SEWER CIPP LINING CONTRACT – SPRING 2020

PROJECT NO. 2020-013
BID # 2432

ENGINEERING DEPARTMENT
635 ALFRED BROWN JR COURT SW, POST OFFICE BOX 308
CONCORD, NORTH CAROLINA 28026-0308
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INVITATION TO BID
SEWER CIPP LINING CONTRACT – SPRING 2020

Sealed Bids will be received by The City of Concord Engineering Division in Conference Room C, Alfred M. Brown Utilities Complex, 635 Alfred Brown Jr. Court SW, Concord, North Carolina 28026 until 3:00 PM., local time, Thursday March 19, 2020 for the City’s 2020 Sewer CIPP Lining Contract.

At said place and time, and promptly thereafter, all Bids that have been duly received will be publicly opened and read aloud.

The proposed Work is generally described as follows:

Multiple mainline sewer lines and manholes within the City’s wastewater collection system need to be rehabilitated. To minimize disturbances caused by excavation, these identified areas will be subject to cured-in-place pipe (CIPP) lining for the sewer main lines and cementitious rehabilitation for the specified manholes with quantities shown below.

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<th>SEWER CURED-IN-PLACE PIPE (CIPP) LINING CONTRACT – SPRING 2020</th>
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<tr>
<td>CURED-IN-PLACE PIPE LINING</td>
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<tr>
<td>Pipe Diameter (Inches)</td>
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<td>------------------------</td>
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<th>CURED IN PLACE SERVICE LATERAL LINING</th>
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<tbody>
<tr>
<td>Quantity</td>
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<td>----------</td>
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<td>20</td>
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<tr>
<td>Manhole Diameter (Feet)</td>
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<td>-------------------------</td>
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</table>

The work will require traffic control, re-connection of approximately 257 service lines, and the rehabilitation of 97 manholes. These manholes are located on the same lines that are being lined under this contract. In addition, traffic control will be required in some of the heavy traffic areas of the city. The Contractor must submit a traffic control plan for approval by the city’s transportation department prior to any lane closure or street closure. Traffic control must be in compliance with NCDOT requirements, including Work Zone Certification for workers within the work zone.

All Bids must be in accordance with the Bidding Documents on file with: The City of Concord (Engineering Department Office). The bid documents can be downloaded from the City’s website at: https://www.concordnc.gov/Departments/Finance/Purchasing/RFPs-and-Bids.

Please contact Enrique A. Blat, P.E. at blatr@concordnc.gov to register to bid. Registration for bidding requires the name of the company, physical address, email address, and telephone number.
Bidders must be properly licensed as required by Chapter 87 of the North Carolina General Statutes. All Subcontractors must also be licensed contractors in the State of North Carolina.

Bids will be received on a unit price basis.

Five (5) percent Bid security must accompany each Bid.

The Successful Bidder will be required to furnish a Construction Performance Bond and a Construction Payment Bond as security for the faithful performance and the payment of all bills and obligations arising from the performance of the Contract. Contractor and all Subcontractors will be required to conform to the labor standards set forth in the Contract Documents.

Pertinent specifications for the project include but are not limited to the Standard Specifications for collection and distribution of Water and Sewer Authority of Cabarrus County (WSACC) as provided at [http://www.wsacc.org/](http://www.wsacc.org/), and all applicable NASSCO specifications as provided at [http://www.nassco.org/](http://www.nassco.org/). The most recent edition of each specification shall be applied.

Owner reserves the right to reject any or all Bids, including without limitation the rights to reject any or all nonconforming, non-responsive, unbalanced, or conditional Bids, and will award to lowest responsible Bidder taking into consideration quality, performance, and time specified in Bid Form for performance of Work. Owner also reserves the right to waive informalities.
INSTRUCTIONS TO BIDDERS

1. DEFINED TERMS. Terms used in these Instructions to Bidders shall have the following meanings assigned to them.

   Contract Documents – Documents contained herein including contract specifications, project specifications, bid forms and construction contract.

   Successful Bidder - The lowest, qualified, responsible, and responsive Bidder to whom Owner (on the basis of Owner's evaluation as herein provided) makes an award.

2. COPIES OF BIDDING DOCUMENTS. Bidding Documents, which include all front-end documents, may be obtained from Owner at address indicated on the Invitation to Bid.

   Partial sets of Bidding Documents will not be issued in response to requests by subject matter.

   Standard Specifications for Wastewater Collection and Water Distribution for Cabarrus County shall be used on this project. Contractor shall obtain standard specifications, current revision date is July 2006 from Water and Sewer Authority of Cabarrus County (WSACC).

   Complete sets of Bidding Documents must be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misrepresentations resulting from the use of incomplete sets of Bidding Documents.

   Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

3. QUALIFICATIONS OF BIDDERS. To demonstrate qualifications to perform the Work, Bidder may be required to submit written evidence on financial data, previous experience, present commitments, and other such data as may be requested by Owner or Engineer. Each Bid must contain evidence of Bidder's qualification to do business in the state where the Project is located, or Bidder must agree to obtain such qualification prior to award of the Contract.

4. EXAMINATION OF CONTRACT DOCUMENTS AND SITE. It is the responsibility of each Bidder, before submitting a Bid, to (a) thoroughly examine the Contract Documents, (b) visit the sites to become familiar with local conditions that may affect cost, progress, performance, or furnishing of the Work, please contact Enrique A. Blat, P.E. at (704) 920-5403 to arrange a site visit, (c) consider federal, state, and local laws and regulations that may affect cost, progress, performance, or furnishing of the Work, (d) study and carefully correlate Bidder's observations with the Contract Documents, and (e) notify Engineer of all conflicts, errors, or discrepancies discovered by Bidder in the Contract Documents.
4.01. **Underground Facilities.** Information and data reflected in the Contract Documents with respect to underground facilities at or contiguous to the site are based upon information and data furnished to Owner and Engineer by owners of such underground facilities or others, and Owner and Engineer disclaim responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in the Supplementary Conditions.

4.02. **Additional Information.** Before submitting a Bid, each Bidder will, at Bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests, and studies and obtain any additional information and data which pertain to the physical conditions (surface, subsurface, and underground facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance, or furnishing of the Work and which Bidder deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price, and other terms and conditions of the Contract Documents.

On request 24 hours in advance, Owner will provide each Bidder access to the site to conduct such explorations and tests as each Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the site to its former condition upon completion of such explorations. Arrangements for site visits shall be made by calling The Office of the Director of Engineering, City of Concord at (704) 920-5425.

4.03. **Easements.** The lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and other lands designated for use by Contractor in performing the Work are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by Contractor. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by Owner unless otherwise specified in the Contract Documents.

4.04. **Unit Price Contracts.** Bidders must satisfy themselves of the accuracy of the estimated quantities in the bid schedule by examination of the site and a review of the drawings and the specifications, including the addenda. After bids have been submitted, the bidder shall not assert that there was a misunderstanding concerning the quantities of work or the nature of the work to be done.

4.05. **Bidder's Representation.** The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement concerning examination of the Contract Documents and the site, that without exception the Bid is premised upon performing and furnishing the Work required by the Contract Documents, and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

5. **INTERPRETATIONS AND ADDENDA.** All questions about the meaning or intent of the Bidding Documents and the Contract Documents shall be submitted to Owner in writing. Interpretations or clarifications considered necessary by Owner in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received the Bidding Documents. Questions received less than 10 days prior to the date for opening of Bids
may not be answered. Only answers issued by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

6. **BID SECURITY.** Each Bid must be accompanied by bid security made payable without condition to Owner in an amount of 5 percent of the Bidder's maximum Bid and in the form of a certified or bank check or a bid bond issued by a surety meeting the requirements set forth in the Contract Specifications.

The bid security of the Successful Bidder will be retained until such Bidder has executed the Agreement, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the bid security will be returned. If the Successful Bidder fails to execute and deliver the Agreement and furnish the required contract security within the number of days set forth in the Bid Form, Owner may annul the Notice of Award and the bid security of that Bidder will be forfeited. The bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Agreement or the day after the last day the Bids remain subject to acceptance as set forth in the Bid Form, whereupon bid security furnished by such Bidders will be returned. Bid security accompanying Bids which are deemed by Owner to be noncompetitive will be returned within 7 days after the bid opening.

7. **CONTRACT TIMES.** The numbers of calendar days within which, or the dates by which, the Work is to be substantially completed and also completed and ready for final payment (the Contract Times) are set forth in the Bid Form.

8. **LIQUIDATED DAMAGES.** Provisions for liquidated damages, if any, are set forth in the Contract Specifications.

9. **SUBSTITUTES OR "OR-EQUAL" ITEMS.** Where an item or material is specified by a proprietary name, it is done for the purpose of establishing a basis of quality and not for the purpose of limiting competition. The Engineer's intent is to consider alternative products that have the desired essential characteristics. The Engineer will consider any such products offered. Requests for acceptance of alternative products shall be made through Bidders bidding as prime Contractors. Acceptances for substitutions will not be granted directly to suppliers, distributors, or subcontractors. Pursuant to Section 133-3, General Statutes of North Carolina, the following procedures shall be used:

Bidders desiring to submit alternative product proposals for prior acceptance of the Engineers shall submit, in writing, such proposals ten days prior to bid date. Applications received after this time will not be reviewed. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute, including drawings, cuts, performance and test data, and other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment, or other work that incorporation of the substitute would require should be included. The Engineer shall consider and either accept or reject all alternative product proposals submitted.
If, by the close of the fifth day prior to the deadline for receiving Bids, the Engineer has accepted any alternative product proposals, the Bidding Documents shall be modified to include the alternative products. The Engineer shall publish the modification in an Addendum at least 5 days prior to the deadline for receiving Bids. The Engineer's decision of acceptance or rejection of a proposed substitute shall be final.

10. **SUBCONTRACTORS, SUPPLIERS, AND OTHERS.** If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, and other persons and organizations (including those who are to furnish the principal items of material and equipment) to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within 3 days after the bid opening submit to Owner the List of Subcontractors completed with all such Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work for which such identification is required. The list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, person, or organization, if requested by Owner. If Owner or Engineer after due investigation has reasonable objection to any proposed Subcontractor, Supplier, or other person or organization, Owner may, before the Notice of Award is given, request the apparent Successful Bidder to submit an acceptable substitute without an increase in the Bid.

All Subcontractors shall be a licensed contractor in the State of North Carolina.

11. **BID FORM.** The Bid Form is bound in the Bidding Documents and shall not be removed therefrom. Bid Forms must be completed in ink.

Bids by corporations must be executed in the corporate name by the president or vice-president (or other corporate officer accompanied by evidence of authority to sign for the corporation). Bids by partnerships must be executed in the partnership name and signed by a partner. Bids by joint ventures shall be signed by each participant in the joint venture or by a representative of the joint venture accompanied by evidence of authority to sign for the joint venture.

The names of all persons signing shall be legibly printed below the signature. A Bid by a person who affixes to his signature the word "president", "secretary", "agent", or other designation without disclosing his principal may be held to be the Bid of the individual signing. When requested by Owner, evidence of the authority of the person signing shall be furnished.

All blanks in the Bid Form shall be filled. A bid price shall be indicated for each unit price item listed therein, or the words "No Bid", "No Charge", "No Change", or other appropriate phrase shall be entered.

The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers and dates of which shall be filled in on the Bid Form.
No alterations in Bids, or in the printed forms therefor, by erasures, interpolations, or otherwise will be acceptable unless each such alteration is signed or initialed by the Bidder; if initialed, Owner may require the Bidder to identify any alteration so initialed.

11.01. Bid Pricing. The Bidder shall complete the schedule of unit prices included in the Bid Form and shall accept all fixed unit prices listed therein.

The total Bid will be determined as the sum of the products of the estimated quantity of each item and the unit price bid. The final Contract Price will be subject to adjustment according to final measured, used, or delivered quantities as provided in Division 1, and the unit prices in the Bid will apply to such final quantities.

11.02. Contingency. The Contingency is to be added to the bid price and is to be used for minor change order items. If the Contingency is to be used, a scope of work and price would be negotiated. The Contingency is for the sole use of Owner. A change order will be issued to delete any unauthorized portion of the Contingency.

