SECTION XXXXXX – TECHNICAL SPECIFICATIONS FOR INSTALLATION OF STRUCTURAL PROTECTIVE LINER SYSTEMS FOR MANHOLES, WETWELLS, AND OTHER SANITARY SEWER STRUCTURES

1.00 PART 1 -- GENERAL

1.01 SCOPE

A. This specification designates general requirements for rehabilitation of existing sanitary sewer manholes, wetwells, lift stations and other sanitary sewer structures by either cured-in-place (CIPM) liner method or formed-in-place liner method.

B. The CIPM method encompasses the rehabilitation of an existing flat wall or round structure with a cured-in-place PVC composite liner. The structural liner shall be manufactured to the shape of the structure. The fibrous portion of the liner shall be saturated with a modified epoxy resin, then pressurized, and cured in-place.

C. The formed in place method utilizes an internal forming system for forming a new and structurally independent wall within the existing structure conforming generally to the existing inside dimensions and shape. The new interior wall shall have a cross sectional dimension of sufficient thickness to be structurally independent and allow for the maximum new diameter possible. It shall be constructed of high strength ready mixed concrete designed to impart certain desirable properties for municipal and industrial sewer collection systems.

D. Either method of installation must provide a tight fit to the existing structure with an exposed layer of PVC to be in contact with the sewer gases. Only factory trained, licensed installers will be allowed to perform work.

1.02 REFERENCES

A. The following standards are hereby incorporated into these specifications by reference:

1. ASTM D695 – Compressive Strength of Rigid Plastics
2. ASTM – The published standards of the American Society for Testing and Materials, West Conshohocken, PA.
3. NACE – The published standards of the National Association of Corrosion Engineers (NACE International), Houston, TX.

1.03 SUBMITTALS

A. All submittals shall be submitted in accordance with the applicable portions of these specifications.

B. The Contractor shall submit the following information to the Engineer for approval prior to beginning the installation of the protective lining system.

1. Manufactures data sheets for the liner materials

2. Third party test results verifying the physical properties of the liner materials meet or exceed the requirements of these specifications.
3. Installer's procedures for preparing the surface of the structure and installing the liner system.
4. Documentation that the Installer of the liner system has been trained and certified by the Manufacturer and meets the experience requirements of these specifications.

2.00 PART 2 – PRODUCTS

2.01 The lining system shall be either a cured-in-place liner method or formed-in-place liner method for use in new or existing manholes, wetwells, liftstations, treatment plants, and other structures. All products to be used on this project must be pre-approved by the Engineer prior to the bid date. The following products have been pre-approved for use on this project.

A. MultiPlexx Model PVCP by Terre Hill Composites
B. Permaform, by AP/M Permaform

2.02 In order to be considered as an equal, a product must meet or exceed the minimum physical characteristics as published by the above manufacturers and must have a minimum corrosion resistance suitable for environments pH of 0.5 or higher.

2.03 Other manufactures or products seeking pre-approval must submit the following documentation to the Engineer a minimum of two weeks prior to bid date. This time frame allows the Engineer ample time to determine if the proposed product is an acceptable alternative.

A. Documentation that the proposed product meets the above minimum physical characteristics including results of testing performed by a bonded, third party testing company.
B. An affidavit attesting to the successful use of the product as a protective coating for concrete or masonry structures for a minimum continuous period of five (5) years in wastewater conditions recognized as corrosive or otherwise detrimental to concrete and masonry.
C. A verifiable list of references that document the successful installation and use of the product in a minimum of 750,000 square feet of sanitary sewer structures.

2.04 All additional products that are pre-approved by the Engineer shall be identified in an addendum issued prior to the bid date.

2.05 The Bidder shall list the pre-approved product to be used on this project on the outside of the bid envelope. Any bids not listing a pre-approved product will be returned unopened.

2.06 MATERIALS – CIPM LINING SYSTEM

A. Liner shall be of the type that allows rehabilitation of a concentric, eccentric, or flat top round structure without removing the access hatch frame, top section or corbel.

B. As a minimum the structural liner systems shall be composed of a multiple layered composite. The primary layer shall be manufactured from 20 mils PVC with 10 ounce per square yard polyester fleece. The surface hairs of the fleece must be embedded in the molten PVC during the manufacturing process of the PVCP laminate. Glued laminates are not allowed.

C. The anticipated hydrostatic head, “h” in feet above the bottom of the invert and the radius, “r” in feet of the structure shall determine the necessary liner thickness. “t” in mils.

D. The minimum compressive strength, as measured by ASTM D695 shall be 12,000 psi.

E. The fibrous body will be impregnated with a modified epoxy resin. For additional liner thickness, additional layers of resin and fiberglass will be incorporated.

