

**SECTION 806
MANHOLE REHABILITATION**

806-1 DESCRIPTION: This specification consists of all work, materials, labor and equipment required for manhole rehabilitation for the purpose of eliminating infiltration and exfiltration, providing corrosion protection, adjusting final grade of manhole top, repair of voids and restoration of the structural integrity of the manhole.

806-1.1 General:

- a. Do not use or retain contaminated, outdated, or diluted materials for resurfacing. Do not use materials from previously opened containers.
- b. Use only products of the approved Manufacturer. Use products of one manufacturer in any one resurfacing system with compatible materials. Provide same material product for touch-up as for original material.
- c. If any requirements of this specification conflict with a referenced standard, the more stringent requirement shall apply.
- d. Make available all locations and phases of the work for access by the Engineer or other personnel designated by the Engineer. The Contractor shall provide ventilation and egress to safely access the coating work areas for inspection.
- e. Conduct work so that the resurfacing system is installed as specified herein and according to manufacturer's recommendation. Inspect work continually to ensure that the resurfacing system is installed as specified herein. The Contractor shall inspect the work to determine conformance with the specifications and referenced documents. The Contractor shall inform the Engineer of the progress and the quality of the work through daily reports, which should at a minimum include EBROSCO manhole number, closest physical address, site and weather conditions, manhole existing conditions, rehabilitation work required, surface preparation, environmental conditions, lining application, quality control, and testing. Any nonconforming coating system work shall be corrected as specified herein or as recommended by the Manufacturer.
- f. The methods of construction shall be in accordance with all requirements of this specification.
- g. Job site environmental conditions such as air and surface temperatures, relative humidity, precipitation, wind, etc. shall be controlled and maintained by the Contractor in accordance with the Manufacturer's instructions.

806-2 SUBMITTALS:

- a. Manhole rehabilitation system manufacturer's literature (cut sheets) describing the rehabilitation system and equipment components, material/chemical properties, MSDS sheets and environmental requirements for application and worker safety requirements. Provide samples of testing, certification and warranty statements.
- b. References of projects successfully completed, incorporating not less than 250 manholes in total which were successfully performed within the last 10 years. Each reference shall include the name of the agency, the name of the project, the date of the project, and an agency contact.

- c. Written certification by the manhole rehabilitation system manufacturer stating the installation Contractor is approved to install the rehabilitation system specified.
- d. Written certification from the product manufacturer that each of the proposed rehabilitation products is compatible with each other.
- e. Warranty affidavit for MCP lining system in accordance with subsection 806-3.9c of this specification.
- f. Manufacturer's written recommendations for product handling and storage requirements including temperature, humidity, and ventilation for resurfacing system materials.
- g. Traffic Control shall be the responsibility of the Contractor. Any necessary lane closures shall require a permit from the Traffic Division of the DPW or the La DOTD. Copies of the permits shall be submitted to the Engineer prior to commencing Work.
- h. Submit with Each Project:
 - 1. Description, layout, and application sequencing plan.
 - 2. Rehabilitation system application requirements including material handling and storage requirements, mixing and proportioning requirements (as applicable), maximum pot life, film/coating thickness, curing, testing and certification requirements of all rehabilitation materials. Product Material Safety Data Sheets.
 - 3. Detailed instructions and methodology for finishing all pipe and manhole connections to rehabilitated manholes to prevent infiltration and exfiltration.
 - 4. Wastewater Flow Control/Bypassing Plan.
 - 5. Confined Space Entry Plan/Permit.
 - 6. Plan for capturing extraneous debris during rehabilitation processes and debris disposal.
 - 7. Liner and vacuum test results.

806-3 MATERIALS: The materials used shall be designed, manufactured and solely intended for sewer manhole rehabilitation. The materials shall have a proven history of performance in sewer manhole rehabilitation for a minimum of 10 years nationally, of similar age, groundwater levels and circumstance. Contractor shall comply with all manufacturers' recommendations for the approved products.

Products will not be considered by Engineer as an "or-equal" or substitute unless a written request for approval has been submitted by Contractor. Requests for approval shall include all of the following information:

- a. A cover sheet stating the name of the proposed product and the name of the currently specified product (with applicable specification section number) which the proposed product is requesting to be approved as an "or-equal."
- b. A letter from the Installer stating that the proposed product is in compliance with all aspects of the specifications including all physical properties, thicknesses, dimensions, cure-times, and warranty requirements; and the Installer shall also include with the

letter complete references (with current contact information) showing exactly how many successful installations of the proposed product that the Installer has completed to date.

- c. A letter from the Manufacturer stating that the proposed product is in compliance with all aspects of the specifications including all physical properties, thicknesses, dimensions, cure-times, and warranty requirements; and the Manufacturer shall also include with the letter complete references (with current contact information) showing that the exact proposed product has been successfully installed in at least 5,000 wastewater structures within the last 5 years.
- d. Affidavits signed by both an Officer of the Manufacturer and the Installer declaring that all of the information submitted is true and that the proposed product is not currently involved in any unsettled disputes over patent infringement.
- e. Product(s) seeking an "or-equal" approval that have not previously performed work with the Owner shall perform a demonstration of their product within the Owner's collection system at no cost to the Owner. Following a successful field installation of the product and the Owner's assessment and approval of said product for a period of six (6) months, the Owner, at their discretion, may elect to approve the product for the project.

The burden of proof of the merit of the proposed item is upon Contractor. Engineer's decision of approval or disapproval of a proposed item will be final. Contractor shall not rely upon approvals made in any other manner.