12. SUBMISSION OF BIDS. Bids shall be submitted at the time and place indicated in the Invitation to Bid, or the modified time and place indicated by Addendum. Bids shall be enclosed in an opaque sealed envelope or wrapping, addressed to:

The City of Concord
Enrique A. Blat, PE, Deputy City Engineer
P.O. Box 308
Alfred M. Brown Operations Center, 850 Warren C. Coleman Blvd.
Concord, North Carolina 28026-0308

Bids shall be marked with the name, license number, and address of the Bidder and shall be accompanied by the bid security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it.

Each Bid envelope shall be identified on the outside with the words "Bid for the Sewer CIPP Lining Contract 2020"

Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

One copy of the bound documents containing Exhibit “A” – Bid Form, Debarred Firms Certification Form, and Bid Bond must be submitted with the Bid.

Oral, telephone, facsimile, or telegraph Bids are invalid and will not receive consideration.

No Bidder may submit more than one Bid. Multiple Bids under different names will not be accepted from one firm or association.
A conditional or qualified bid will not be accepted.

13. **MODIFICATION AND WITHDRAWAL OF BIDS.** Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to the opening of Bids.

If, within 24 hours after Bids are opened, any Bidder files a duly signed, written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid and the bid security will be returned. Thereafter, that Bidder will be disqualified from further bidding on the Work to be provided under the Contract Documents.

14. **OPENING OF BIDS.** Bids will be publicly opened and read aloud. An abstract of the amounts of the Base Bids and major alternatives (if any) will be made available to Bidders after the opening of Bids.

The procedure for opening bids will follow the laws of North Carolina, and applicable regulations of various Licensing Boards.

15. **BIDS TO REMAIN SUBJECT TO ACCEPTANCE.** All Bids will remain subject to acceptance for the number of days set forth in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the bid security prior to that date.

16. **AWARD OF CONTRACT.** Owner reserves the right to reject any or all Bids, including without limitation the rights to reject any or all nonconforming, nonresponsive, unbalanced, or conditional Bids, and will award to lowest responsible Bidder taking into consideration quality, performance, and time specified in Bid Form for performance of Work. Owner also reserves the right to waive informalities.

In evaluating Bids, Owner will consider the qualifications of the Bidders, whether or not the Bids comply with the prescribed requirements, and such alternatives, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

Owner may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other persons and organizations must be submitted as provided in the Supplementary Conditions. Owner also may consider the operating costs, maintenance requirements, performance data, and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data is required for submission prior to the Notice of Award.

Owner may conduct such investigations as Owner deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to Owner's satisfaction within the prescribed time.
If the Contract is to be awarded, it will be awarded to the lowest Bidder whose evaluation by Owner indicates to Owner that the award will be in the best interests of Owner.

If the Contract is to be awarded, Owner will give the Successful Bidder a Notice of Award within the number of days set forth in the Bid Form.

The evaluation of Suppliers' or manufacturers' data submitted with the Bid, or submitted upon request prior to the Notice of Award, will include consideration of the following:

- Owner-required inventory of spare parts.
- Building design changes which would be required to accommodate the proposed materials and equipment.
- Installation requirements and related engineering, training, and operating costs.
- Experience and performance record of the Supplier or the manufacturer.
- Maintenance and frequency of inspections required to assure reliable performance of the equipment.
- Suppliers' or manufacturers' service facilities and availability of qualified field service personnel.
- Efficiency and related operating expense during the anticipated useful life of the equipment.

17. **CONTRACT SECURITY.** The Contract Specifications set forth Owner's requirements as to Performance and Payment Bonds. These Bonds shall be delivered to Owner with the executed Agreement.

18. **SIGNING OF AGREEMENT.** When Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by four unsigned counterparts of the Agreement with all other written Contract Documents attached. Within the number of days set forth in the Bid Form, the Successful Bidder shall sign, leaving the dates blank, and deliver the required number of counterparts of the Agreement and attached documents to Owner with the required Bonds and power of attorney. Within 30 days thereafter, Owner shall execute all copies of the Agreement and other Contract Documents submitted by Contractor (Successful Bidder); shall insert the date of contract on the Agreement, Bonds, and power of attorney; and shall distribute signed copies as stipulated in the Agreement.

Should the Owner not execute the Contract within the period specified, the Successful Bidder may, by written notice, withdraw his signed Contract. Such notice or withdrawal shall be effective upon receipt of the notice by the Owner.

19. **SALES AND USE TAXES.** Provisions for sales and use taxes, if any, are set forth in the Contract Specifications.
20. **RETAI NAGE.** Provisions concerning retainage are set forth in the Contract Specifications. The City shall keep a 10% retainage on the project. Once the project is 50% complete, the City has the option to keep the retainage at 10% or lower it to 5%.

21. **LAWS AND REGULATIONS.** Additional provisions, if any, concerning Laws and Regulations are set forth in the Contract Specifications.

21.01. **Collusive Bidding.** In accordance with Section 112(c) of Title 23 USC, and G.S. 75-5(b)(7) of the State of North Carolina, the Contractor (Bidder), by submission and execution of this bid, certifies that he has not entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with his bid on this project.
DEBARRED FIRMS CERTIFICATION FORM

Sewer Lining Contract- Spring 2020
Project No. 2020-013

The undersigned hereby certifies that the firm of ________________________________ has not been suspended by the State of North Carolina or any agency or department thereof for conviction or indictment or any of the offenses enumerated in G.S. 133-27 nor will award subcontracts of any tier to firms that have been suspended for conviction or indictment of any of the offenses enumerated in G.S. 133-27.

________________________
Name of Firm

ATTEST ____________________________          (SEAL)

________________________________
Signature of Authorized Official

________________________________
Title

Sworn and subscribed before me this
_____ day of ____________, 2020

________________________
Notary Public
NOTICE OF AWARD

TO:

FROM: City of Concord City Council (OWNER)
P.O. Box 308
35 Cabarrus Ave. W
Concord, North Carolina 28026-0308

PROJECT: Sewer Lining Contract- Spring 2020
Project No. 2020-013

You are hereby notified that the bid submitted by you for the above named project in response to the City of Concord’s Invitation to Bid dated February 27, 2020 in the amount of

$_________________________ and ________/100 DOLLARS

($_________________________) has been accepted.

You are hereby required to execute the formal AGREEMENT with the City of Concord City Council and to furnish any and all Contractor’s Bond(s), Certificate of Insurance and Power of Attorney(s) along with other documents pertaining to the work as designated by the City of Concord.

If you fail to execute said AGREEMENT and to furnish this and any other required documents pertaining to the work within ten (10) days from the date of delivery of this NOTICE OF AWARD, said Owner will be entitled to consider all your rights arising out of the Owner’s acceptance of your bid as abandoned and to award the work covered by your proposal to another, or to re-bid the work or otherwise dispose thereof as the Owner may see fit.

Dated this the ______ day of ______________, 20____

City of Concord, North Carolina

By: __________________________
Title: City Manager

CONTRACTOR

By: __________________________
Title: _________________________

ACCEPTANCE OF NOTICE OF AWARD

Receipt of the above NOTICE OF AWARD is hereby acknowledged this the ___ day of ____________, 20____.
NOTICE TO PROCEED

TO:

FROM: City of Concord City Council (OWNER)
P.O. Box 308
35 Cabarrus Ave. W
Concord, North Carolina 28026-0308

PROJECT: Sewer Lining Contract- Spring 2020
Project No. 2020-013

Contract Amount: __________________________and___/100 DOLLARS
($__________________________).

You are hereby notified to commence work on or before the _____ day of ___, 20__, pending acceptance of your Certificate of Insurance and any other required documents, and are to fully complete the work by the _____ day of _____________, 20__.

Your project final completion date is therefore the ______ day of ___________, 20___, and as set forth in the above named project’s schedule unless an extension is granted by the City of Concord Director of Engineering in writing.

City of Concord, North Carolina
By: __________________________

Title: City Manager

Dated this the ____ day of ____________, 20__.
STANDARD FORM CONSTRUCTION CONTRACT

This contract (together with all exhibits and valid amendments, the “Agreement” or the “Contract”) is made and entered into as of the ___ day of ________________, 20___, by the City of CONCORD (“City”) and ____________________________ (“Contractor”), ( ) a corporation, ( ) a professional corporation, ( ) a professional association, ( ) a limited partnership, ( ) a sole proprietorship, or ( ) a general partnership; organized and existing under the laws of the State of _________________________.

Sec. 1. Background and Purpose.

Multiple mainline sewer lines, service lines and manholes within the City’s wastewater collection system need to be rehabilitated. To minimize disturbances caused by excavation, these identified areas will be subject to cured-in-place pipe (CIPP) lining sewer main lines and cementitious rehabilitation for the specified manholes. The complete list of targeted lines for CIPP and manholes for cementitious rehabilitation include: See Exhibit C.

Sec. 2. Services and Scope to be Performed. The Contractor shall provide the services at the charges set forth either in this paragraph or in Exhibit “A”. Additional exhibits may be used to further define this Agreement when the Contractor and City so agree. Any additional exhibits shall be designated as exhibits to the Agreement with capitalized, sequential letters of the alphabet, shall be attached hereto and incorporated herein by reference as if the same were fully recited, and shall become terms of this Agreement upon execution by both parties.

In this Contract, “services” means the services that the Contractor is required to perform pursuant to this Contract and all of the Contractor’s duties to the City that arise out of this Contract. Any amendments, corrections, or change orders by either party must be made in writing signed in the same manner as the original. (This form may be used for amendments and change orders.) The City reserves the right to refuse payment for any work outside that authorized herein or pursuant to a duly approved amendment or change order.

Sec. 3. Complete Work without Extra Cost. Unless otherwise provided, the Contractor shall obtain and provide, without additional cost to the City, all labor, materials, equipment, transportation, facilities, services, permits, and licenses necessary to perform the Work.

Sec. 4. Compensation. The City shall pay the Contractor for the Work as described in this paragraph below OR as described in Exhibit “A” attached. In the event of a conflict, the provisions of this paragraph shall control. Any additional expenses or charges shall only be paid after both the City and the Contractor agree to and execute a written change order. The City shall not be obligated to pay the Contractor any fees, payments, expenses or compensation other than those authorized in this Contract or in a duly-approved amendment or change order. All payments shall be deemed inclusive of tax and other obligations.

Sec. 4a. Retainage. The City shall withhold no retainage on Contracts having a “total project cost” of less than $100,000.00. The City may withhold retainage on contracts having a total project cost between $100,000 and $200,000. The City shall withhold retainage on contracts whose total project cost exceeds $300,000. When withheld, retainage shall equal no more than five percent of each progress payment. When the project is fifty per cent complete, the City shall not retain anything from future project payments provided that (i) the surety concurs in writing, (ii) the Contractor continues to perform satisfactorily, (iii) any non-conforming work identified in writing by the architect, engineer(s) or City has been corrected by the Contractor and accepted by the architect, engineer(s) or City. However, if the City determines that the Contractor’s performance is unsatisfactory, the City may withhold up to five percent retainage from each project payment. The City may withhold additional amounts above five percent for unsatisfactory job progress, defective construction not remedied, disputed work, third party claims filed against the owner or reasonable evidence that a third-party claim will be filed.

Definitions:

“Total Project Cost”: Total value of the Contract and any approved change orders or amendments.

“Project is Fifty Percent Complete”: When the Contractor’s validly-issued gross project invoices (excluding the value of the materials stored off-site) equal or exceed fifty percent of the value of the Contract, except that the value of
materials stored on-site shall not exceed twenty percent of the Contractor’s gross project invoices for the purpose of determining whether the project is fifty percent complete.

Sec. 5. Term. The Contractor shall commence work within ten (10) days of the date of its receipt of written Notice to Proceed from the City. The date that is ten (10) days from the date of the Contractor’s receipt of the Notice to Proceed shall be the “Commencement Date.” All work as set forth in the Scope of Services in Exhibit “A” shall be completed within one-hundred-eighty (180) calendar days of the Commencement Date. The date that is one-hundred-eighty (180) calendar days from the Commencement Date shall be the “Completion Date.” Time is of the essence with regard to this Project. If Contractor’s obligations are not completed by the Completion Date, the City reserves the right to nullify this Agreement, order the Contractor to immediately cease all work under this Agreement and vacate the premises, and to seek professional services equivalent to those outlined in Exhibit “A.” The Contractor shall be held accountable for all damages incurred by the City as a consequence of the missed Completion Date. The exercise of any of these rights by the City shall not be interpreted to prejudice any other rights the City may have under this Agreement or in law or equity. This Contract shall not be automatically extended unless agreed to in writing by the City or as provided in Exhibit “A”.