F. Where indicated on the schedule, the inverts shall be lined.

G. The exposed surface of the liner shall be white PVC.

2.07 MATERIALS – FORMED IN PLACE LINING SYSTEM

A. Reference specifications

1. ASTM C-39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
2. ASTM C-94 Standard Test Method for Ready-Mix Concrete
3. ASTM C-143 Standard Test Method for Slump of Hydraulic Cement Concrete
4. ASTM D-149 Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
5. NACE RP0274 High Voltage Electrical Inspection of Pipeline Coating Prior to Installation

B. Concrete - The concrete shall be Type I/II Portland cement concrete with 5/8 inch minus coarse aggregate with fiber reinforcement and plasticizers

producing an average compressive strength of 4,000 psi at full cure. (Other formulations and filler materials may be selected to meet specific needs.)

C. Plastic liner - A ribbed or studded plastic liner shall be anchored into the new interior wall during the procedure to create an impermeable barrier. The plastic liner shall be PVC.

3.00 PART 3 – EXECUTION

3.01 INSTALLER QUALIFICATIONS

A. All products must be installed by an Installer that has been trained and certified by the manufacturer.
B. The Installer must provide verifiable documentation of the successful installation of 75,000 square feet of cured-in-place manhole liners in sanitary sewer structures.

3.02 QUALITY ASSURANCE

A. Installer shall initiate and enforce quality control procedures consistent with applicable ASTM standards.
B. Installer shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts. These workmen shall be completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
C. Installer shall use approved specialty equipment adequate in size, capacity and number sufficient to accomplish the work of this Section in a timely manner.

3.03 SAFETY

A. Installer shall perform his work in a manner to protect the health and safety of all workmen and the public.
B. All work shall be in accordance with standard industry safety practices.
C. All work, including entry into confined spaces shall be performed in strict compliance with current OSHA regulations.

3.04 PRE-LINING INSPECTION

A. The Installer’s vehicles and equipment must be able to access the structures to be coated under their own power.
B. Active flows shall be dammed, plugged or diverted as required to ensure that the liquid flow is maintained below the surfaces to be coated
C. In general, the OWNER assumes responsibility for the structural integrity of existing structure. Before beginning work, the structure shall be visually

inspected and any areas of apparent structural damage shall be reported to the OWNER for restoration.

3.05 SURFACE PREPARATION – CIPM LINER

A. Voids and irregularities in the structure interior walls and benches shall be patched with cementitious patching/plugging compounds as manufactured by Tamms, Inc., or approved equal.

B. Channel reconstruction cement shall be speed-crete as manufactured by Tamms, Inc., formed Portland cement concrete of 4,000-psi compression strength, or approved equal.

C. Unlined flow channel. Install a bridge or flow through tube and cut the liner bottom near the flow line in the channel to expose the flow channel and give access to the pipes. Plug the pipes entering the structure through the wall and trim the pipe opening to restore flow.

D. Lined flow channel. Plug the pipes entering the structure and line the flow channel to the edge of the pipe. Trim all pipe openings and restore the flow.

E. Wet well bottoms. Wet well bottoms, as a minimum shall be lined to one foot below the lowest level. A wooden false floor shall be placed at the liner termination level to support the inflation bladder. Alternatively, the bottom may be lined and the bottom section removed to avoid building a false floor.

F. All surfaces of the structure shall be cleaned with a high-pressure water-jet sprayer with an operating pressure of at least 3,500 psi. Pressure wash the structure to remove all dirt, grease, sand, and surface contaminants on the wall and floor leaving a clean damp surface.

G. Badly deteriorated and pitted pre-cast structures and brick round structures, with missing bricks and grout, shall be repaired to form a smooth compatible surface for the liner.

H. The interior wall surfaces shall be air-dried. The relative humidity of the wall surfaces shall be less than 100% of the ambient environment. The structure may not show damp surfaces prior to the application of the lining.

I. The stopping of active hydrostatic infiltration shall be accomplished by using Tamms cementitious products Speed Crete and Powder X, as manufactured by Tamms Industrial, Division of LaPorte Construction Chemicals, Mentor, Ohio, Hydro-gel by prime resins, or approved equal.

J. Water infiltration can also be stopped using expansion type grouts such as Seal Guard™, Sikafix H-H, 3M, or Avanti.

3.06 INSTALLATION – CIPM LINER

A. Installation shall be by a certified installer that is qualified by the liner manufacturer. The Installer shall include the furnishing of all materials, equipment, tools, and labor as required for the rehabilitation of the structures selected, including the installation of the interior liner.