806-3.1 Riser Rings:

- a. **Precast Concrete:** New precast concrete riser rings free from cracks, voids and other defects and shall conform to ASTM C478. Contractor shall use precast concrete riser rings of a nominal thickness of not less than four (4) inches and not more than six (6) inches for reconstruction and/or adjustment of the manhole frame and cover. Concrete riser rings shall include the protective admixtures in accordance with Section 803. Joints shall also be externally wrapped with an external seal wrap as specified in Section 803.
- b. **Cast Iron:** New cast iron riser rings shall be of domestic origin, conform to the latest edition of AASHTO M306. Contractor shall use cast iron riser rings for reconstruction and/or adjustment of the manhole frame and cover of less than 4 inches.

806-3.2 Cone Replacement: The new precast concrete cone shall be concentric, unless otherwise specified, conforming to ASTM C478 and Section 1017-2. Concrete manhole cones shall include the protective admixtures in accordance with Section 803. Joints shall be sealed with gaskets conforming to ASTM C990 or C443. Joints shall also be externally wrapped with an external seal wrap as specified in Section 803.

806-3.3 Manhole Frame and Cover: New manhole and Air Release Valve vault frames and/or covers shall conform to Section 1011-5 and the Contract Documents. Frames and covers shall be completely coated with an environmentally safe, water-base asphaltic coating which is nontoxic, nonflammable, colorless, and dries to a hard black finish. Manhole frames shall also be externally wrapped with an external seal wrap as specified in Section 803. Air Release Valve vault frames are not required to be wrapped with an external seal wrap.

806-3.4 Stainless Steel Inserts: The insert body shall be manufactured of 304 stainless steel with a thickness of not less than 18 gauge. The dish shall have a handle of 3/16" plastic coated stainless steel cable installed on the body of the dish. The handle shall be attached with a #6 high grade stainless steel rivet. The gasket shall be made of close cell neoprene, and shall have a pressure

sensitive adhesive on one side. The gas relief valve shall be designed to release at a pressure of .5 to 1.5 psi. The valve shall be made of Nitrile for prevention of corrosion from contact with hydrogen sulfide, diluted sulfuric acid and other gases associated with waste-water collection systems. Each dish shall have a factory installed five foot long, 3/16" stainless steel cable retaining tether that shall pass through a water tight grommet in the bottom of the dish with a high grade stainless steel adjustable locking device located between the bottom of the dish and lift loop at the top end of tether. The cable terminal and eye end shall be made of stainless steel.

806-3.5 Cementitious Mortar: Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150. Sand shall meet the requirements of ASTM C 144.

806-3.6 Patching Material: A quick setting fiber reinforced cementitious material shall be used as a patching material and is to be mixed and applied according to manufacturer's recommendations.

806-3.7 Hydraulic Cement: A rapid setting, high-early-strength, cementitious product specifically formulated for leak control shall be used to stop water infiltration. The material shall be mixed and applied according to the manufacturer's recommendations.

806-3.8 Chemical Grout: A chemical grout shall be used for stopping very active infiltration and filling voids. Chemical grout shall be an acrylic, acrylate, or urethane base grout for non-structural infiltration control with the following properties:

a. Acrylic or Acrylate Base Grout:

1. Minimum 25% acrylic or acrylate base material by volume.
2. Controllable reaction time: 30 seconds to 1 hour.
3. Viscosity: 1 to 3 centipoises water.
4. Tolerates dilution and reacts in moving water.
5. Final reaction:
 - i. Produces chemically, continuous irreversible, non-biodegradable, flexible gel, impermeable to water at pressures up to 15psi in pure form.
 - ii. Produces stabilized soil in ground that will not become brittle or rigid.
6. Gel does not bleed water under stress.
7. Dehydrated gel returns to 90% of its original volume and form after prolonged period of low ground water.
8. Do not use catalyst containing dimethyl amino propionitrile (DMAPM).
9. Tinted to allow detection of grout in drill holes or at leakage locations.

b. Urethane Base Grout:

1. Ratio: One part urethane prepolymer to 10 parts water by volume (10 to 50% prepolymer).
2. Liquid Prepolymer:
 - i. Solids content: 77 to 83%
 - ii. Specific gravity: 1.04
 - iii. Flash Point: 20 degrees F
 - iv. Viscosity: 200 to 1200 centipoises water at 70 degrees F
3. Water for reaching prepolymer: pH of 5 to 9.
4. Use manufacturer recommended gel control agent to control cure time as required.
5. Final reaction:
 - i. Produces chemically, continuous irreversible, non-biodegradable, flexible gel, impermeable to water at pressures up to 15psi in pure form.

- ii. Produces stabilized soil in ground that will not become brittle or rigid.
- 6. Dehydrated gel returns to 90% of its original volume and form after prolonged period of low ground water.
- 7. Do not use catalyst containing dimethyl amino propionitrile (DMAPM).
- 8. Tinted to allow detection of grout in drill holes or at leakage locations.

Chemical grouts shall be as manufactured by Avanti International, De Neef, Inc., or approved equal.

806-3.9 Liner Materials:

- a. **Cementitious Liner Material:** Cementitious liner products shall be used to form a structural monolithic liner covering all interior manhole surfaces and shall have the following minimum requirements:

- 1. Compressive Strength (ASTM C109): 6,000 psi, 28days
- 2. Tensile Strength (ASTM C496): 600 psi, 28 days
- 3. Flexural Strength (ASTM C293): 1,000 psi, 28 days
- 4. Shrinkage (ASTM C596): 0.02% at 28 days
- 5. Minimum Bond (ASTM C952): 200 psi, 28 days

When used as the final rehabilitation liner material (no epoxy liner), product shall be made with calcium aluminate cement. Calcium aluminate is not required when the cementitious liner is used as the underlayment for the epoxy liner application.