Sec. 6. Contractor’s Billings to City. Payments will be made in accordance with the schedule found in this section below OR attached at Exhibit “A”. Contractor shall submit an original pay request (invoice) to the City Purchasing Agent by the first of each month in order to expedite payment. Upon receipt of the request the City Purchasing Agent shall verify the amounts and if correct forward the request to the Accounts Receivable Division of the Finance Dept. Final payment on the Contract shall be made in 45 days, except in the case of retainage. Within 60 days after the submission of the final pay request, the City (with the written consent of the surety) shall release to the Contractor all retainage payments IF the City receives a certificate of substantial completion from the architect, engineer or designer-in-charge of the project OR the City receives beneficial occupancy and use of the project. In either case, the City may retain up to 2.5 times the estimated value of the work to be completed or corrected.

Sec. 7. Insurance. Contractor shall maintain and cause all sub-contractors to maintain insurance policies at all times with minimum limits as follows:

<table>
<thead>
<tr>
<th>Coverage</th>
<th>Minimum Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers’ Compensation</td>
<td>$100,000 each accident, $100,000 bodily injury by disease each employee, $500,000 bodily injury by disease policy limit</td>
</tr>
<tr>
<td>General Liability</td>
<td>$1,000,000 per occurrence regardless of the contract size</td>
</tr>
<tr>
<td>Automobile Liability</td>
<td>$1,000,000 per occurrence regardless of the contract size</td>
</tr>
<tr>
<td>Umbrella</td>
<td>$1,000,000 per occurrence if contract does not exceed 180 days and does not exceed $500,000; otherwise, $2,000,000 per occurrence</td>
</tr>
</tbody>
</table>

Contractor shall provide a Certificate of Insurance to the City listing the City as an additional insured. Such Certificate shall be in a form acceptable to the City.

Sec. 8. Documentation Requirements:
A. Contractor shall provide the City with a Certificate of Insurance for review prior to the issuance of any contract or Purchase Order. All Certificates of Insurance will require written notice by the insurer or Contractor’s agent in the event of cancellation, reduction or other modifications of coverage by the insurer. Such notice shall be not less than 30 days for nonrenewal by the insurer, not less than 10 days for cancellation due to nonpayment of the premium and as soon as possible for all other types of modifications. In addition to the notice requirement above, Contractor shall provide the City with written notice of cancellation, reduction, or other modification of coverage of insurance whether instigated by the insurer or by the Contractor immediately upon Contractor’s receipt of knowledge of such modifications. Upon failure of the Contractor to provide such notice, Contractor assumes sole responsibility for all losses incurred by the City for which insurance would have provided coverage. The insurance certificate shall be for the
insured period in which the initial contract period begins and shall be renewed by the Contractor for each subsequent renewal period of the insurance for so long as the contract remains in effect.

The City shall be named as an additional insured on all policies except Workers’ Compensation and it is required that coverage be placed with “A” rated insurance companies acceptable to the City. Statement should read, “City of Concord is added as an additional insured as evidenced by an endorsement attached to this certificate.” Failure to maintain the required insurance in force may be cause for termination of this Agreement. In the event that the Contractor fails to maintain and keep in force the insurance herein required, the City has the right to cancel and terminate the Agreement without notice.

B. Contractor shall provide a completed W-9 form to the City prior to execution by the City of this Agreement.

Sec. 9. Performance of Work by Contractor.

(a) The Contractor warrants that all work performed under this Contract conforms to the Contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier. This warranty shall continue for a period of 1 year from the date of issuance by the City of written final completion of the work.

(b) The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to City-owned or controlled real or personal property, when that damage is the result of--

(1) The Contractor's failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished.

(c) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

(d) The City shall notify the Contractor, in writing, within a reasonable time, not to exceed 30 days, after the discovery of any failure, defect, or damage.

(e) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time, not to exceed 30 days unless otherwise agreed in writing and signed by the City Manager or his designee, after receipt of notice, the City shall have the right to replace repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(f) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this Contract, the Contractor shall--

(1) Obtain all warranties that would be given in normal commercial practice,

(2) Require all warranties to be executed, in writing, for the benefit of the City, if directed to do so by the City; and

(3) Enforce all warranties for the benefit of the City, if directed to do so by the City

(g) In the event the Contractor’s warranty has expired, the City may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

(h) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the City nor for the repair of any damage that results from any defect in City-furnished material or design.
Sec. 10. **Performance of Work by City.** If the Contractor fails to perform the Work in accordance with the schedule referred to in Exhibit “A”, the City may, in its discretion, perform or cause to be performed some or all of the Work, and doing so shall not waive any of the City’s rights and remedies. Before doing so, the City shall give the Contractor reasonable notice of its intention. The Contractor shall reimburse the City for all costs incurred by the City in exercising its right to perform or cause to be performed some or all of the Work pursuant to this section.

Sec. 11. **Attachments.** Additional exhibits may be used to further define this Agreement when the Contractor and City so agree. Any additional exhibits shall be designated as exhibits to the Agreement with capitalized, sequential letters of the alphabet, shall be attached hereto and incorporated herein by reference as if the same were fully recited, and shall become terms of this Agreement upon execution by both parties.

*The following attachments are made a part of this Contract and incorporated herein by reference:*

(a) Exhibit “A” – BID FORM WITH UNIT PRICE SCHEDULE
(b) Exhibit “B” – NASSCO SPECIFICATIONS FOR CURED-IN-PLACE PIPE (CIPP) & MANHOLE REHABILITATION
(c) Exhibit “C” – LIST OF SEWER LINE SECTIONS FOR CIPP AND MANHOLES FOR REHABILITATION
(d) Exhibit “D” – MAPS
(e) Exhibit “E” – GENERAL CONDITIONS
(f) Exhibit “F” – STANDARD FORM OF PERFORMANCE BOND
(g) Exhibit “G” – Contractor must execute the Affidavit attached as Exhibit “G”, attesting to compliance with state and federal laws related to E-Verify.
(h) Exhibit “H” – Tax Form(s).
(i) Exhibit “I” – Certificate of Insurance.

In case of conflict between an attachment and the text of this contract excluding the attachment, the text of this contract shall control. Any attachment that materially alters the standard terms contained herein must be reviewed by the City Attorney and approved by the City in writing.

Sec. 12. **Notice.** (a) All notices and other communications required or permitted by this Contract shall be in writing and shall be given either by personal delivery, fax, or certified United States mail, return receipt requested, addressed as follows:

To the City:  
Enrique A. Blat, P.E.  
Deputy City Engineer  
P.O. Box 308  
Concord, NC 28026  
Fax Number: (704) 786-4521

To the Contractor:  
Valerie Kołczynski, Esq.  
City Attorney  
PO Box 308  
Concord, NC 28026  
Fax Number: (704) 784-1791

(b) **Change of Address, Date Notice Deemed Given:** A change of address, fax number, or person to receive notice may be made by either party by notice given to the other party. Any notice or other communication under this Contract shall be deemed given at the time of actual delivery, if it is personally delivered or sent by fax. If the notice or other communication is sent by US Mail, it shall be deemed given upon the third calendar day following the day on which such notice or other communication is deposited with the US Postal Service or upon actual delivery, whichever first occurs.

Sec. 13. **Indemnification.** To the maximum extent allowed by law, the Contractor shall defend, indemnify, and save harmless the City of Concord, its agents, officers, and employees, from and against all charges that arise in any manner from, in connection with, or out of this Contract as a result of the acts or omissions of the Contractor or subcontractors or any person directly or indirectly employed by any of them or anyone for whose acts any of them may be liable except for damage or injury caused solely by the negligence of the City its agents, officers, or employees. In performing its duties under this section, the Contractor shall at its sole expense defend the City of Concord, its agents, officers, and employees with legal counsel reasonably acceptable to City. As used in this subsection – “Charges” means claims, judgments, costs, damages, losses, demands, liabilities, duties, obligations, fines, penalties, royalties, settlements, expenses, interest, reasonable attorney’s fees, and amounts for alleged violations of sedimentation pollution, erosion control, pollution, or other environmental laws, regulations, ordinances, rules, or orders. Nothing in this section shall
affect any warranties in favor of the City that are otherwise provided in or arise out of this Contract. This section is in addition to and shall be construed separately from any other indemnification provisions that may be in this Contract. This section shall remain in force despite termination of this Contract (whether by expiration of the term or otherwise) and termination of the services of the Contractor under this Contract.

Sec. 14. Corporate Status. If the Contractor is dissolved or suspended and the Contractor does not notify the City of such dissolution within three (3) business days from date of dissolution or suspension, and/or the corporate status is not reinstated within thirty (30) days, this Contract, at the sole option of the City and without prejudice to City’s other remedies, shall be declared null and void or the Contractor shall execute a new contract showing the Contractor’s correct legal entity.

Sec. 15. Miscellaneous.
(a) Choice of Law and Forum. This Contract shall be deemed made in Cabarrus County, North Carolina. This Contract shall be governed by and construed in accordance with the laws of North Carolina. The exclusive forum and venue for all actions arising out of this Contract shall be the appropriate division of the North Carolina General Court of Justice, in Cabarrus County. Such actions shall neither be commenced in nor removed to federal court. This section shall not apply to subsequent actions to enforce a judgment entered in actions heard pursuant to this section.
(b) Waiver. No action or failure to act by the City shall constitute a waiver of any of its rights or remedies that arise out this Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.
(c) Performance of Government Functions. Nothing contained in this Contract shall be deemed or construed so as to in any way estop, limit, or impair the City from exercising or performing any regulatory, policing, legislative, governmental, or other powers or functions.
(d) Severability. If any provision of this Contract shall be unenforceable, the remainder of this Contract shall be enforceable to the extent permitted by law.
(e) Assignment, Successors and Assigns. Without the City’s written consent, the Contractor shall not assign (which includes to delegate) any of its rights (including the right to payment) or duties that arise out this Contract. Unless the City otherwise agrees in writing, the Contractor and all assigns shall be subject to all of the City’s defenses and shall be liable for all of the Contractor’s duties that arise out of this Contract and all of the City’s claims that arise out of this Contract. Without granting the Contractor the right to assign, it is agreed that the duties of the Contractor that arise out of this Contract shall be binding upon it and its heirs, personal representatives, successors, and assigns.
(f) Compliance with Law. In performing all of the Work, the Contractor shall comply with all applicable law. Without limitation, Contractor shall comply with the requirements of Article 2, Chapter 64 (Verification of Work Authorization) of the North Carolina General Statutes relating to E-Verify. Further, if Contractor utilizes a subcontractor, Contractor shall require the subcontractor to comply with the requirements of Article 2 of Chapter 64 of the General Statutes.
(g) EEO Provisions. During the performance of this Contract the Contractor agrees as follows:
(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, political affiliation or belief, age, or handicap. The Contractor shall take affirmative action to insure that applicants are employed and that employees are treated equally during employment, without regard to race, color, religion, sex, national origin, political affiliation or belief, age, or handicap. The Contractor shall post in conspicuous places available to employees and applicants for employment, notices setting forth these EEO provisions.
(2) The Contractor in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, political affiliation or belief, age, or handicap.
(i) No Third Party Right Created. This Contract is intended for the benefit of the City and the Contractor and not any other person.
(j) Principles of Interpretation. In this Contract, unless the context requires otherwise the singular includes the plural and the plural the singular. The pronouns “it” and “its” include the masculine and feminine. Reference to statutes or regulations include all statutory or regulatory provisions consolidating, amending, or replacing the statute or regulation. References to contracts and agreements shall be deemed to include all amendments to them. The word “person” includes natural persons, firms, companies associations, partnerships, trusts, corporations, governmental agencies and units, and any other legal entities.

