISTING MANHOLES.** After the pipe has been inserted into the entire sewer section length, anchor the pipe at existing manholes. The pipe shall protrude in manholes for enough distance to allow sealing and trimming.

After the pipe has been inserted into the entire sewer section length, install new precast manholes as needed or as directed by Owner or Engineer, and as shown on the Drawings.

If a new manhole is not shown on the Drawings, restore manhole bottom and invert, and repair damage caused by the insertion process. If the Owner or Engineer deems the damage caused by insertion process not repairable, replace the manhole at no cost to Owner.

When the replacement pipe passes through or terminates at an existing manhole, the channel and portion of the base shall be removed as the Contractor deems necessary for the bursting tool to be able to maintain a constant line and grade upstream and downstream of the manhole. The pipe within the existing manhole shall be neatly and completely saw-cut off and not broken or sheared off, to protrude at least 4 inches away from the manhole walls. The channel in the manhole shall be rebuilt with new concrete and mortar, shall be a smooth continuation of the pipe(s), and shall be merged with other lines or channels, if any. Channel cross section shall be U-shaped with a minimum height to the pipe's crown. The channel sides shall be built up with mortar/concrete to provide benches at a 1 in 12 pitch maximum towards the channel.

All cutting and sealing for the new pipe at manhole connections shall provide watertight pipe and manhole trough seals. Connections to manholes shall not be made any earlier than 24 hours following the bursting operations. This 24-hour "relaxation period" is intended to allow the pipe temperature to reach equilibrium with the surrounding soil and for the pipe to release stresses imparted during bursting operations. The time period shall be extended based on manufacturer's and/or supplier's recommendations, if required.

To seal the pipe at the manhole, provide a flexible gasket connector in the manhole wall at the pipe's end, centered in the existing manhole wall. Grout the flexible connector in the manhole wall filling all voids for the full thickness.

The replacement pipe in the manhole shall be locked down and sealed as specified above before proceeding to the next pipe bursting section. All manholes shall be individually inspected by the Owner or Engineer for replacement pipe cutoffs, benches, and sealing works prior to any additional manhole rehabilitation activities.

- D. **SERVICE CONNECTIONS.** After the replacement pipe has been completely installed and tested, all existing active service laterals shall be reconnected after the replacement pipe has been pulled in place, but not permanently before the pipe has been allowed to relax for 24 hours minimum.

The Contractor shall abandon inactive laterals without further action and shall burst through the abandoned laterals. No payment will be made for abandoning laterals. No bursting through abandoned laterals shall be performed without prior approval from the Owner or Engineer.

Prepare and submit to the Owner or Engineer a list of active and abandoned laterals. This list shall include GPS Coordinates as specified in Section 702.13.

Materials and construction procedures for the replacement (as necessary) of service lines are found in Sections 702.04 and 702.09.

If shown on the plans or directed by the Owner or Engineer, sewer laterals from the connection shall be replaced by excavation to the easement or property line if in rights-of-way with a cleanout installed. For reconstructed laterals, a minimum 2 percent slope is required.

- E. **POST-CCTV INSPECTION.** Following the pipe bursting operations, including work associated with manhole and service connections, conduct post rehabilitation CCTV inspection for the completed work.

#### **707.09 INSPECTION AND TESTING**

Field acceptance of the new pipeline shall be based on the Owner or Engineer's evaluation of the installation, including CCTV videos, and all pipe and manhole testing results. The Contractor shall be responsible for conducting the final or post-bursting CCTV as part of the contract work. See Section 701 for CCTV requirements.

Testing shall be required after the replacement pipe has been installed. The replacement pipe shall be tested before it has been sealed in-place at the manholes, and before any service reconnections have been made. The purpose of this test is to check the integrity of the joints that have been made and to verify that the replacement pipe has not been damaged by inserting it through the host conduit.

Testing requirements for the replacement pipe shall conform to Section 702.11.

Groundwater infiltration into the new pipe shall be zero.

All service connections shall be open, clear and watertight.

### **707.10 CLEANING AND RESTORATION**

- A. **CLEANING OF NEW SEWER MAIN LINE.** If the Owner or Engineer determine, based on the evaluation of the installation, including CCTV videotapes, that the new sewer mainline needs to be cleaned, the Contractor shall re-clean the line at no additional cost to the Owner. Cleaning operations shall conform to Section 701.
- B. **DISTURBED AREAS.** Upon completion of the trenchless pipe replacement operation, the Contractor shall restore all areas disturbed by these operations, including streets, cross country easements, and wetland areas. Yards and acreage maintained by property owners shall be replaced with sod.