- b. **Epoxy Liner Material:** 100% solids epoxy liner is to be applied where structural enhancement is needed and severe corrosion is anticipated. The epoxy liner material shall be applied over the completed cementitious liner material (without the calcium aluminate). The liner shall be spray applied or spin cast. The manufacturer of the selected epoxy liner material shall approve in writing that their epoxy liner is compatible with cementitious repair and liner material. The epoxy liner material shall have the following minimum requirements:

- 1. Hardness, Shore D (ASTM D2240): 85 (±2)
- 2. Adhesion (ASTM D4541), Concrete: Substrate Failure
- 3. Abrasion: ASTM D 4060 – Requirement: No more than 180 mg loss after 1,000 cycles
- 4. Corrosion Resistance: Suitable for environments PH of .5 or higher. Highly resistant to hydrogen sulfide, sulfuric acid, MIC and treatment chemicals.

- c. **Multi-Component Polyurea (MCP) System Liner Material:** A multi-component, non-volatile, silicone modified polyurea stress panel liner is to be applied where an infiltration barrier is needed, severe corrosion is anticipated, and where service turnaround time is extremely limited.

- 1. The liner components shall be as follows:

<u>Component</u>	<u>Material</u>
Moisture Barrier	Silicone Modified Polymer (polyurea)
Surfacer	Polyurethane/Polymeric blend
Final Corrosion Barrier	Silicone Modified Polymer (polyurea)

- 2. The Barrier coat material is a two component 100% solids Silicone Modified Polyurea with the following minimum requirements and properties:

- i. Tensile Strength (ASTM D412): 2,600 psi

- ii. Elongation (ASTM D412): 420%
 - iii. Tear Strength (ASTM D624): 280 pli
 - iv. Hardness, Shore D (ASTM D2240): 42 (± 2)
 - v. Flexibility (ASTM D522): Pass (1/ 8 "Mandrel)
 - vi. Taber Abrasion (ASTM D4060): No more than 25 mg loss after 1,000 cycles (CS 17 Wheel 1kg)
 - vii. Corrosion Resistance: Suitable for environments PH of .5 or higher. Highly resistant to hydrogen sulfide, sulfuric acid, MIC and treatment chemicals.
 - viii. Processing Properties:
 - A. Gel Time: 1-2 seconds
 - B. Tack Free Time: 15 seconds
 - C. Cure Time: 30 seconds
3. The Surfacer coat material is a two component premium, closed cell, specially formulated polyurethane foam with the following minimum requirements and properties:
- i. Density (ASTM D1622): 4 pcf
 - ii. Compressive Strength (ASTM D1621): 90 psi
 - iii. Closed Cell Content (ASTM D1940): >95%
 - iv. Water Absorption (ASTM D2842): 0.020 gm/cc
 - v. Water Vapor Transmission (ASTM E96): 0.61 perms
 - vi. Processing Properties:
 - A. Cream Time: 1-4 seconds
 - B. Tack Free Time: 5-8 seconds
 - C. Rise Time: 6-10 seconds
4. Modified polymer shall be sprayable, solvent free, two component polymeric, moisture/chemical barrier specifically developed for the corrosive wastewater environment.
5. A mechanical anchoring system shall be imbedded and sprayed into the liner at all leaks and at the wall/floor termination.
6. MCP System Warranty: The supplied lining system shall include a 10-year limited warranty covering both materials and installation beginning on the date of final acceptance. Both the Manufacturer and the Applicator shall stand behind this warranty for 10 years. Contractor shall submit the following:
- i. An affidavit executed under seal by an officer of the Manufacturer and the Installer stating that if their proposed MCP lining system is used on this project; the Manufacturer will warrant the finished, in-place, lining system against infiltration and corrosion for a minimum of 10 years from the installation date.

MCP liner products shall be SpectraShield with AnchorShield as manufactured by CCI Spectrum, Inc., or approved equal.

- d. **Water:** Water shall be clean and potable.

806-3.10 Internal Manhole Chimney Seal Material: An aromatic urethane rubber material or flexible epoxy mastic used to prevent leakage of water into the manhole through the frame joint area and the area above the manhole cone and shall have the following minimum requirements:

- a. Elongation (ASTM D412): 600%
- b. Tensile Strength (ASTM D412): 1,150 psi

- c. Adhesive Strength (ASTM D903): 175 lb. l/in.
- d. Tear Resistance (ASTM D1004): 155 lb. l/in.

The seal shall extend from the inside of the manhole frame down to the cone or corbel of the manhole.

806-3.11 External Manhole Seal Wrap: When work consists of adjusting manholes or cone replacements, an external seal wrap shall be installed to the outside of concrete risers, steel risers and joints of the precast manhole in order to eliminate infiltration. The external seal wrap shall conform with Section 803 and be installed in accordance with the details of the Contract Documents and the manufacturer's recommendations.

806-3.12 Manhole Cover Vent System: A simple device that is installed on existing manhole covers that allows airflow in and out of a manhole. The dome-shaped device is slightly raised which forces a majority of storm water runoff to flow around the device rather than inflow into the manhole, while still safe for vehicle traffic.