Contract-5
(k) Modifications, Entire Agreement. A modification of this Contract is not valid unless signed by both parties and otherwise in accordance with requirements of law. Further, a modification is not enforceable against the City unless the City Manager or other duly authorized official signs it for the City. This Contract contains the entire agreement between the parties pertaining to the subject matter of this Contract. With respect to that subject matter, there are no promises, agreements, conditions, inducements, warranties, or understandings, written or oral, expressed or implied, between the parties, other than as set forth or referenced in this Contract.

(l) Corporate Seal. If a corporate seal is included by any party to this Contract, it is only for authentication purposes. This Contract is not signed under seal.

(m) No Employment Relationship. For all matters relating to this Agreement, Contractor shall be deemed an Independent Contractor. Nothing in this Agreement shall be construed in such a manner as to create an employee-employer relationship between City and Contractor.

(The following section applies to construction contracts only if amount is over $50,000)

Sec. 16. Bonding. Both performance and payment bonds for the full amount of this Contract are required to be attached. Instead of bonds, you may submit a deposit of money, certified check or government securities for the full amount of the Contract. The performance bond shall have a value equal to 100% of this Contract. This bond shall be conditioned upon faithful performance of the Contract in accordance with the plans, specifications and conditions of the Contract. The performance bond shall be solely for the protection of the City. The payment bond shall be in an amount equal to 100% of the Contract, and conditioned upon the prompt payment for all labor or materials for which a contractor or subcontractor is liable. The payment bond shall be solely for the protection of the persons furnishing materials or performance labor for which a contractor or subcontractor is liable.

Sec. 17. Dispute Resolution. It is understood and agreed that NCGS 143-128(f1-g) requires that disputes arising under an agreement for the erection, construction, alteration or repair of a building be subject to a dispute resolution process specified by the City. The amount in controversy shall be at least $15,000.00 before this dispute resolution procedure may be used. In compliance with this statutory provision, the City specifies this Section as the dispute resolution process to be used on this Project. It is further understood and agreed that this dispute resolution process is based on non-binding mediation and will only be effective to the extent that the Parties to any mediated dispute participate in the mediation in good faith. It is also understood and agreed that the City is under no obligation under any circumstance to secure or enforce the participation of any other Party in the mediation of any dispute subject to this Section and NCGS 143-128(f1-g).

This Section 17 does not apply to:

(a) The purchase and erection of prefabricated or relocatable buildings or portions of such buildings, except that portion of the work that must be performed at the construction site; or

(b) The erection, construction alteration or repair of a building when the cost of such building is $300,000 or less.

17.1 Any dispute arising between or among the Parties listed in Section 17.3 that arises from an agreement to construct the Project, including without limitation a breach of such agreement, shall be subject to non-binding mediation administered by the American Arbitration Association under its Construction Industry Mediation Rules (“Rules”), except as otherwise expressly set forth in this Section. To the extent any provision of the Rules is inconsistent with the provisions of this Section, the provisions of this Section shall control. The mediation provided in this Section shall be used pursuant to this Agreement and NCGS 143-128(f1-g) and is in lieu of any dispute resolution process adopted by the North Carolina State Building Commission, which process shall not apply to this Project.

17.2 For purposes of this Section the following definitions shall apply:

a. Agreement to construct the Project means an agreement to construct the Project that is subject to the requirements of NCGS 143-128 and does not include any agreement related to the Project that is not subject to said statute.
b. *Construct or construction* refers to and includes the erection, construction, alteration or repair of the Project.

c. *Party or Parties* refers to the parties listed in Section 16.4.

d. *Project* means the building to be erected, constructed, altered or repaired pursuant to this Agreement.

17.3 The City and any Party contracting with the City or with any first-tier or lower-tier subcontractor for the construction of the Project agree to participate in good faith in any mediation of a dispute subject to this Section and NCGS 143-128(f1-g), including without limitation the following Parties (if any): architect(s), engineer(s), surveyor(s), construction manager, construction manager at risk, prime contractor(s), surety(ies), subcontractor(s), and supplier(s).

17.4 In order to facilitate compliance with NCGS 143-128(f1-g), the Contractor and all other Parties shall include this Section 17 in every agreement to which it (any of them) is a Party for the construction of the Project without variation or exception. Failure to do so will constitute a breach of this Agreement, and the Contractor or other Party failing to include this Section in any agreement required by this Section shall indemnify and hold harmless the remaining Parties from and against any and all claims, including without limitation reasonable attorney fees and other costs of litigation, arising in any manner from such breach. Notwithstanding the foregoing provisions of this Section, it is expressly understood and agreed that the Parties are intended to be and shall be third-party beneficiaries of the provisions of this Section and can enforce the provisions hereof.

17.5 The following disputes are not subject to mediation: (i) a dispute seeking a non-monetary recovery; and (ii) a dispute seeking a monetary recovery of $15,000 or less.

17.6 A dispute seeking the extension of any time limit set forth in an agreement to construct the Project shall be subject to mediation pursuant to this Section and NCGS 143-128(f1-g), but only if the damages which would be suffered by the Party seeking the extension would exceed $15,000 if the disputed extension is denied. To the extent that liquidated damages are set forth in such agreement as the measurement of damages for failure by such Party to meet such time limit, such liquidated damages shall be the exclusive standard for determining the amount of damages associated with such dispute.

17.7 For purposes of this Section, a dispute is limited to the recovery of monetary damages from the same transaction or occurrence against a single Party or two or more Parties alleged to be liable jointly, severally or in the alternative. Two or more disputes may not be consolidated or otherwise combined without the consent of all Parties to such disputes.

17.8 In addition to such matters as are required by the Rules, a request for mediation shall include the amount of the monetary relief requested.

17.9 Prior to requesting mediation, a Party must form a good faith belief that it is entitled under applicable law to recover the monetary amount to be included in the request from one or more of the remaining Parties. Such belief must be based on a reasonable and prudent investigation into the dispute that is the subject of the request. The request for mediation must be based on such investigation and may not include any amount or the name of any remaining Party, unless supported by such investigation and good faith belief by the Party requesting the mediation.

17.10 If a Party breaches any provision of Section 17.9, it shall indemnify and hold harmless all other Parties from any costs, including reasonable attorney fees and other costs of litigation, and damages incurred by such other Parties that arise from such breach.

17.11 All expenses incurred by a Party to a dispute in preparing and presenting any claim or defense at the mediation shall be paid by the Party. Such expenses include without limitation preparation and production of witnesses and exhibits and attorney fees. All other expenses of the mediation, including filing fees and required
traveling and other expenses of the mediator, shall be borne as follows: one half by the Party requesting the mediation, with the remaining parties paying equal shares of the remaining expenses and costs; provided that, if the City is named as a party to the mediation, the City shall pay at least one-third of the mediation expenses and costs divided among the Parties. If more than one Party to a dispute requests a mediation, the mediation expenses and costs to be divided among the Parties shall be borne equally by the Parties to the dispute; provided that, if the City is named as a Party to the mediation, the City shall pay at least one-third of the mediation expenses and costs divided among the Parties.

17.12 The mediation shall be held at a location agreeable to the mediator and all of the Parties; provided that, if no agreement can be reached, the mediation will be held at such location in Cabarrus County as the mediator shall determine.

17.13 The provisions of this Section are subject to any other provision of this Agreement concerning the submission, documentation and/or proof of any claim or dispute. Such other provisions shall apply in full force and shall be satisfied as a condition precedent to mediation pursuant to this Section.

17.14 The Parties understand and agree that mediation in accordance with this Section shall be a condition precedent to institution of any legal or equitable proceeding seeking monetary recovery based on any dispute that is subject to mediation pursuant to this Section.

**Sec. 18. Breach.** In the event of a violation of any material term of this Agreement, the non-violating party may terminate the Agreement upon written notice. Such notice shall state the violation with specificity and shall give ten (10) days to cure the violation. The cure period shall be measured as ten (10) days from the date of receipt of notice by the violating party, or, if the date is not known, then thirteen (13) days from the date the notice is placed in the United States Post. If the violation remains uncorrected at the end of the cure period, the Agreement shall be terminated without any further action by the non-violating party. Any remaining disputes shall be subject to the dispute resolution procedure set forth above, if applicable.

[Signature Page to Follow]
IN WITNESS WHEREOF, the City of Concord and the Contractor have caused this Contract to be executed by their respective duly authorized agents or officers.

CITY OF CONCORD: (Typed or Printed Legal Name of Contractor)

By: ____________________________
    City Manager

Date: __________________________

Printed Name: __________________

Title: __________________________

ATTEST BY:

Date: __________________________

City Clerk

ATTEST:

BY: ____________________________
    Signature of Vice President, Secretary, or other officer

Printed Name: __________________

Title __________________________

APPROVED AS TO FORM:

______________________________
Attorney for the City of Concord

SEAL

APPROVAL BY CITY FINANCE OFFICER

This instrument has been pre-audited in the manner required by the Local Government Budget and Fiscal Control Act.

______________________________
Signature
EXHIBIT A

BID FORM WITH UNIT PRICE SCHEDULE
EXHIBIT A

BID FORM

PROJECT IDENTIFICATION: Sewer CIPP Lining Contract – 2020

Contract No: 2020-013

THIS BID IS SUBMITTED TO:

Enrique A. Blat, PE Deputy City Engineer
City of Concord
850 Warren C. Coleman Blvd.
Concord, North Carolina 28025
(PO Box 308, Concord, NC, 28026-0308)

1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with Owner in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents within the specified time and for the amount indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.

2. Bidder accepts all of the terms and conditions of the Invitation to Bid and the Instructions to Bidders, including without limitation those dealing with the disposition of bid security. This Bid will remain subject to acceptance for 60 days after the day of bid opening. Bidder will sign and submit the Agreement with the Bonds and other documents required by the Bidding Documents within 10 days after the date of Owner’s Notice of Award.

3. In submitting this Bid, Bidder represents that:
   a. Bidder has examined copies of all the Bidding Documents and of the following Addenda (receipt of all which is hereby acknowledged):

      | No. | Dated |
      |-----|-------|
      |     |       |
      |     |       |
      |     |       |
      |     |       |
      |     |       |

   b. Bidder has visited the site and become familiar with and satisfied itself as to the general, local, and site conditions that may affect cost, progress, performance, and furnishing of the Work.
EXHIBIT A

c. Bidder is familiar with and has satisfied itself as to all Federal, state, and local Laws and Regulations that may affect cost, progress, performance, and furnishing of the Work.

d. Bidder has obtained and carefully studied (or assumes responsibility for having done so) all such additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and underground facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance, or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder and safety precautions and programs incident thereto. Bidder does not consider that any additional examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance and furnishing of the Work in accordance with the time, price, and other terms and conditions of the Contract Documents.

e. Bidder is aware of the general nature of Work to be performed by Owner and others at the site that relates to Work for which this Bid is submitted as indicated in the Contract Documents.

f. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.

g. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Contract Documents and the written resolution thereof by Engineer is acceptable to Bidder, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this Bid is submitted.

h. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm, or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

4. Bidder will complete the Work for the following unit prices. Quantities indicated are estimated and not guaranteed; they are solely for comparing Bids and establishing the initial Contract Price. Final payment will be based on actual quantities.
## UNIT PRICE SCHEDULE
### Contract 2017-047

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Price ($)</th>
<th>Item Total ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8-inch Lining</td>
<td>LF</td>
<td></td>
<td>23,197</td>
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</tr>
<tr>
<td>2</td>
<td>Lateral lining</td>
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<td>3</td>
<td>Re-connection of service lines</td>
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<td></td>
<td>257</td>
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<tr>
<td>4</td>
<td>Removing protruding taps</td>
<td>EA</td>
<td></td>
<td>10</td>
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</tr>
<tr>
<td>5</td>
<td>4-foot diameter manhole rehabilitation (97 MH’s total)</td>
<td>VF</td>
<td></td>
<td>596</td>
<td></td>
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<tr>
<td>6</td>
<td>Invert Reconstruction</td>
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<td></td>
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<td>7</td>
<td>Rebuild Shelve of line-through MH</td>
<td>EA</td>
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<tr>
<td>8</td>
<td>Traffic Control</td>
<td>LS</td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

**BASE BID:**

**5% CONTINGENCY:**

**TOTAL BID:**

---

1. Items 1 and 2 shall be in accordance with the NASSCO “Performance Specification Guideline for the Installation of Cured-in-Place Pipe (CIPP)” latest edition.