### **707.11 MEASUREMENT AND PAYMENT**

The measurement and payment of the work included in this section of the specifications shall be at the contract unit prices listed in the proposal for the items of work. Payment at the contract unit price for each item shall be considered full compensation for furnishing all materials, labor, equipment, tools, supplies and incidentals necessary to complete each item of work.

- A. **PIPE BURSTING.** Replacement of existing pipe with HDPE or PVC pipe via pipe bursting of the size of the line installed, shall be measured in place on a linear foot basis which is satisfactorily installed and accepted by the Owner or Engineer. Measurements shall be from the center-to-center of the manholes for each line along the centerline of the pipe. Payment for replacement of existing pipe with HDPE or PVC pipe via pipe bursting shall be for the quantity as above determined at the Contract unit price bid in the Schedule of Prices. This price and payment shall be full compensation for furnishing all labor, materials and equipment required for pipe bursting, including:
- Cleaning of the existing sewers
  - Disposal of debris removed
  - Locating all live and abandoned service taps
  - Sewer preparation and pre-construction inspection
  - Locating and protecting all utilities with test pits
  - Furnishing pre-splitting equipment and lubrication as necessary to fracture existing pipe;
  - Rehabilitation of existing sewer pipe using pipe bursting
  - Bypass pumping of wastewater flows
  - Connections to existing sewer main and existing manholes
  - Disconnecting service lateral connections (if applicable)
  - Bypass of service lateral flows
  - Excavation of any existing concrete encasement
  - Recovery of equipment that reaches a rejection point

- Repair of existing pipe sags
- Modifications to manholes necessary to accept new pipe
- Specified testing
- Clean-up and complete restoration of areas disturbed by operations
- Any item incidental thereto for which separate payment is not provided under other items.
- Repair of manhole
- GPS and data delivery requirements

Payment for above work shall be incidental to sewer rehabilitation by the pipe bursting system, since the payment is made from center line to center line of manhole(s).

No additional compensation will be made if additional work is required because the existing line was not sufficiently cleaned.

**B. SERVICE LATERAL REINSTATEMENT AFTER PIPE BURST OF MAIN.**

Reconnection of active service laterals shall be measured by the actual number of laterals of the size of the line installed and reconnected as determined by the Owner or Engineer. Payment shall be full compensation for furnishing and installing compression-fit service connection, couplings, risers, plugs, connections, excavation, trenching, gravel bedding, backfilling and related work. Connection of sewer service lines to existing manholes shall be paid for under Section 706, Existing Sewer Structures. Surface restoration shall be paid for separately under applicable pay item. Reconnection of active service laterals shall be paid for each building lateral reconnected as determined above at the Contract unit price bid.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Pipe Bursting (Size & Type)	LF
Service Lateral Reinstatement After Pipe Burst of Main (Size)	EA



## **SECTION 708 SERVICE LATERAL CONNECTION LINING (MLCIPL) PROCESS**

### **708.01 SCOPE OF WORK**

This work shall consist of furnishing all labor, materials, tools equipment, incidentals, testing and construction methods or processes required to rehabilitate lateral to main connections using the Main and Lateral Cured In-Place Lining (MLCIPL) process; stopping active leaks that might interfere with the integrity of the liner to be installed; complete and accepted, in accordance with the Contract Documents. Work shall conform to the latest ASTM standard:

ASTM F2561 – Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One Piece Main and Lateral Cured-in-Place Liner

### **708.02 SUBMITTALS**

Prior to or at the preconstruction conference, the Contractor shall submit a work plan to the Engineer for review and approval. The work plan shall address the following minimum preparations and/or steps: work schedule, safety, pre-installation television inspection, bypassing sewage, line obstructions, proposed materials, installation procedures, post-CCTV inspection, and restoration of services. Additional items to be addressed in the work plan may be added as directed by the Owner or Engineer.

Owner or Engineer reserves the right to approve or disapprove Contractor, Superintendent, and/or manufacturer based on submitted qualifications.

Shop drawings, a list of materials, and technical data shall be submitted to the Owner for approval prior to any work being performed under this Section of the Specifications.