The device shall be made of a nylon resin material that is:

- a. Highly impact resistant (HS-20 vehicle loading)
- b. Chemical resistant
- c. UV light resistant
- d. Heat and cold resistant

The device shall be installed with a commercial grade EPDM rubber gasket for water tightness and shall meet the following:

- a. Minimum 1000 psi tensile strength
- b. Accommodates temperatures from -20 to 230 °F
- c. Resistant to ozone and many oxidizing chemicals and acids
- d. Highly resistant to sunlight

A high-strength adhesive that is suitable for hot and cold environments, does not crack or loose bond, cures quickly, and is environmentally friendly shall be utilized for the devices installation. The device shall have an optional vent pipe extension. This extension pipe shall be a pultruded fiberglass tube made of isophthalic polyester resin and e-glass. The tubing shall be UV resistant, corrosion resistant, flexible but strong, and available in a non-fading bright yellow color that is integral to the tubing (not painted on). The manhole cover vent extension shall be 4 ft. in height. Manhole cover vent system and extension pipe shall be as manufactured by Sewer Sentry or approved equal.

806-4 EQUIPMENT: Contractor shall utilize equipment approved by the material supplier for the specific application. Hard to reach areas, primer application and touch-up may be performed using hand tools as approved by the manufacturer. Contractor shall be trained by, or have their training approved and certified by the coating product manufacturer for the handling, mixing, application and inspection of the coating product(s) to be used as specified herein.

806-5 PREPARATION:

- a. Perform traffic control in accordance with the approved traffic control submittal.
- b. Store materials in accordance with manufacturer's recommendations.
- c. Schedule and perform the work in a manner that does not cause or contribute to overflows or spills of sewage from the sewer system.

- d. Install devices to prevent extraneous material from entering the sewer system and to prevent upstream line from flooding the manhole. If extraneous material or debris falls into a "live" manhole during adjustment operations, the Contractor shall remove debris at no cost to the Owner.
- e. Dispose of wastes in accordance with applicable regulations.
- f. Schedule and perform any bypass pumping that will be necessary to properly rehabilitate the manhole. Refer to section 813 for sewer flow requirements.
- g. If present in the manhole, Contractor shall remove all access steps. Removal shall consist of neatly cutting steps flush with the wall prior to any lining installation. Contractor shall be responsible for proper disposal of steps.
- h. For manholes that are located within pavement areas and require resetting or replacement of concrete riser rings, cones, and /or frames, the Contractor shall sawcut, remove, and replace a 6 ft. x 6 ft. square section of pavement and base for rehabilitation operations. Costs for removal and replacement of pavement and base beyond these limits shall be borne by the Contractor.

806-6 INSTALLATION: Prior to any lining all other miscellaneous work must be complete.

806-6.1 Cone Replacement: The Contractor shall replace existing deteriorated manhole cone section with new precast concrete cone section. A preformed gasket material shall be placed in all keyways between existing manhole riser section and cone joints. Prior to backfilling, rubber external seal wraps shall be applied to the cone and manhole section joint, riser rings and frame in accordance with Subsection 803-4.7. If the existing manhole is of brick construction, the cone shall be set in a full bed of mortar on the top course of bricks.

806-6.2 Riser Rings: The Contractor shall replace existing, deteriorated riser rings with new precast concrete riser rings and/or cast iron riser rings. All manholes designated to receive casting adjustment and/or alignment shall be adjusted to meet existing finished grade unless an alternative elevation is specified. A cementitious mortar shall be placed in between individual precast concrete riser rings, and precast concrete riser ring and cone joints. The mortar shall be struck smooth with the interior surface of the manhole and floated with a sponge float to a surface profile of 8-10 mils. An epoxy system designed for metal-to-metal adhesion shall be used to connect individual cast iron riser rings and the cast iron riser rings to the frame. Prior to backfilling, rubber external seal wraps shall be applied to the cone and manhole section joint, riser rings and frame in accordance with Subsection 803-4.7.

806-6.3 Frame and Cover: Existing frames and covers which must be removed to facilitate manhole and/or Air Release Valve vault rehabilitation, riser reconstruction, and/or casting alignment or grade adjustments shall be salvaged, cleaned and given two coats of an approved bituminous coating by the Contractor for replacement unless determined to be defective by Engineer. If frame and/or cover are determined to be defective, Contractor shall replace with new frame and/or cover. Replacement frames and/or covers shall be furnished and installed in accordance with the Contract Documents. Frames shall be set in full mortar bed. The mortar shall be struck smooth with the interior surface of the manhole and floated with a sponge float to a surface profile of 8-10 mils. Prior to backfilling, rubber external seal wraps shall be applied to the cone and manhole section joint, riser rings and frame in accordance with Subsection 803-4.7.

806-6.4 Cementitious Liner:

- a. All manholes to be lined shall be cleaned and scarified with a minimum of 5,000 psi water jet at a minimum water temperature of 180 degrees F. The water jet shall hit the manhole wall surface at as near perpendicular angle as possible. Cleaning the

manhole walls from the ground surface without the appropriate angled nozzles will not be accepted. Manhole surface build-up of debris and loose manhole construction materials shall be removed during the cleaning process.