2. Items 5, 6 and 7 shall be in accordance with Section 2.2 Cementitious Manhole Restoration of the NASSCO “Performance Specification Guideline for Manhole Rehabilitation” latest edition.

3. Item 6 above is for the total reconstruction of the invert in manholes to be rehabilitated.

4. Item 7 above is to construct the manhole shelve where we are proposing to line-through them.

5. Traffic control must be in compliance with NCDOT requirements, including Work Zone Certification for workers within the work zone.

It is the responsibility of the contractor to provide all necessary signs and personnel for traffic control.

6. Bidder agrees that the Work will be complete within **180 days** of the date of the Notice to Proceed. Liquidated damages are set at $200.00 per day past the completion date set forth in the construction contract.
EXHIBIT A

7. Communications concerning this Bid shall be sent to Bidder at the following address:

    NAME: ____________________________________________

    ADDRESS: _________________________________________

    P.O. BOX: _________________________________________

    CITY: __________________________ STATE: ____________

    ZIP CODE: ________________________________

8. The terms used in this Bid, which are defined in the General Conditions included as part of the Contract Documents, have the meanings assigned to them in the General Conditions.

SIGNATURE OF BIDDER

    Contractor's License Number __________________________

    License Expiration Date ________________________________

If an Individual

    By_______________________________________________________________
    (signature of individual)

    Doing business as ____________________________________________

    Business address ____________________________________________

    Phone No. ________________________________

    Date ____________________________ , 20________

    ATTEST ____________________________ TITLE __________________

If a Partnership

    By_______________________________________________________________
    (Firm name)

    By_______________________________________________________________
    (signature of individual)
EXHIBIT A

Business address ________________________________

Phone No. ________________________________

Date ________________________________, 20_____

ATTEST ____________________________ TITLE ____________________________

If a Corporation

By ________________________________

(Corporation name)

By ________________________________

(signature of authorized person) (title)

Business address ________________________________

Phone No. ________________________________

Date ________________________________, 20_____

ATTEST ____________________________ TITLE ____________________________

(Seal) 

IF A JOINT VENTURE (Other party must sign below.)

Contractor's License Number ________________________________

License Expiration Date ________________________________

By ________________________________

(Signature of individual)

Doing business as ________________________________

Business address ________________________________

Phone No. ________________________________
EXHIBIT A

Date __________________________, 20____

ATTEST __________________________ TITLE ____________________

______________________________________________

(Signature of general partner)

(Seal)
EXHIBIT B

NASSCO SPECIFICATIONS FOR CURED-IN-PLACE PIPE (CIPP)

NASSCO SPECIFICATIONS FOR CURED-IN-PLACE (CIPP) LATERAL SEALS

&

NASSCO SPECIFICATIONS FOR MANHOLE REHABILITATION

See Section 2.2 of the NASSCO Performance Specification Guideline for Manhole Rehabilitation, December 2013 for Cementitious Manhole Restoration
CURED-IN-PLACE PIPE (CIPP) INSTALLATION

PERFORMANCE SPECIFICATION GUIDELINE (PSG)

July 2017

Thanks to the following participants for the development of this document:

2017 Edition
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2011 Edition
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NASSCO CIPP Committee

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Jim Harris - Murfreesboro, TN.
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John Williamson - Nova Pipe
Geoff Yothers - Inliner Technologies

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Disclaimer

These specifications were prepared by NASSCO and peer reviewed by industry professionals. These specifications are not specific to any one product and should be considered a guideline only. Conditions for use may require additions, deletions or amendments to these guidelines so as to conform to project specific site conditions. NASSCO assumes no liability as to content, use and application of these guidelines.

EFECTIVE SPECIFICATIONS

Effective specifications should encourage the most innovative, efficient and experienced contractor to provide the level of quality required by the Owner at the best and lowest competitive price.

The specification should not strive to encourage the contractor to seek the cheapest approach and product delivery available to provide the lowest price.

Effective specifications are critical for project success, which includes:

1. Product selection for the best solution.
2. Definition of project goals and requirements, both short and long term.
3. Construction means and methods as defined, in writing, by the contractor.
4. Product provided and installed as specified by the product manufacturer.
5. Product quality and quantity confirmed through inspection and testing.
6. Product design and service life verified through warranty inspection.
### PERFORMANCE SPECIFICATIONS

NASSCO recommends performance specifications that require the contractor to use superior skill, experience and innovative means available to deliver a specified product at a defined level of quality at a competitive price. This requires that the contractor, not the engineer, define the means and methods by submitting a detailed Performance Work Statement (PWS) before the project begins.
PART 1 - GENERAL

This performance specification guideline (PSG) is for the rehabilitation of gravity sewers, either sanitary or storm, by the installation of cured-in-place-pipe (CIPP).

A. This PSG includes the minimum requirements for the rehabilitation of sanitary and storm sewer pipelines by the installation of Cured-In-Place Pipe (CIPP) within the existing, deteriorated pipe as shown on the plans included as part of these contract documents.

B. The rehabilitation of pipelines shall be done by the installation of a resin-impregnated flexible tube which, when cured, shall be continuous and tight-fitting throughout the entire length of the original pipe. The CIPP shall extend the full length of the original pipe and provide a structurally sound, jointless and water-tight new pipe-within-a-pipe. The Contractor is responsible for proper, accurate and complete installation of the CIPP using the system selected by the Contractor meeting the Owners requirements.

C. Neither the CIPP product, system, nor its installation, shall cause adverse effects to any of the Owner’s processes or facilities. The installation pressure for the product shall not damage the system in any way, and the use of the product shall not result in the formation or production of any detrimental compounds or by-products at the wastewater treatment plant. The Contractor shall notify the Owner and identify any by-products produced as a result of the installation operations, test and monitor the levels, and comply with any and all local waste discharge requirements. The Contractor shall conduct installation operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians, businesses and property owners or tenants.

D. The prices submitted by the Contractor, shall include all costs of permits, labor, equipment and materials for the various bid items necessary for furnishing and installing, complete in place, CIPP in accordance with these specifications. All items of work not specifically mentioned herein which are required, by the contractor, to make the product perform as intended and deliver the final product as specified herein shall be included in the respective lump sum and unit prices bid.

1.1 DESCRIPTION OF WORK AND PRODUCT DELIVERY

The specifications must include a detailed description of the work required including all products that are to be included in the installation, and what is to be delivered by the contractor.
A. This PSG covers all work necessary to furnish and install the CIPP. The Contractor shall provide all materials, labor, equipment, and services necessary for traffic control, bypass pumping and/or diversion of flows, cleaning and television inspection of sewers to be rehabilitated, liner installation, reconnection of service connections, all quality controls, provide samples for performance of required material tests, final television inspection, testing of the rehabilitated pipe system, warranty work and other work, all as specified herein.

B. The product furnished shall be a complete CIPP system including specific materials, applicable equipment and installation procedures. The CIPP system manufacturer may submit, a minimum of 14 calendar days in advance of the bid date, required information to the Owner to obtain pre-approval status. Those CIPP systems that have been pre-approved will not be required to furnish information as required in the submittal section of these specifications unless specifically requested to do so by the Owner or if any of the CIPP system components have changed from those pre-approved by the Owner. All other CIPP systems or multi-component products will be required to meet the submittal requirements as contained herein.

C. The CIPP shall be continuous and jointless from manhole to manhole or access point to access point and shall be free of all defects that will affect the long-term life and operation of the pipe.

D. The CIPP shall fit sufficiently tight within the existing pipe so as to not leak at the manholes, at the service connections or through the wall of the installed pipe. If leakage occurs at the manholes or the service connections, the Contractor shall seal these areas to stop all leakage using a material compatible with the CIPP as directed by the Owner at the price bid in the Proposal. If leakage occurs through the wall of the pipe, the CIPP shall be repaired or removed as recommended by the CIPP manufacturer. Final approval of the CIPP will be based on a leak tight pipe.

E. The CIPP shall be designed for a life of 50 years or greater and an equal service life unless specifically specified otherwise by the Owner.

F. The CIPP may be designed to resist external groundwater pressures only or as a fully structural stand-alone pipe-within-a-pipe. If the design is for groundwater, only the design groundwater level is required for external loads. If specified in the contract documents, the installed CIPP shall be a structurally designed pipe-within-a-pipe, meet or exceed all contract specified physical properties, fitting tightly within the existing pipe all within the tolerances specified. The installed CIPP shall withstand all applicable surcharge loads (soil overburden, live loads, etc.) and external hydrostatic (groundwater) pressure, if present, for each specific installation location.
G. The installed CIPP shall have a long term (50 year) corrosion resistance to the typical chemicals found in domestic sewage and defined in the referenced and applicable ASTM standards

H. All existing and confirmed active service connections and any other service laterals to be reinstated, as directed by the Owner, shall be re-opened robotically or by hand in the case of man-entry size piping, to their original shape and to 90% - 95% of their original area. All over-cut or under-cut service connections will be properly repaired to meet the requirements of these specifications.

I. All materials furnished, as part of this contract shall be marked with detailed product information, stored in a manner specified by the manufacturer and tested to the requirement of this contract.

J. Testing and warranty inspections shall be executed by the Owner. Any defects found shall be repaired or replaced by the Contractor.

K. The Contractor shall furnish, from the project installation, all samples for product testing at the request of the Owner. The Owner shall take possession of the samples for testing and shall maintain the chain of custody, deliver the samples to an approved laboratory and pay for all material and product testing performed under this contract.

1.2 REFERENCES

All applicable reference documents should be listed in this section. If a document does not apply, is not pertinent or has unknown content, it should not be included. Specific reference document requirements should be defined in the contract documents or by reference to a specific section of the document. Specific contractor requirements and/or test procedures contained in the references should be defined in detail in the contract documents.

A. The following documents form a part of this specification to the extent stated herein and shall be the latest editions thereof. Where differences exist between codes and standards, the requirements of these specifications shall apply. All references to codes and standards shall be to the latest revised version.

ASTM - F1216 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
ASTM - F1743 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pull in and Inflate and Curing of a Resin-Impregnated Tube
ASTM - D543 Standard and Practice for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM - D638 Standard Test Method for Tensile Properties of Plastics
1.3 PERFORMANCE WORK STATEMENT (PWS) SUBMITTAL

In place of the engineer defining the specific method for product installation, the contractor defines the installation means and methods through a written plan called the Performance Work Statement (PWS). During construction the PWS provides valuable information to the inspector so that the inspector can determine if the submitted means and methods are being followed by the contractor. The PWS also outlines the necessary quality checks to be performed and the installation crew qualifications.

A. The Contractor shall submit, to the Owner a Performance Work Statement (PWS) which clearly defines the CIPP product delivery in conformance with the requirements of these contract documents. Unless otherwise directed by the Owner, the PWS shall at a minimum contain the following:

B. Clearly indicate that the CIPP will conform to the project requirements as outlined in the Description of Work and as delineated in these specifications.

C. Where the scope of work is specifically delineated in the contract documents, a detailed installation plan describing all preparation work, cleaning operations, pre-CCTV inspections, bypass pumping, traffic control, installation procedure, method of curing, service reconnection, quality control, testing to be performed, final CCTV inspection, warranties furnished and all else necessary and appropriate for a complete liner installation. A detailed installation schedule shall be prepared, submitted and conform to the requirements of this contract.

D. Contractor’s description of the proposed CIPP technology, including a detailed plan for identifying all active service connections maintaining service, during mainline
installation, to each home connected to the section of pipe being lined, including temporary service for commercial, industrial and apartment complexes, if required by the contract.

E. A description of the CIPP materials to be furnished for the project. Materials shall be fully detailed in the submittals and conform to these specifications and/or shall conform to the pre-approved product submission.