Contractor is required to submit the following:

- (1) MLCIPL Manufacturer Installation Instructions
- (2) MLCIPL Manufacturer Design Calculations
- (3) MLCIPL Manufacturer Material Data, Compatibility, and Test Results
- (4) MLCIPL Installation Logs
- (5) MLCIPL Experience Record
- (6) MLCIPL Curing Schedule

- (7) Copies of Quality Control Tests
- (8) Job Logs (For Each Work Crew)
- (9) Physical Samples

Samples removed for testing will be individually labeled and logged to record the following:

- (1) Owner's project number and title
- (2) Name of Contractor
- (3) Segment number of line and location of connection point
- (4) Date and time of sample
- (5) Sample number
- (6) Person taking sample
- (7) Results of the test

Samples shall be taken once (1) in every five (5) MLCIPL liners, with a minimum of one (1) sample per day per MLCIPL liner per crew. The specimens for testing shall be tested in accordance with ASTM Test Method D790. The samples shall be numbered as follows:

- (1) Sample #/A: Resin Sample
- (2) Sample #/B: Flat Plate Sample
- (3) Sample #/C: Thickness Test

Reports shall be formatted to fit on 8-1/2" x 11" paper. Larger drawings shall be folded to this format. Submittals shall be labeled by Contractor to indicate Contractor, date of submittal, Owner's project title and number, applicable Section of Specifications to be referenced, and signature of preparer.

### **708.03 QUALITY ASSURANCE**

The purpose of the main and lateral cured in-place lining (MLCIPL) is to provide for a permanent seal of the annular space of the sewer to provide a seal of the service lateral. If the

sewer main is lined, MLCIPL shall be installed after the service lateral is re-instated in the mainline. MLCIPL shall be installed per ASTM F2561.

The Contractor performing the 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:

- (1) The number of years of experience installing sewer service lateral MLCIPL.
- (2) The name of the 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 liner manufacturer.
- (3) A list of municipal clients within the United States of America that the Contractor has performed this type of work for without defects or performance problems. The list shall contain the following information:
  - (a) Names and telephone numbers of persons to be called to verify previous satisfactory performance.
  - (b) A full description of the actual work performed.
  - (c) Description of projects, including the number of laterals rehabilitated over the past 3 years.

The MLCIPL shall be provided by a single manufacturer. The supplier shall be responsible for the provision of all test requirements specified herein.

Service connection MLCIPL shall be compatible with the pipe or CIPP liner used in the pipe that the service connection is connected to.

Any installation not meeting specified strengths shall have the defective service connection MLCIPL removed and replaced with a product acceptable to the Owner at the expense of the Contractor.

#### **708.04 NOTIFICATION**

Refer to Section 711 for notification details and information.

#### **708.05 HANDLING AND STORAGE**

Care shall be taken in shipping, handling and storage to avoid damaging the MLCIPL service connections. Any liner or service connection damaged in shipment shall be replaced as directed by the Engineer.

Any MLCIPL service connection 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.

The MLCIPL service connection shall be maintained as required by the manufacturer. Any MLCIPL service connection showing evidence of premature curing will be rejected for use and will be removed from the site immediately.

#### **708.06 FIELD MEASUREMENTS**

All pipe sizes will be stated on the contract documents. Contractor shall verify diameter of the main pipe and the location of the lateral connections in field prior to ordering any MLCIPL materials. Contractor shall also measure inside diameter of each service lateral in field prior to ordering liner so that liner can be installed in a tight-fitted condition with little or no wrinkling.

#### **708.07 GENERAL**

Work performed under this Specification shall be done in accordance with Municipal, State, and Federal standards. Traffic control and safety are the responsibility of the Contractor. All traffic control must be in accordance with Section 120 MAINTENANCE OF TRAFFIC AND TRAFFIC CONTROL. All signage for work on state highway rights-of-way shall conform to the Arkansas State Highway Department requirements.

All water used during rehab processes shall be collected and transported to a proper disposal facility or, upon approval, at the City of Fort Smith Waste Water treatment facility.

The Contractor shall provide whatever measures are required to prevent the movement or discharge of gases, liquids, or solids associated with the rehabilitation materials and processes into any adjacent buildings upstream or downstream of the sewers being rehabilitated. The Contractor shall be responsible and liable for any damages or violations associated with such actions. The Contractor shall also be responsible for monitoring and protecting the discharge of any byproducts caused by the installation of any rehabilitation materials or processes.

Provide necessary bypass pumping of sewage flows where and when required, per Section 708.

Noise related to CIPP and MLCIPL activities shall be attenuated to not exceed the limits discussed in City of Fort Smith Ordinance, Chapter 16, Article II – Noise.

Manholes are considered as a confined space area. Proper procedures are to be followed when accessing manholes.

### **708.08 COORDINATION**

Work that requires excavation must be completed and approved before any trenchless rehabilitation work begins unless otherwise directed by the Owner or Engineer.