- b. The intent of the surface preparation and cleaning work is to remove debris, films or unsound, deteriorated concrete and to provide a structurally sound, clean surface that will enable lining materials to bond to the original substrate at adhesion strengths of that specified herein, a substrate pH of 8.3 is the minimum pH that will be considered acceptable to demonstrate that the surface preparation and cleaning have been properly performed.
- c. Additional aggressive surface preparation and cleaning methods may be necessary to remove carbonated cementitious lining concrete or contaminants that remain after the cleaning performed as described above. The Contractor shall test the pH of the cleaned manhole interior surface at various locations of the manhole and when the results indicate a pH less than 8.3 then additional surface preparations and cleaning will be required. As a minimum level of effort the Contractor shall either dry sand blasting or pneumatic jackhammering with a bushing bit followed by a minimum 5,000 psi water blast.
- d. Active leaks shall be stopped using hydraulic cement and/or chemical grout as necessary. Installation of chemical grout shall follow ASTM F2414 and as specified herein:
 1. Brick Manholes:
 - i. Drill only the amount of holes necessary to stop leakage following industry standards and chemical grout manufacturer's recommendations.
 - A. Do not use curtain of grout sealing method.
 - ii. Proceed with manhole repairs and/or reconstruction.
 2. Precast manholes:
 - i. Seal pipe connections as specified by drilling between pipe and manhole opening and injecting grout.
 - ii. When specified, seal precast manhole base by drilling holes at leakage points along bench to wall, and in channel.
 - iii. At precast joints inject grout through holes drilled at leaking joint.
 3. Equipment: The basic equipment shall consist of chemical pumps, chemical containers, injection packers, hoses, valves, and necessary equipment and tools required to seal manholes. The injection pumps shall be equipped with pressure gages that will provide for monitoring pressure during the injection process.
- e. Chemical grout shall be pumped through grout injection ports until material refusal is recorded on the pumping unit pressure gage or a predetermined quantity of sealant has been injected. Care shall be taken during the pumping operation to insure that excessive pressures do not develop and cause damage to the manhole structure. Upon completion of the injection, the ports shall be removed and the remaining holes filled with mortar or patching material and troweled flush with the surface of the manhole walls or other surfaces..
- f. Any bench, invert or service line repairs shall be made at this time using quick setting grout or repair mortar per the manufacturer's recommendations.
- g. Invert repair shall be performed on all inverts with visible damage or where infiltration is present. After blocking flow through the manhole and thoroughly cleaning the invert,

quick setting patch material shall be applied to the invert in an expeditious manner. The finished invert surfaces shall have a smooth surface and form a continuous monolithic conduit with the sewer pipe entering and leaving the manhole. The bench and invert shall form a watertight seal with the manhole walls, base and pipe seal.

- h. Wastewater flow shall be controlled by methods which prevent contact with the new bench and invert for 6-8 hours after mortar placement. If 6-8 hours set time is not possible, a fast setting, high early strength mortar shall be used with provisions for flow control until concrete has set.
- i. Fill all cracks, holes and joints what have voids using non-shrink grouts in accordance with the manufacturer's recommendations. Repair exposed rebar, defective pipe penetrations or inverts, etc. with non-shrink grouts or other approved alternative method.
- j. Apply Cementitious Liner Material per the Manufacturer's recommendations. Apply Cementitious Liner material so that the final thickness is 0.5-inch minimum or per the thickness required by the manufacturer's minimum specification, whichever is greater. The material shall start at the bottom of the manhole frame and extend to the water level of the invert.
- k. Finish repair material to a hard trowel finish and then finish with a sponge float. The sponge float finish shall have a surface profile of 8-10 mils.
- l. If the cementitious lining material is not immediately coated with epoxy, apply a seal coat compatible with the repair material to aid in curing and minimize recontamination of the substrate prior to application of the epoxy liner material.

806-6.5 Epoxy Liner:

- a. Prior to any Epoxy lining perform all work shown in Section 806-6.4 above.
- b. Remove any curing compounds, sealers or contaminates prior to epoxy lining.
- c. Apply epoxy lining material in accordance with the manufacturer's recommendations over the waterproofing/structural repair material shown in Section 806-6.4.
- d. Epoxy liner shall be 125 mils, minimum, dry film thickness.

806-6.6 Multi-Component Polyurea (MCP) System Liner:

- a. Prior to any MCP System lining perform all work shown in Sections 806-6.4 a. through h. above.
- b. Mechanical anchoring system shall be imbedded and sprayed into the liner at all wall seams and at the wall/floor termination.

- c. Application of multi-component system shall be in strict accordance with manufacturer's recommendation and must be performed by a contractor licensed and trained by the Manufacturer. A permanent identification number and date of work performed shall be affixed to the structure in a readily visible location.
 - 1. Apply Moisture Barrier. This layer of polyurea shall be spray applied to all surfaces.
 - 2. Apply Surfacer. This layer of polyurethane rigid structure foam shall be spray applied to all surfaces previously lined with the moisture barrier. Layer thickness may vary depending on the condition of the substrate and the level of deterioration. Mechanical anchoring system shall be embedded in this layer.
 - 3. Apply Final Corrosion Barrier to all surfaces lined with the Surfacing layer.
- d. Total MCP System lining thickness shall be 500 mils, minimum, dry film thickness.

806-6.7 Internal Manhole Chimney Sealant:

- a. Perform all work shown in Sections 806-6.4 and 6.5 (if 6.5 is required) prior to any Internal Manhole Chimney Sealant.
- b. Clean all contaminates from manhole frame by sandblasting or mechanical methods as recommended by the chimney sealant manufacturer.
- c. Install Internal Manhole Chimney Sealant in accordance with the manufacturer's recommendations. The Contractor shall contact the manufacture for thickness recommendations; however, the final liner material shall be made no less than 170 mils.