F. A statement of the Contractors experience. The Contractor shall have a minimum of Five (5) years of continuous experience installing CIPP in pipe of a similar size, length and configuration as contained in this contract. A minimum of 500,000 linear feet of shop wet-out liner installation is required and minimum of 6 onsite wet-out installations are required as specifically applicable to this contract. The lead personnel including the superintendent, the foreman and the lead crew personnel for the CCTV inspection, resin wet-out, the liner installation, liner curing and the robotic service reconnections each must have a minimum of Five (5) years of total experience with the CIPP technology proposed for this contract and must have demonstrated competency and experience to perform the scope of work contained in this contract. The name and experience of each lead individual performing work on this contract shall be submitted with the PWS. Personnel replaced by the contractor, on this contract, shall have similar, verifiable experience as the personnel originally submitted for the project.

G. Engineering design calculations, in accordance with the Appendix of ASTM F1216, for each length of liner to be installed including the thickness of each proposed CIPP. It will be acceptable for the Contractor to submit a design for the most severe line condition and apply that design to all of the line sections. These calculations shall be performed and certified by a qualified, Professional Engineer. All calculations shall include data that conforms to the requirements of these specifications or has been pre-approved by the Owner.
H. Proposed manufacturers technology data shall be submitted for all CIPP products and all associated technologies to be furnished.

Reinstating service laterals is a critical operation for completing small diameter CIPP installations. This specialty type equipment is not readily available for rent from local equipment rental companies. Because of this, often redundant robotic cutters are specified for small diameter projects with service laterals.

I. Submittals shall include information on the cured-in-place pipe intended for installation and all tools and equipment required for a complete installation. The PWS shall identify which tools and equipment will be redundant on the job site in the event of equipment breakdown. All equipment to be furnished for the project, including proposed back-up equipment, shall be clearly described. The Contractor shall outline the mitigation procedure to be implemented in the event of key equipment failure during the installation process.

Non-specialty backup equipment should be identified and reserved by the contractor (on will call) from local rental companies in the event of equipment failure.

J. A detailed description of the Contractor's proposed procedures for removal of any existing blockages in the pipeline that may be encountered during the cleaning process.

Proper public notification can prevent many public relations issues during a project. If the residents know that there will be workers and equipment near their homes, that they should not use large volumes of water or that they may smell strange odors, many homeowner concerns and problems can be prevented.

K. A detailed public notification plan shall be prepared and submitted including detailed staged notification to residences affected by the CIPP installation.

A CIPP installation typically includes the use of polyester resins. The resin emits a distinctive odor from the styrene component in the resin. Even though not harmful in small concentrations, it does emit an odor that is considered a nuisance. To minimize this nuisance odor the contractor should devise an odor control plan that will mitigate the nuisance effect to the general public and residents at the project site during the liner installation.

L. An odor control plan shall be submitted, by the contractor, that will ensure that project specific odors will be minimized at the project site and surrounding area.

M. Compensation for all work required for the submittal of the PWS shall be included in the various pipelining items contained in the Proposal.
1.4 PRODUCT SUBMITTALS

Product submittals require the contractor to submit the materials to be incorporated in the installation. This also allows the contractor to submit alternative materials that may be equal or better than those specified. The engineer must be prepared to evaluate alternative materials through evaluation, certifications and third party testing to validate the alternative materials to meet the specified requirements of the contract.

This section includes a list of all significant CIPP products and procedures that should be included in the submittal package. These include the two principal products, the tube and the resin, in addition to handling and storing these items from the manufacturing plant to the wet-out facility. Also included are detailed procedures for wet-out, installation and curing.

A. Fabric Tube – including the manufacturer and description of product components such as felts and reinforcing materials.

B. Flexible membrane (coating) material – including materials specific to the proposed curing method and recommended repair (patching) procedure if applicable.

C. Raw Resin Data - including the manufacturer and description of product components including the Spectroscopic Wavelength diagram for the resin being furnished

D. Manufacturers’ shipping, storage and handling recommendations for all components of the CIPP system.

E. All Safety Data Sheets (SDS) for all materials to be furnished for the project.

F. Tube wet-out & cure method including:

1. A complete description of the proposed wet-out procedure for the proposed technology.

2. The Manufacturer’s recommended cure method for each diameter and thickness of liner to be installed. The PWS shall contain a detailed curing procedure outlining the curing medium, the method of application and how the curing temperatures will be monitored.

G. Compensation for all work required for the submittal of product data shall be included in the Lump Sum price contained in the Proposal for Mobilization.
1.5 SAFETY

A. The Contractor shall conform to all work safety requirements of pertinent regulatory agencies, and shall secure the site for the working conditions in compliance with the same. The Contractor shall erect such signs and other devices as are necessary for the safety of the work site.

B. The Contractor shall perform all of the Work in accordance with applicable OSHA standards. Emphasis shall be placed upon the requirements for entering confined spaces and with the equipment being utilized for pipe renewal.

C. The Contractor shall submit a proposed Safety Plan to the Owner, prior to beginning any work, identifying all competent persons. The plan shall include a description of a daily safety program for the job site and all emergency procedures to be implemented in the event of a safety incident. All work shall be conducted in accordance with the Contractor’s submitted Safety Plan.

D. Compensation for all work required for the submittal of the Safety Plan shall be included in the various pipelining items contained in the Proposal.

1.6 QUALITY CONTROL PLAN (QCP)

A detailed Quality Control Plan (QPC) should be submitted by the contractor. The QPC should include a discussion of the proposed quality controls to be performed by the contractor during installation including material protection and handling, equipment operation and documentation requirements. The contractor personnel, including names and cell phone numbers for those that are responsible for assuring that all quality requirements are met, should be identified and submitted.

A. A detailed quality control plan (QCP) shall be submitted to the Owner that fully represents and conforms to the requirements of these specifications. At a minimum the QCP shall include the following:

1. A detailed discussion of the proposed quality controls to be performed by the Contractor.
2. Defined responsibilities, of the Contractor's personnel, for assuring that all quality requirements for this contract are met. These shall be assigned, by the Contractor, to specific personnel.

3. Proposed procedures for quality control, product sampling and testing shall be defined and submitted as part of the plan.

4. Proposed methods for product performance controls, including method of and frequency of product sampling and testing both in raw material form and cured product form.

5. Scheduled performance and product test result reviews between the Contractor and the Owner at a regularly scheduled job meeting.

6. Inspection forms and guidelines for quality control inspections shall be prepared in accordance with the standards specified in this contract and submitted with the QCP.

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**B.** Two (2) days of inspector training, by the CIPP system manufacture, for the Owners inspectors shall be provided. This training shall be prior to liner installation, include both technical and field training and include all key aspects of visual inspection and sampling procedures for testing requirements. On smaller projects having an estimated duration of less than two (2) weeks of installation work, the system manufacturer shall furnish a check list containing key elements of the CIPP installation criteria that are important for the Owners inspector to ensure that quality control and testing requirements are performed in accordance with the contract documents.

**C.** Compensation for all work required for the submittal of the QCP shall be included in the various pipelining items contained in the Proposal. Compensation for inspector training shall be included in the price bid in the Proposal.
1.7 CIPP REPAIR/REPLACEMENT

As part of the PWS, the contractor should submit repair and replacement procedures for common CIPP defects. Defects should be categorized as those that need no repair, those that can be repaired and those that must be removed and replaced. Defects that affect the operation or longevity of the CIPP should be repaired or replaced.

A. Occasionally installations will result in the need to repair or replace a defective CIPP. The Contractor shall outline specific repair or replacement procedures for potential defects that may occur in the installed CIPP. Repair/replacement procedures shall be as recommended by the CIPP system manufacturer and shall be submitted as part of the PWS.

B. Defects in the installed CIPP that will not affect the operation and long term life of the product shall be identified and defined.

C. Repairable defects that may occur in the installed CIPP shall be specifically defined by the Contractor based on manufacturer’s recommendations, including a detailed step-by-step repair procedure, resulting in a finished product meeting the requirements of these contract specifications.

D. Unrepairable defects that may occur to the CIPP shall be clearly defined by the Contractor based on the manufacturer’s recommendations, including a recommended procedure for the removal and replacement of the CIPP.

1.8 AS-BUILT DRAWINGS/RECORDS

As-Built drawings/records include the identification of the work completed by the contractor and should include the pre and post inspection documentation. As-Built drawings /records should be kept current and should be available on the project site at all times. As-Built drawings/records can be in the form of actual drawings, either paper or electronic, spreadsheets or Word documents.

A. As-Built drawings/records, pre & post inspection videotapes, CDs or other electronic media shall be submitted to the Owner, by the Contractor, within 2 weeks of final acceptance of said work or as specified by the Owner. As-Built drawings/records will include the identification of the work completed by the Contractor and shall be prepared on one set of Contract Drawings/Records provided to the Contractor at the onset of the project.

B. As-Built drawings/records shall be kept on the project site at all times, shall include all necessary information as outlined in the PWS or as agreed to by the Owner and the Contractor at the start of the Contract, shall be updated as the work is being completed and shall be clearly legible.
C. Compensation for all work required for the submittal and approval of As-Built drawings/records shall be included in the various pipelining items contained in the Proposal.

1.9 WARRRANTY

The contractor should warrant the CIPP material and installation for a period as specified. If required by the Owner, the contractor should warrant any defective work that has been repaired for an extended period as agreed. After completion of the work but before the warranty period has expired, the owner should inspect a portion of the rehabilitated system. Initial warranty inspection should include up to 15% of the completed work. The warranty inspection should be based on the recommendations documented by the project inspector during the execution of the project. Any defects found should be handled in accordance with the repair/replacement plan submitted in the PWS. Depending on the frequency of defects found, the Owner may require more installations inspections as necessary.

A. The materials used for the project shall be certified by the manufacturer for the specified purpose. The Contractor shall warrant the CIPP material and installation for a period of one (1) year. During the Contractor warranty period, any defect which may materially affect the integrity, strength, function and/or operation of the pipe, shall be repaired at the Contractor’s expense in accordance with procedures included in Section 1.7 CIPP Repair/Replacement and as recommended by the manufacturer.

B. On any work completed by the contractor that is defective and/or has been repaired, the contractor shall warrant this work for (1) year in addition to the warrantee required by the contract.

C. After a pipe section has been rehabilitated and for a period of time up to one (1) year following completion of the project, the Owner may inspect all or portions of the rehabilitated system. The specific locations will be selected at random by the Owner’s inspector and should include all sizes of CIPP from this project. If it is found that any of the CIPP has developed abnormalities since the time of "Post Construction Television Inspection," the abnormalities shall be repaired and/or replaced as defined in Section 1.7 CIPP Repair/Replacement and as recommended by the manufacturer. If, after inspection of a portion of the rehabilitated system under the contract, problems are found, the Owner may televise all the CIPP installed on the contract. All verified defects shall be repaired and/or replaced by the Contractor and shall be performed in accordance with Section 1.7 CIPP Repair/Replacement and per the original specifications, all at no additional cost to the Owner.
PART 2 - PRODUCTS

2.1 MATERIALS

The cured CIPP product must meet the chemical resistance requirements specified as referenced in ASTM F1216 and ASTM D5813. The tested product should be of the same type tube and resin used on the project. Chemical resistance testing is a qualification test that is typically completed by the resin manufacturer who then certifies that the product meets the specified requirement. This certification, which can be accompanied by the test report, is submitted by the contractor prior to the start of the project.

A. The CIPP System must meet the chemical resistance requirements of these contract documents.

B. All materials shipped to the project site shall be accompanied by test reports certifying that the material conforms to the ASTM standards listed herein. Materials shall be shipped, stored, and handled in a manner consistent with written recommendations of the CIPP system manufacturer to avoid damage. Damage includes, but is not limited to, gouging, abrasion, flattening, cutting, puncturing or ultra-violet (UV) degradation. On site storage locations shall be approved by the Owner. All damaged materials shall be promptly removed from the project site at the Contractor’s expense and disposed of in accordance with all current applicable agency regulations.

2.2 FABRIC TUBE

The fabric tube is the vehicle that carries the resin into the pipeline and holds the resin in place prior to and during cure. The thickness of the fabric tube will determine the finished thickness of the CIPP. A properly designed and specified fabric tube is critical to achieving the specified finished CIPP thickness.