B. The installation of the approved liner system shall be in strict accordance with the manufacturer's instructions. This shall include the preparation, installation, inflation, curing, and finishing operations required for the completion of the round structure rehabilitation process.

C. The structural liner shall be manufactured to the shape of the structure. The fibrous portion of the liner shall be saturated with a modified epoxy resin, then pressurized, and cured in-place.

D. The liner shall be installed and cured in place via controlled curing by heat and pressurization in the structure to complete the curing process.

E. The lining of the structure shall cover the shape and contour of the existing structure. The liner shall be installed and substantially bond to the interior structure substrate. The liner shall be free of open joints or openings other than pipe inlets, outlets and the access hatch opening.

3.07 INSTALLATION – FORMED IN PLACE LINER

A. Preparation - The CONTRACTOR shall employ adequate cleaning to remove loose material and debris from the structure. Existing steps that might interfere with the erection of the forms shall be removed. Precautions shall be taken to prevent foreign material from entering the active lines. Infiltration which may adversely affect placement of the concrete shall be eliminated or reduced to an acceptable level

B. Equipment - Segmented, stackable steel forms shall be bolted together in cylindrical and conical sections with either eccentric or concentric cones or flat top ceilings and conform generally to the interior slope of the existing structure.

C. Installation procedure

1. Pipe extensions shall be placed through the new concrete wall at the base and at higher points of entry, such as drop inlets, to maintain flows during the procedure.
2. The form shall be sized and erected to conform to the existing interior dimensions and shape. The space between the forms and the existing wall shall be of a sufficient thickness, usually 3 inches and no less than 1 inch. The finished opening shall have a minimum diameter set by the OWNER.
3. The form shall be positioned, sealed and finished at the structure base to ensure concrete does not enter the sewer.
4. The concrete shall be carefully placed from the bottom up in such a manner as to prevent segregation of the cement and aggregate. The concrete shall be consolidated to fill all pockets, seams, and cracks within the existing wall.
5. When the concrete has sufficiently cured to preclude slump or damage, the form shall be disassembled and removed.

6. When the plastic liner is employed, it shall be fitted securely to the exterior of the steel forms during their erection within the structure. When the forms are removed, any joints in the liner shall be welded and tested.
7. The bench shall receive an overlay of concrete or prior-approved high solids epoxy mastic for corrosion resistance as directed by the ENGINEER at a thickness of three inches at the wall tapering to 1/2" at the edge of the channel. Prior to the overlay, a hydrophilic sealing strip shall be placed around the circumference of the bench where it meets the vertical wall and around all pipe penetrations to form a water stop.
8. At the frame and cover, the plastic lining may be folded under the cast iron frame and reset with butyl mastic, or the plastic liner may extend 1/4" above the finished concrete at which time epoxy is poured into such space against the plastic liner to seal any exposed concrete, or a flexible chimney seal may be attached or applied to the upper 3” portion of the plastic liner and the lower 3” portion of the prepared frame.
9. Sealing at all pipe penetration shall be accomplished using one of the following procedures:
10. If the penetrating pipe is PVC and the liner is PVC or if the penetrating pipe is PE and the liner is PE, a fusion or extrude weld shall be made at their jointure with the new plastic lined wall.
11. If the penetrating pipe is clay (VCP), cast iron, ductile iron or other material, a flat square section of the plastic liner approximately 1.5 times the pipe diameter shall be fitted over the penetrating pipe and fastened with a stainless steel hose clamp. Then it shall be folded back over the hose clamp and flush with the plastic liner embedded into the wall. A weld strip or an extrude bead shall be welded along each edge of this flashing.
12. Upon completion, the CONTRACTOR shall clean up the work site and properly dispose of any excess material or debris.
13. The assembled internal structure forms shall be bolted together to prevent shifting and shall have sufficient stiffness and strength to prevent collapse. All work shall be performed in strict accordance with the city and OSHA safety standards for confined space entry procedures.

3.08 QUALITY ASSURANCE

A. Installer shall initiate and enforce quality control procedures consistent with applicable ASTM standards.
B. Installer shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts. These workmen shall be

completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

C. Installer shall use approved specialty equipment adequate in size, capacity and number sufficient to accomplish the work of this Section in a timely manner.

3.09 TESTING AND INSPECTION

A. The Engineer and Installer shall make a final visual inspection. Any deficiencies in the finished system shall be marked and repaired according to the procedures set forth herein by Installer.

4.00 PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Measurement for new and rehabilitated manholes shall be per vertical foot for each designated diameter and shall be measured from the invert to the top of the frame.

4.02 PAYMENT

A. PAYMENT

Payment will be made under:

____Dia. Manhole CIPM Liner - per VF