For MLCIPL service liner installation, the sequence of work is as follows:

- (1) Cleaning & Pre-CCTV (See Specification Section 701)
- (2) Repair Service Laterals At Interface With Pipe
- (3) Install Service Laterals
- (4) Post CCTV (See Specification Section 701)

### **708.09 MAIN AND LATERAL CURED IN-PLACE LINING (MLCIPL)**

- A. **GENERAL.** All service connections shall be a seamless one-piece product at the junction between the main sewer and the service lateral. The junction between the collar and the lateral sleeve must be watertight and will consist of a lateral portion and a mainline portion. The lateral portion shall extend into the lateral to the property line or as shown on the plans. The mainline portion shall be a full circle of the mainline pipe and be permanently marked with a lateral identification label for future reference. Service connection shall be LMK T-Liner or approved equal.

The service connection material shall be capable of conforming to offset joints, bells, and disfigured pipe sections. A corrosion resistant resin compatible with the installation process shall be used.

- B. **MATERIALS.** All materials shall conform to the most recent ASTM standards. The table below indicates the applicable governing standards.

<u>Material</u>	<u>Standard</u>
Polyester Felt Tube	ASTM D790, ASTM F1216
Resin System	ASTM D5813 or ASTM F1216

- C. **CLEANING AND INSPECTION.** Cleaning and CCTV inspection shall be done in accordance with Section 701.

- D. **LINE PREPARATION.** Line preparation shall be done in accordance with the Manufacturer's recommendations.
- E. **INSTALLATION.** Installation shall be done in accordance with the Manufacturer's recommendations.

#### **708.10 INSPECTION AND TESTING**

- A. **FIELD TESTING AND ACCEPTANCE.** Following installation of the service connection, conduct a CCTV inspection of the completed work, including the service lateral connections at the sewer main. Retainage will be held in accordance with the Agreement until the CCTV has been completed, submitted and accepted by the Owner or Engineer.

Copies of these recordings, and those made prior to the service connection installation, shall be submitted to the Engineer for approval.

Field acceptance of the service connection shall be based on the Owner or Engineer's evaluation of the installation including CCTV inspection video recordings and a review of certified test data for the submitted pipe samples.

Groundwater infiltration of the liner shall be zero.

The finished service connection shall be free of dry spots, lifts, delamination and excess resin. There shall be no evidence of splits, cracks, breaks, lifts, kinks or crazing.

If any defective service connection is discovered after it has been installed, it shall be removed and replaced at no additional cost to the Owner. Repair methods shall be submitted to the Owner or Engineer for approval. Any failure that requires excavation work to repair shall be initiated within two (2) hours of failure observation.

The Contractor shall clean up each project area after the work is completed and all testing is accepted. Remove and dispose of all excess materials and debris at each location as directed by the Owner or Engineer.

- B. **CERTIFICATION TESTING.** The Contractor shall provide sufficient specimens from each installation to allow an independent laboratory to conduct their separate tests for each of the flexural and tensile properties of the liner as specified below. The specimens shall be plate samples obtained in the field submitted as requested by the Owner or Engineer. 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 installation as directed by the Owner or Engineer.

- (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.

Copies of the test results shall be sent directly to the Owner or Engineer by the laboratory. The certified results shall report the actual test results for each of the properties being tested.

Each individual reported value shall meet or exceed the value of that property as specified or as used in the design calculations, whichever is higher.

All the expenses related to certified testing of liners furnished under this contract shall be paid for by the Contractor.

#### **708.10 MEASUREMENT AND PAYMENT**

The measurement and payment of the work included in this section of the specifications shall be at the contract unit prices listed in the proposal for the items of work. Payment at the contract unit price for each item shall be considered full compensation for furnishing all materials, labor, equipment, tools, supplies and incidentals necessary to complete each item of work. Data collection shall be considered incidental to construction.

All cleaning and pre-construction CCTV inspection, and post-construction CCTV inspection, for service connections shall be paid for in Section 701.

- A. MLCIPL UP TO 3 FEET. Measurement for installation of MLCIPL up to 3 feet of the size of the line installed, as measured from point of connection to the main. Service lateral connection shall be paid for under the respective quantities as determined at the Contract unit prices bid. This price and payment shall be full compensation for project notices; coordination with property owners and the Owner; furnishing written logs; stopping active infiltration; furnishing and installing the service lateral connection liners; bypass pumping, materials testing; and all else incidental thereto for which separate payment is not provided under other Items.
- B. ADDITIONAL LENGTH FOR MLCIPL. Measurement for installation of additional length of MLCIPL of the size of the line installed, as measured from the initial 3 feet of MLCIPL, will be based on the actual length of MLCIPL installed. Such measurement shall include the items required to complete the work as stated above for MLCIPL UP TO 3 FEET.