806-6.8 External Manhole Seal Wrap: When Work consists of adjusting sewer manholes or cone replacement, an external seal wrap shall be installed to the outside of concrete risers, steel risers and joints of the precast manhole in order to eliminate infiltration. Frame and cover shall be completely coated prior to installation of the external seal wrap. The external seal wrap shall be installed in accordance with the details of the Contract Documents and the manufacturer's recommendations.

806-6.9 Stainless Steel Insert: If existing manhole is equipped with a non-stainless steel insert, Contractor shall remove and dispose of existing insert and furnish and install a new stainless steel insert in accordance with manufacturer's recommendations. Rivet used for attaching insert to manhole shall be installed into the casting. If existing manhole is equipped with a stainless steel insert pan to prevent intrusion of storm water, pan shall be cleaned and reinstalled by the Contractor unless determined to be defective by the Engineer. If insert is determined to be defective, Contractor shall furnish a new stainless steel insert and install in accordance with manufacturer's recommendations at the completion of manhole rehabilitation operations.

806-6.10 Manhole Cover Vent System: Preparation and installation of the manhole cover vent system shall be in accordance with the manufacturer's recommendations. When directed by the Engineer, a vent extension pipe shall also be installed. The extension pipe shall be installed into the manhole cover vent with the use of high-strength adhesive so as not to be easily removed. Contractor shall take care that adhesive does not restrict vent opening.

806-7 TESTING: After completion of any rehabilitation operation and backfilling (if required), the Contractor shall conduct the following tests on the manholes:

- a. Vacuum Test: Manhole shall be vacuum tested in accordance with Subsection 803-5.
- b. Visual Inspection: The Engineer and Applicator shall make a final visual inspection.

Any deficiencies in the finished system shall be marked and repaired.

If an epoxy or MCP liner is applied, the following additional tests will be required:

- a. **Wet Film Thickness Gage:** During application a wet film thickness gage, meeting ASTM D4414 – Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used to ensure a monolithic coating and uniform thickness during application.
- b. **Holiday Test:** Upon full cure, the installed lining system shall be checked by high voltage spark detection in accordance with NACE RP0188-90 to verify a pinhole-free surface. Voltage shall be set at 11,000 volts. Areas which do not pass the spark detection test shall be corrected and rechecked at no additional cost to the Owner.

806-8 MEASUREMENT:

- a. **Manhole Riser Ring (Concrete):** Measurement for precast concrete manhole riser rings shall be made on a vertical inch basis.
- b. **Manhole Riser Ring (Cast Iron):** Measurement for cast iron manhole riser rings shall be made on a vertical inch basis.
- c. **Manhole Cone Replacement:** Measurement of Work for payment of this Item shall be made at the unit price bid per vertical foot based on manhole diameter. Measurement shall be made from the bottom of cone to top of cone. Excavation, backfill, disposal of deteriorated cones and surplus excavated material is considered incidental to and, if required, shall be included in this Bid Item. Sawcutting, removal and restoration of pavement and base material, curbs and gutters, shall be paid for as required under the Bid Item for that particular portion of the Work.
- d. **Reset Existing Manhole Frames and Covers:** Measurement for removing, cleaning, and resetting existing manhole and/or Air Release Valve vault frames and covers shall be the actual count (each).
- e. **Manhole Frame:** Measurement for new manhole frame shall be the actual count (each).
- f. **Manhole Frame (Oversized):** Measurement for new oversized manhole frame that is larger than the standard 25" diameter manhole frame shall be the actual count (each).
- g. **Manhole Frame (Bolt Down Watertight):** Measurement for new bolt down watertight manhole frame shall be the actual count (each).
- h. **Manhole Frame and Cover (Hinged):** Measurement for new hinged manhole frame and cover assembly shall be the actual count (each).
- i. **Air Release Valve Vault Frame:** Measurement for new Air Release Valve vault frame shall be the actual count (each).
- j. **Manhole Cover:** Measurement for new manhole cover shall be the actual count (each).
- k. **Manhole Cover (Oversized):** Measurement for new oversized manhole cover that is larger than the standard 23 ¼" diameter manhole cover shall be the actual count (each).