A. The fabric tube shall consist of one or more layers of absorbent non-woven felt fabric, felt/fiberglass, felt/carbon fiber, carbon fiber or fiberglass and meet the requirements of ASTM F 1216, ASTM F 1743, or ASTM F2019 and ASTM D5813. The fabric tube shall be capable of absorbing and carrying resins, constructed to withstand installation pressures and curing temperatures and have sufficient strength to bridge missing pipe segments and stretch to fit irregular pipe sections. The contractor shall submit certified information from the felt manufacturer on the nominal void volume in the felt fabric that will be filled with resin.

B. The wet-out fabric tube shall have a uniform thickness and excess resin distribution that when compressed at installation pressures will meet or exceed the design thickness after cure.
C. The fabric tube shall be manufactured to a size and length that when installed will tightly fit the internal circumference, meeting applicable ASTM standards or better, of the original pipe. Allowance shall be made for circumferential stretching during installation. The tube shall be properly sized to the diameter of the existing pipe and the length to be rehabilitated and be able to stretch to fit irregular pipe sections and negotiate bends. The Contractor shall determine the minimum tube length necessary to effectively span the designated run between manholes. The Contractor shall verify the lengths in the field prior to ordering and prior to impregnation of the tube with resin to ensure that the tube will have sufficient length to extend the entire length of the run. The Contractor shall also measure the inside diameter of the existing pipelines in the field prior to ordering liner so that the liner can be installed in a tight-fitted condition.

D. The outside and/or inside layer of the fabric tube (before inversion/pull-in, as applicable) shall be coated with an impermeable, flexible membrane that will contain the resin and facilitate, if applicable, vacuum impregnation and monitoring of the resin saturation during the resin impregnation (wet-out) procedure.

E. No material shall be included in the fabric tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be acceptable upon visual inspection as evident by color contrast between the tube fabric and the activated resin containing a colorant.

F. The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made. The hue of the color shall be dark enough to distinguish a contrast between the fully resin saturated felt fabric and dry or resin lean areas.

G. Seams in the fabric tube, if applicable, shall meet the requirements of ASTM D5813.

H. The outside of the fabric tube shall be marked a maximum of every 5 feet with the name of the manufacturer or CIPP system, manufacturing lot and production footage.

I. The minimum length of the fabric tube shall be that deemed necessary by the installer to effectively span the distance from the starting manhole to the terminating manhole or access point, plus that amount required to run-in and run-out for the installation process.

J. The nominal fabric tube wall thickness shall be constructed, as a minimum, to the nearest 0.5 mm increment, rounded up from the design thickness for that section of installed CIPP. Wall thickness transitions, in 0.5 mm increments or greater as appropriate, may be fabricated into the fabric tube between installation entrance and exit access points. The quantity of resin used in the impregnation shall be sufficient to fill all of the felt voids for the nominal felt thickness.
2.3 RESIN

In felt tube CIPP the resin is the structural pipe. In reinforced tube CIPP, the resin is important in providing the structural matrix so that the reinforcing fibers can significantly increase the CIPP’s physical properties. Thus, it is important that the applicable resin for the pipe’s flow characteristics is specified and delivered to the wet-out facility. The engineer should verify that the resin specified or substituted by the contractor meets the contract specified requirements. The inspector should verify that the specified or approved resin is supplied by the contractor and correct amount of resin is added to the tube at the wet-out facility. This information can be verified from the Spectroscopic Wavelength Diagram of the resin, the tube wet-out report and standard resin saturation charts furnished from the suppliers of the resin and tube.

A. The resin shall be a corrosion resistant polyester or vinyl ester resin and catalyst system or epoxy and hardener system that, when properly cured within the tube composite, meets the requirements of ASTM F1216, ASTM F1743 or F2019 and ASTM D5813, the physical properties herein, and those which are to be utilized in the design of the CIPP for this project. The resin, specified for the specific application defined in the contract documents, shall produce CIPP which will comply with or exceed the structural and chemical resistance requirements of this specification.

B. The resin to tube ratio, by volume, shall be furnished as recommended by the manufacturer.

2.4 STRUCTURAL REQUIREMENTS

Typically the minimum physical properties of the resin material are specified, and, with this data, the contractor submits a CIPP wall thickness design with the PWS submittal. If the physical properties used in the wall thickness design exceed the minimum properties specified, the contractor must meet the higher physical properties determined during CIPP sample testing.

A. The physical properties and characteristics of the finished CIPP will vary considerably, depending on the types and mixing proportions of the materials used and the degree of cure executed. It shall be the responsibility of the Contractor to control these variables and to provide a CIPP system which meets or exceeds the minimum properties specified herein.

B. The CIPP shall be designed as per ASTM F1216 Appendixes. The CIPP design shall assume no bonding to the original pipe wall.
C. The design engineer shall set the long-term (50 year extrapolated) Creep Retention Factor at 50% of the initial design flexural modulus as determined by ASTM D790 test method. This value shall be used unless the Contractor submits long-term test data (ASTM D2990) to substantiate a higher retention factor.

D. The cured pipe material (CIPP) shall, at a minimum, meet or exceed the structural properties, as listed below.

2.5 MINIMUM PHYSICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Cured Composite Per ASTM F1216</th>
<th>Cured Composite Per Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexural Modulus of Elasticity (Short-Term)</td>
<td>ASTM D790</td>
<td>250,000 psi</td>
<td>Contractor Value</td>
</tr>
<tr>
<td>Felt Tubes. Felt/Fiberglass, Fiberglass as recommended by the Manufacturer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexural Strength (Short-Term)</td>
<td>ASTM D790</td>
<td>4,500 psi</td>
<td>Contractor Value</td>
</tr>
<tr>
<td>Felt Tubes. Felt/Fiberglass, Fiberglass as recommended by the Manufacturer</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A. The required structural CIPP wall thickness shall be based, as a minimum, on the physical properties of the cured composite and per the design of the Professional Engineer (see section 1.3.G) and in accordance with the Design Equations contained in the appendix of ASTM F1216, and the following design parameters:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Safety Factor</td>
<td>2.0 (1.5 for pipes 36&quot; or larger, if applicable)</td>
</tr>
<tr>
<td>Creep Retention Factor</td>
<td>50%</td>
</tr>
<tr>
<td>Ovality</td>
<td>2% or as measured by field inspection</td>
</tr>
<tr>
<td>Constrained Soil Modulus</td>
<td>Per AASHTO LRFD Section 12 and AWWA Manual M45</td>
</tr>
<tr>
<td>Groundwater Depth</td>
<td>As specified or indicated on the Plans</td>
</tr>
<tr>
<td>Soil Depth (above the crown)</td>
<td>As specified or indicated on the Plans</td>
</tr>
<tr>
<td>Live Load</td>
<td>Highway, railroad or airport as applicable</td>
</tr>
<tr>
<td>Soil Load (assumed)</td>
<td>120 lb./cu. ft.</td>
</tr>
<tr>
<td>Minimum Service Life</td>
<td>50 years</td>
</tr>
</tbody>
</table>

B. The Contractor shall submit, prior to installation of the lining materials, certification of compliance with these specifications and/or the requirements of the pre-approved CIPP system. Certified material test results shall be included that confirm that all
materials conform to these specification and/or the pre-approved system. Materials not complying with these requirements will be rejected.

C. The design soil modulus may be adjusted based on data, determined from detailed project soil testing results, as provided by the Owner in the contract documents.

PART 3 - INSTALLATION

3.1 CONSTRUCTION REQUIREMENTS

The construction requirements cover all on-site activities needed for a proper installation the CIPP product. All of these activities (cleaning, inspection, bypass, etc.) should have been explained in detail in the PWS submitted by the contractor. Inspection and testing requirements, during construction, should be clearly defined for the contractor and the inspector.

A. Preparation, cleaning, inspection, flow bypassing and public notification. The Contractor shall clean the interior of the existing host pipe prior to installation of the liner. All debris and obstructions that will affect the installation and the final CIPP product delivery to the Owner shall be removed and disposed of.

B. The liner shall be constructed of materials and methods that, when installed, shall provide a jointless and continuous structurally sound CIPP able to withstand all imposed static, and dynamic loads on a long-term basis.

C. The Contractor may, under the direction of the Owner, utilize any of the existing manholes in the project area as installation access points. If a street must be closed to traffic because of the location of the sewer, the Contractor shall furnish a detailed traffic control plan and all labor and equipment necessary. The plan shall be in conformance with the requirements of the local agency having jurisdiction over traffic control.

D. Cleaning of Pipe Lines – Before ordering liner materials for the project, the Contractor shall remove all internal debris from the pipe line that will interfere with the installation and the final product delivery of the CIPP, as required in these specifications, and accurately measure and document the exact size of the existing pipeline to be rehabilitated. Solid debris and deposits shall be removed from the system and disposed of properly by the Contractor. Moving material from manhole section to manhole section shall not be allowed. As applicable, the contractor shall either plug or install a flow bypass pumping system to properly clean the pipe lines. Precaution shall be taken by the Contractor in the use of cleaning equipment to avoid damage to the existing pipe. The repair of any damage, caused by the cleaning equipment, shall be the responsibility of the Contractor. The Owner will designate a site for the disposal of all debris removed from the Owner's sewer system as a direct result of the cleaning operation. Unless otherwise specified by the Owner, the Contractor shall dispose of
all debris at no charge. Should any dumping fees apply, the Contractor shall be compensated at the respective unit price bid in the Proposal for cleaning.

E. BypassingExisting Flows - The Contractor shall provide for the flow of existing mainline and service connection effluent around the section or sections of pipe designated for CIPP installation. With most small diameter pipelines, particularly on terminal sewers, plugging will be adequate but must be monitored on a regular basis to prevent backup of sewage into adjacent homes. Service connection effluent may be plugged only after proper notification to the affected residence and may not remain plugged overnight. Installation of the liner shall not begin until the Contractor has installed the required plugs or a sewage bypass system and all pumping facilities have been installed and tested under full operating conditions including the bypass of mainline and side sewer flows. Once the installation has begun, existing flows shall be maintained, until the resin/tube composite is fully cured, cooled down, full televised and the CIPP ends finished. The Contractor shall coordinate sewer bypass and flow interruptions with the Owner at least 14 days in advance and with the property owners and businesses at least 1 business day in advance. The pump and bypass lines shall be of adequate capacity and size to handle peak flows. The Contractor shall submit a detail of the bypass plan and design to the Owner before proceeding with any CIPP installation. Compensation for bypass pumping and all associated plans and approvals shall be at the price bid in the Proposal.

F. Contractor shall perform post-cleaning video inspections of the pipelines. Only PACP certified personnel trained in locating breaks, obstacles and service connections by closed circuit television shall perform the inspection. The Contractor shall provide the Owner a copy of the pre-cleaning and post-cleaning video and suitable log, and/or in digital format, for review prior to installation of the CIPP and for later reference by the Owner.

G. Line Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions that will interfere with the installation and long-term performance of the CIPP. If pre-installation inspection reveals an obstruction, misalignment, broken or collapsed section or sag that was not identified as part of the original scope of work and will prohibit proper installation of the CIPP, the Contractor may be directed by the Owner to correct the problem(s) prior to installation by utilizing open cut repair methods. The Contractor shall be compensated for this work under a contingency pay item designated for open cut point repairs. Removal of any previously unknown obstructions shall be considered as a changed condition. The cost of removal of obstructions that appeared on pre-bid video documentation and made available to the Contractor, prior to the bid opening, shall be compensated for on a unit price basis in accordance with the contract documents.

H. The Contractor shall be responsible for confirming the locations of all branch service connections prior to installing the CIPP. If required in the contract documents, each
connection will be dye tested to determine whether or not the connection is live or abandoned. The cost for dye testing of existing service connections shall be compensated at the unit price bid in the Proposal for Dye Testing of Existing Service Connections. In the event the status of a service connection cannot be adequately defined, the Owner will make the final decision, prior to installation of the liner, as to the status. Typically only service connections deemed “active” shall be reopened by the Contractor.

I. The Contractor shall be allowed use water from an owner-approved fire hydrant in the project vicinity. Use of an approved double check backflow assembly shall be required. Contractor shall provide his own approved assembly. Contractor shall pay current market price for all water usage.