Payment will be made under:

Pay Item

Pay Unit

MLCIPL Up to 3 Feet (Size)

EA

Additional Length for MLCIPL (Size)

LF



## **SECTION 709 BYPASS PUMPING**

### **709.01 SCOPE OF WORK**

This work in this Section shall consist of furnishing all labor, materials, tools equipment, incidentals, testing and construction methods or processes required for Bypass Pumping; complete and accepted, in accordance with the Contract Documents.

### **709.02 SUBMITTALS**

- A. Prior to or at the preconstruction conference, the Contractor shall submit a work plan, diversion plan, and work schedule related to bypass pumping, to the Owner and Engineer for review and approval.
- B. Owner or Engineer reserves the right to approve or disapprove the work plan.

### **709.03 GENERAL**

- A. Work performed under this Specification shall be done in accordance with Municipal, State, and Federal standards. Traffic control and safety are the responsibility of the Contractor. All traffic control must be in accordance with Section 120 MAINTENANCE OF TRAFFIC AND TRAFFIC CONTROL. All signage for work on state highway rights-of-way shall conform to the Arkansas State Highway Department requirements. Access to driveways shall be maintained during by-pass pumping operations.
- B. Provide necessary Bypass Pumping of sewage flows where and when required.
- C. Noise related to Bypass Pumping activities shall be attenuated to not exceed the limits discussed in City of Fort Smith Ordinance, Chapter 16, Article II – Noise.
- D. Provide full-time monitoring of Bypass Pumping operations. A backup pump shall be readily available. If a release occurs, the Contractor must notify the Owner immediately. Clean-up of overflows shall be responsibility of contractor at no charge to owner. Fines for release will be \$1,250.00 or as provided in the Consent Decree between The United States of America and the City of Fort Smith, Arkansas (Date of Lodging 01/02/2015) paragraph 108, 109, and 110, whichever is higher.

#### **709.04 MAINTENANCE OF FLOW / BYPASS SEWAGE**

- A. It will be the Contractor's responsibility to dewater the sewer and maintain existing sewage flows at all times. A plan for diversion must be submitted to the Owner or Engineer for review and approval prior to commencement of any work.
- B. The Contractor shall be responsible to maintain the existing flows at all times in an acceptable manner so as not to create a nuisance or in any way endanger the adjoining properties, utilities or environment.
- C. By-passing to storm sewers or other watercourses shall not be allowed at any time.
- D. The Owner does not assume any liability to the Contractor for any delay, cancellation, loss or expense to which he may become subject, directly or indirectly, due to the normal or heavy flows in the existing sewer.

#### **709.05 MEASUREMENT AND PAYMENT**

The measurement and payment of the work included in this section of the specifications shall be considered incidental to all work performed.

## **SECTION 711 NOTIFICATION**

### **711.01 SCOPE OF WORK**

This work shall consist of notification of property owners and business establishments, in accordance with the Contract Documents.

- A. All property owners shall receive notification that their sewage service will be interrupted as a result of any work performed on sewer pipe or structures. The Contractor shall distribute all written notices to each affected property owner at the following times:
  - 1. Forty Eight (48) hours prior to work activities.
  - 2. Within one (1) hour after completion of work activities.
- B. The Owner will provide a sample of all public notifications for distribution by the Contractor.
- C. Each notice shall include the date, start time, and estimated time when service will be completely restored. The notice shall include the name of the Contractor and a 24-hour telephone number for contacting the Contractor or his designated representative and the Utility Department 24 hour emergency phone number, 479-784-2342. Sewer service shall not be disrupted prior to 8:00 a.m. All services must be reestablished by 6:00 p.m. unless otherwise approved by the Engineer and the Owner.
- D. The Contractor shall contact and notify any home or business that cannot be reestablished within the time stated in the written notice. Contractor shall also contact and notify Engineer and Owner of the delay.
- E. The maximum amount of time any home or business shall be without sanitary sewer service is eight (8) hours. Any home or business that is without sanitary service for longer than (8) hours will be bypassed to the sanitary sewer at no additional cost to the Owner.
- F. Contractor's schedule is subject to approval based on critical stakeholders and at no additional cost to the Owner.

### **711.02 MEASUREMENT AND PAYMENT**

All equipment, materials, and labor related to Notification shall be considered incidental to all work performed.