- l. **Manhole Cover (Bolt Down Watertight):** Measurement for new bolt down watertight manhole cover shall be the actual count (each).
- m. **Air Release Valve Vault Cover:** Measurement for new Air Release Valve vault cover shall be the actual count (each).
- n. **S.S. Manhole Insert:** Measurement for new stainless steel manhole insert shall be the actual count (each).
- o. **Manhole Repair (Patching):** Measurement for manhole repair shall be made on a cubic foot basis as determined by the actual volume of water seal, solid filler, or waterproof grout mix used to make repairs to wall sections, bench, and invert to manhole connections. All application shall be in accordance with manufacturer's recommendations. All work under this Item is considered to be performed from the interior of the manhole. Manhole repair shall not be measured for payment when required as surface preparation for a manhole lining rehabilitation operation.
- p. **Chemical Grouting for Leakage Control:** Measurement for chemical grouting for leakage control shall be made on a per gallon basis as determined by the actual volume of chemical sealing material used to seal manhole from active leaks. All application shall be in accordance with ASTM F 2414 and manufacturer's recommendations. All work under this Item is considered to be performed from the interior of the manhole.
- q. **Manhole Rehabilitation (Cementitious Lining):** Measurement for payment of these Items shall be based on the actual number of vertical feet of manhole wall rehabilitated for a standard four-foot diameter manhole. Where manhole diameter is significantly different from the standard (i.e., 5' or 6') then the vertical footage shall be adjusted for pay purposes accordingly, to account for the additional square footage of area requiring rehabilitation (i.e., 5' diameter = 1.25 x vertical footage of standard; 6' diameter = 1.50 x vertical footage of standard, etc.). In like manner, structures that are discovered to have geometric shapes other than circular shall be adjusted as above to provide a consistent method of accounting for the actual square footage of area requiring rehabilitation of walls. All other aspects of measurement shall remain as indicated. All measurements shall be as specified or made by conventional means with accuracies consistent with field conditions and common practice. Should a discrepancy in measurement exist which is greater than ten percent (10%), the Item in question shall be re-measured by both the Contractor and the Engineer for verification. Manhole rehabilitation (cementitious lining) shall not be measured for payment when required as underlayment for a manhole rehabilitation (epoxy lining) operation.
- r. **Manhole Rehabilitation (Epoxy Lining):** Measurement for payment of these Items shall be based on the actual number of vertical feet of manhole wall rehabilitated for a standard four-foot diameter manhole. Where manhole diameter is significantly different from the standard (i.e., 5' or 6') then the vertical footage shall be adjusted for pay purposes accordingly, to account for the additional square footage of area requiring rehabilitation (i.e., 5' diameter = 1.25 x vertical footage of standard; 6' diameter = 1.50 x vertical footage of standard, etc.). In like manner, structures that are discovered to have geometric shapes other than circular shall be adjusted as above to provide a consistent method of accounting for the actual square footage of area requiring rehabilitation of walls. All other aspects of measurement shall remain as indicated. All measurements shall be as specified or made by conventional means with accuracies consistent with field conditions and common practice. Should a discrepancy in measurement exist which is greater than ten percent (10%), the Item in question shall be re-measured by both the Contractor and the Engineer for verification.

- s. **Manhole Rehabilitation (MCP Lining):** Measurement for payment of these Items shall be based on the actual number of vertical feet of manhole wall rehabilitated for a standard four-foot diameter manhole. Where manhole diameter is significantly different from the standard (i.e., 5' or 6') then the vertical footage shall be adjusted for pay purposes accordingly, to account for the additional square footage of area requiring rehabilitation (i.e., 5' diameter = 1.25 x vertical footage of standard; 6' diameter = 1.50 x vertical footage of standard, etc.). In like manner, structures that are discovered to have geometric shapes other than circular shall be adjusted as above to provide a consistent method of accounting for the actual square footage of area requiring rehabilitation of walls. All other aspects of measurement shall remain as indicated. All measurements shall be as specified or made by conventional means with accuracies consistent with field conditions and common practice. Should a discrepancy in measurement exist which is greater than ten percent (10%), the Item in question shall be re-measured by both the Contractor and the Engineer for verification.
- t. **Internal Manhole Chimney Sealant:** Measurement for payment of this Item shall be based on the actual number of vertical inches depending on the depth of each seal applied. The depth of each seal will be measured as the distance from the manhole frame joint to the top joint of the manhole cone for which final liner material is to be applied. Fractional measurement will be rounded down to the nearest whole number as reported in inches.
- u. **Removal of Interior Manhole Steps:** Measurement of Work for payment of this Item shall be made at the unit price bid per manhole containing steps, regardless of the number of steps in each.
- v. **Manhole Cover Vent System:** Measurement for a new manhole cover vent system shall be the actual count (each) installed per manhole cover.
- w. **Manhole Cover Vent Extension:** Measurement for a new manhole cover vent extension 4 ft. pipe shall be the actual count (each) installed per manhole cover.

806-9 PAYMENT:

- a. **Manhole Riser Ring (Concrete):** Payment for precast concrete manhole riser rings will be full compensation for all labor, materials, and equipment necessary to remove and dispose of existing deteriorated concrete manhole riser rings and replace with new precast concrete manhole riser rings; including traffic control, external seal wraps, excavation, backfill, and disposal of surplus excavated material, if required. Sawcutting, removal and restoration of pavement and base material, curbs and gutters, shall be paid for as required under the Bid Item for that particular portion of the Work.
- b. **Manhole Riser Ring (Cast Iron):** Payment for cast iron manhole riser rings will be full compensation for all labor, materials, and equipment necessary to remove and dispose of existing deteriorated cast iron manhole riser rings and replace with new cast iron manhole riser rings; including traffic control, external seal wraps, excavation, backfill, and disposal of surplus excavated material, if required. Sawcutting, removal and restoration of pavement and base material, curbs and gutters, shall be paid for as required under the Bid Item for that particular portion of the Work.
- c. **Manhole Cone Replacement:** Payment of the unit price amount bid for this Item shall be full compensation for furnishing all materials, labor, and equipment; including traffic control, excavation, backfill, external seal wraps, and disposal of deteriorated cones and surplus excavated material, if required. Sawcutting, removal and restoration of pavement and base material, curbs and gutters, shall be paid for as required under the Bid Item for that particular portion of the Work.

- d. **Reset Existing Manhole Frames and Covers:** Payment for resetting existing manhole and/or Air Release Valve vault frames and covers will be full compensation for all materials, labor, equipment; including traffic control, external seal wraps, excavation, backfill, and disposal of deteriorated cones and surplus excavated material, if required. Sawcutting, removal and restoration of pavement and base material, curbs and gutters, shall be paid for as required under the Bid Item for that particular portion of the Work.
- e. **Manhole Frame:** Payment for this item includes full compensation for furnishing and installing a new manhole frame, disposal of damaged manhole frame, external seal wraps, and traffic control.
- f. **Manhole Frame (Oversized):** Payment for this item includes full compensation for furnishing and installing a new oversized manhole frame, disposal of damaged oversized manhole frame, external seal wraps, and traffic control.
- g. **Manhole Frame (Bolt Down Watertight):** Payment for this item includes full compensation for furnishing and installing a new bolt down watertight manhole frame, disposal of damaged manhole frame, external seal wraps, and traffic control.
- h. **Manhole Frame and Cover (Hinged):** Payment for this item includes full compensation for furnishing and installing a new hinged manhole frame and cover, disposal of damaged manhole frame and cover, external seal wraps, and traffic control.
- i. **Air Release Valve Vault Frame:** Payment for this item includes full compensation for furnishing and installing a new Air Release Valve vault frame, disposal of damaged Air Release Valve vault frame, and traffic control.
- j. **Manhole Cover:** Payment for this item includes full compensation for furnishing and installing a new manhole cover, disposal of damaged manhole cover, and traffic control.
- k. **Manhole Cover (Oversized):** Payment for this item includes full compensation for furnishing and installing a new oversized manhole cover, disposal of damaged oversized manhole cover, and traffic control.
- l. **Manhole Cover (Bolt Down Watertight):** Payment for this item includes full compensation for furnishing and installing a new bolt down watertight manhole cover, disposal of damaged manhole cover, and traffic control.
- m. **Air Release Valve Vault Cover:** Payment for this item includes full compensation for furnishing and installing a new Air Release Valve vault cover, disposal of damaged Air Release Valve vault cover, and traffic control.
- n. **S.S. Manhole Insert:** Payment for this item includes full compensation for furnishing and installing a new stainless steel manhole insert, and traffic control.
- o. **Manhole Repair:** Payment for manhole repair will be full compensation for cleaning and preparing surfaces; drilling for access or infiltration relief purposes; and for labor, materials and equipment necessary to purchase, store, transport, mix and apply all patching and preparatory items required to complete the Work; sewer flow control, traffic control and testing.
- p. **Chemical Grouting for Leakage Control:** Payment for chemical grouting for leakage control will be full compensation for cleaning and preparing surfaces; drilling for sealant injection ports; and for labor, materials and equipment necessary to seal manhole from

active leaks through chemical grouting and preparatory items required to complete the Work; sewer flow control, traffic control and testing.

- q. **Manhole Rehabilitation (Cementitious Lining):** Payment of the unit price amount bid for this Item shall be full compensation for all labor, materials, equipment, surface cleaning and preparation, patching and/or grouting, sewer flow control, traffic control, and testing.
- r. **Manhole Rehabilitation (Epoxy Lining):** Payment of the unit price amount bid for this Item shall be full compensation for all labor, materials, equipment, surface cleaning and preparation, patching and/or grouting, cementitious underlayment, sewer flow control, traffic control, and testing.
- s. **Manhole Rehabilitation (MCP Lining):** Payment of the unit price amount bid for this Item shall be full compensation for all labor, materials, equipment, surface cleaning and preparation, multiple-component polyurea liner system, sewer flow control, traffic control, and testing.
- t. **Internal Manhole Chimney Sealant:** Payment of the unit price amount bid for this Item shall be full compensation for all labor, materials, sealant system accessories, equipment, surface cleaning and preparation, patching and/or grouting, sewer flow control, traffic control, and testing.
- u. **Removal of Interior Manhole Steps:** Payment for this item will be full compensation for labor, materials and equipment necessary to remove steps from the interior of the manhole, patch any voids created by the removal, sewer flow control, and traffic control.
- v. **Manhole Cover Vent System:** Payment for this item will be full compensation for labor, materials and equipment necessary to install manhole cover vent system including, but not limited to the manhole cover vent system, rubber gaskets for system and manhole frame/cover, drilling into manhole cover, high-strength glue, and all incidentals; in accordance with the Contract Documents.
- w. **Manhole Cover Vent Extension:** Payment for this item will be full compensation for labor, materials and equipment necessary to install manhole cover vent extension including, but not limited to the manhole cover vent extension pipe (4 ft. height), high-strength glue, and all incidentals; in accordance with the Contract Documents.

806-10 PAY ITEMS:

<u>Item No.</u>	<u>Item</u>	<u>Unit</u>
8061100	Manhole Riser Ring (Concrete)	Vertical Inch
8061200	Manhole Riser Ring (Cast Iron)	Vertical Inch
80620__	__” Manhole Cone Replacement	Vertical Foot
8063000	Reset Existing Manhole Frames and Covers	Each
8063100	Manhole Frame	Each
8063101	Manhole Frame (Oversized)	Each
8063102	Manhole Frame (Bolt Down Watertight)	Each
8063103	Manhole Frame and Cover (Hinged)	Each
8063104	Air Release Valve Vault Frame	Each

8063200	Manhole Cover	Each
8063201	Manhole Cover (Oversized)	Each
8063202	Manhole Cover (Bolt Down Watertight)	Each
8063203	Air Release Valve Vault Cover	Each
8064000	S.S. Manhole Insert	Each
8065000	Manhole Repair (Patching)	Cubic Foot
8066100	Manhole Rehabilitation (Cementitious Lining)	Vertical Foot
8066200	Manhole Rehabilitation (Epoxy Lining)	Vertical Foot
8066250	Manhole Rehabilitation (MCP Lining)	Vertical Foot
8066300	Internal Manhole Chimney Sealant	Vertical Inch
8067000	Removal of Interior Manhole Steps (Per M.H.)	Each
8068000	Manhole Cover Vent System	Each
8068001	Manhole Cover Vent Extension	Each