3.2 INSTALLATION OF LINER

| It is important that the CIPP be installed in accordance with the manufacturer's recommendations. These procedures should have been outlined in detail in the PWS submitted by the contractor. Some key procedure that should be maintained include: Installation speed and pressure, the cure schedule and curing temperature monitoring must be maintained and documented, as recommended by the manufacturer. A pre-liner should be installed where the infiltration into the pipeline is excessive and may affect the cure and/or the final structure of the CIPP. |

A. The liner shall be installed and cured in the host pipe per the manufacturer's specifications as described and submitted in the PWS.

B. CIPP installation shall be in accordance with the applicable ASTM standards as modified in this section 3.2.

C. If significant groundwater infiltration is present in the existing sewer such as heavy runners and gushers, the contractor shall install a pre-liner tube or perform chemical grouting to control resin loss and contamination, maintain CIPP thickness, prevent physical property reduction and prevent inadequate curing of the liner resulting from water or other contamination of the resin during installation. The pre-liner tube shall be a reinforced plastic tube to fit the existing pipeline and shall be continuous from manhole (access) to manhole (access).

D. The wet-out tube shall be positioned in the pipeline using the method specified by the manufacturer. Care should be exercised not to damage the tube as a result of installation. The liner should be pulled-in or inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point.

E. Prior to installation and as recommended by the manufacturer, remote temperature gauges or sensors shall be placed inside the host pipe to monitor the temperatures
during the cure cycle. Liner and/or host pipe interface temperature shall be monitored and logged during curing of the liner.

F. To monitor the temperature of the liner wall and to verify correct curing, where specified by the contract documents, temperature monitors can be placed between the host pipe and the liner in the bottom of the host pipe (invert) at manholes or access points and/or throughout its entire length (continuous) to monitor the temperature on the outside of the liner during the curing process. For continuous temperature monitoring, a fiber optic cable is installed in the pipe invert prior to the liner installation. The fiber optic cable is monitored by a computer that is capable of recording temperatures at the interface of the liner and the host pipe continuously in time and location throughout the entire pipeline being rehabilitated.

Monitoring curing temperatures is important for verifying the correct cure of the resin. Temperatures can be monitored continuously in time and location throughout the pipeline being rehabilitated by using a fiber optic cable sensing system. Continuous monitoring systems are computer controlled with a real-time screen display, and can be monitored by any smart device. This is especially useful for critical sewers and medium to large diameter sewers. As a minimum, standard thermocouples, which measure temperatures at one point, should be used, typically at the pipe invert in the termination manhole. Often thermocouples are used in addition to continuous monitoring systems to verify proper cure of the CIPP.

G. Curing shall be accomplished by utilizing the appropriate medium or ultraviolet light in accordance with the manufacturer's recommended cure procedure and/or schedule. The curing source or in and output temperatures shall be monitored and logged during the cure cycles, if applicable. The manufacturer's recommended cure method & schedule shall be used for each line segment installed, and the liner wall thickness and the existing ground conditions with regard to temperature, moisture level, and thermal conductivity of soil, per ASTM as applicable, shall be taken into account by the Contractor.

H. For heat cured liners, if any temperature sensor, or continuous sensor location does not reach the temperature as specified by the manufacturer to achieve proper curing or cooling, the installer can make necessary adjustments to comply with the manufacturer's recommendations. For continuous temperature monitoring, the system computer should have an output report that specifically identifies stations along the length of pipe, indicates the maximum temperature achieved and the sustained temperature time at the stations. At each station along the length of the pipe, the computer should record both the maximum temperature and the minimum cool down temperature and comply with the manufacturers recommendations.

I. For UV Cured Liners, all light train sensor readings, recorded by the tamper proof computer, shall provide output documenting the cure along the entire length of the
installed liner. The cure procedure shall be in accordance with the manufacturer’s recommendation as included in the PWS submission by the contractor.

3.3 COOL DOWN

Proper cool down of CIPP is important to help minimize CIPP shrinkage and cracking. The temperature profile and times required should be provided as a part of the cure schedule. Short cuts that reduce the cool down time should not be allowed.

A. The Contractor shall cool the CIPP in accordance with the approved CIPP manufacturer’s recommendations as described and outlined in the PWS.

B. Temperatures and curing data shall be monitored and recorded, by the Contractor, throughout the installation process to ensure that each phase of the process is achieved as approved in accordance with the CIPP System manufacturer’s recommendations.

3.4 FINISH

Any defect which could affect the structural integrity or longevity of the CIPP should be repaired. Sealing the ends of the CIPP at manholes and at service connection openings is important in cases where the sewer is below the groundwater surface elevation. Leaks through the wall of the CIPP are considered a defect.

A. The installed CIPP shall be continuous over the entire length of a sewer line section and be free from visual defects such as foreign inclusions, dry spots, pinholes, major wrinkles and delamination. The CIPP shall be impervious and free of any leakage through the CIPP wall.

B. Any defect which will or could affect the structural integrity or strength of the CIPP shall be repaired at the Contractor’s expense in accordance with the procedures submitted under Section 1.7 CIPP Repair/Replacement.

C. The beginning and end of the CIPP shall be sealed to the existing host pipe. The sealing material shall be compatible with the pipe end and shall provide a watertight seal.
D. If any of the service connections leak water between the host pipe and the installed CIPP, the connection mainline interface shall be sealed to provide a water tight connection.

E. If the wall of the CIPP leaks, it shall be repaired or removed and replaced with a watertight pipe as recommended by the manufacture of the CIPP system.

F. Compensation shall be at the actual length of cured-in-place pipe installed. The length shall be measured from center of manhole to center of manhole. The unit price per linear foot installed shall include all materials, labor, equipment and supplies necessary for the complete CIPP installation. Compensation for service connection sealing and pipe sealing at the manhole/wall interface shall be at the unit price bid in the Proposal.

The long-term structural capability of the existing underground pipeline is defined by the pipe design and the surrounding soil structure. When a CIPP is installed through an existing pipe that represents such defects as soil visible or soil missing, the engineer should consider that the soils be replaced using a flowable fill technique to provide soils support for the newly installed CIPP.

3.5 FLOWABLE FILL OF VOID AREAS

Where required by the owner, the contractor shall backfill voids that remain after installation of CIPP. The material shall be of the flowable fill type and shall be injected into the void while removing all trapped air from the void. The contractor shall submit the proposed method of placing the flowable fill, including pressures that will not collapse the CIPP and air release method to be employed, to the owner for review before any material is installed. The cost of this work shall be at the unit price bid for flowable fill complete and include all material, equipment and labor to complete the filling of the soil void.

3.6 MANHOLE CONNECTIONS AND RECONNECTIONS OF EXISTING SERVICES

The most common method of sealing the CIPP at manholes is to install a hydrophilic rubber seal prior to installing the CIPP. Sealing the CIPP at manholes after the CIPP has been installed is possible but less effective. Side connections should be cut open to at least 90%-95% of the original service connection opening area. In all cases, the invert of the lateral connection shall be cut flush with the invert entering the mainline to eliminate debris build-up.

A. A seal, consisting of a resin mixture or hydrophilic seal compatible with the installed CIPP, shall be applied at manhole/wall interface in accordance with the CIPP System manufacturer’s recommendations.

B. Existing services shall be internally or externally reconnected unless indicated otherwise in the contract documents.
C. Reconnections of existing services shall be made after the CIPP has been installed, fully cured, and cooled down. It is the Contractor's responsibility to make sure that all active service connections are reconnected.

D. External reconnections are to be made with a tee fitting in accordance with CIPP System manufacturer's recommendations. Saddle connections shall be seated and sealed to the new CIPP using grout or resin compatible with the CIPP.

E. A CCTV camera and remote cutting tool shall be used for internal reconnections. The machined opening shall be at least 90 percent of the service connection opening area and the bottom of both openings must match. The opening shall not be more than 100 percent of the service connection opening. The edges of the opening shall not have pipe fragments or CIPP fragments which may obstruct flow or snag debris. In all cases the invert of the sewer connection shall be cut flush with the invert entering the mainline.

F. In the event that service reinstatements result in openings that are greater than 100 percent of the service connection opening, the Contractor shall install a CIPP type repair, sufficiently in size to completely cover the over-cut service connection. No additional compensation will be paid for the repair of over-cut service connections.

G. Coupons of pipe material resulting from service tap cutting shall be collected at the next manhole downstream of the pipe rehabilitation operation prior to leaving the site. Coupons may not be allowed to pass through the system.

H. Compensation shall be at the actual number of services reconnected using either internal or external means as contained in the Proposal. The unit price bid per service line reconnected shall be include all materials, labor, equipment and supplies necessary to complete the work as required in these specifications.

3.7 TESTING OF INSTALLED CIPP

CIPP physical properties should be verified through field sampling and independent testing. Samples shall be taken from the line section installed and should be properly marked and transmitted to an independent testing laboratory or obtained from the project site by a laboratory representing the Owner. Test results should be transmitted from the laboratory to the owner's representative. Sampling should be in accordance with ASTM F 1216, and a chain of custody should be strictly maintained. Restrainted samples can be used for sewers of up to 18" in diameter or less. Plate samples are used for pipelines larger than 18" in diameter. A sample should be acquired for each section of CIPP installed.

A. The physical properties of the installed CIPP shall be verified through field sampling and laboratory testing. All materials for testing shall be furnished by the Contractor to the Owner for testing. All materials testing shall be performed at the Owner's expense.
by an independent third party laboratory selected by the Owner as recommended by the CIPP manufacturer. All tests shall be in accordance with applicable ASTM test methods to confirm compliance with the requirements specified in these contract documents.

B. The Contractor shall provide samples for testing to the Owner from the actual installed CIPP. Samples shall be provided from each section of CIPP installed or as required by the Owner. The sample shall be cut from a section of cured CIPP that has been inverted or pulled through a like diameter pipe which has been held in place by a suitable heat sink, such as sandbags. All curing, cutting and identification of samples will be witnessed by the Owner and transmitted by the Owner’s representative as specified, to the testing laboratory. On pipelines greater than 18 inches in diameter, the Owner may, at its discretion, require plate samples cured with the CIPP or designate a location in the newly installed CIPP where the Contractor shall take a sample. The Opening produced from the sample shall be repaired in accordance with manufacturer’s recommended procedures.

C. The laboratory results shall identify the test sample location as referenced to the nearest manhole and station. Final payment for the project shall be withheld pending receipt and approval of the test results. If properties tested do not meet the minimum physical and thickness requirements, the CIPP shall be repaired or replaced by the Contractor unless the actual physical properties and the thickness of the sample tested meet the design requirements as required in the contract.

D. Chemical resistance - The CIPP system installed shall meet the chemical resistance requirements of ASTM F1216 and ASTM D5813. CIPP samples tested shall be of the fabric tube and the specific resin proposed for actual construction. It is required that CIPP samples without plastic coating meet these chemical testing requirements. A certification may be submitted, by the contractor, from the manufacturer verifying that the chemical resistance of the CIPP meets the contract requirements.

E. Hydraulic Capacity - Overall, the hydraulic capacity shall be maintained as large as possible. The installed CIPP shall, at a minimum, be equal to the full flow capacity of the original pipe before rehabilitation. In those cases where full capacity cannot be
achieved after CIPP installation, the Contractor shall submit a request to waive this requirement together with the reasons for the waiver request. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.

F. The installed CIPP thickness shall be measured for each line section installed as per the ASTM requirements specified. If the CIPP thickness does not meet that specified in the contract and submitted as the approved design by the Contractor, then the CIPP shall be repaired or removed unless the tested physical properties and the thickness of the sample tested meet the design requirements as required in the contract. The CIPP thickness shall have tolerance of minus 5% - plus 10%. In worker-entry size piping, the Contractor shall remove a minimum of one sample every line section of installed CIPP to be used to check the CIPP thickness. The samples shall be taken by core drilling 2-inch diameter test plugs at random locations selected by the Owner. The openings produced from the samples shall be repaired in accordance with manufacturer’s recommended procedures.

For small diameter CIPP of 18” inch diameter or less, the restrained sample can be measured for thickness. In sewers larger than 18 inch diameter where flat plate samples are collected and tested, 2 inch core samples must be removed from the CIPP at the 12:00 o’clock position to check thickness. The core hole shall be repaired as recommended by the manufacturer.

G. All costs to the Contractor associated with providing cured CIPP samples for testing shall be included in the Lump Sum price bid for Mobilization. Payment for all testing by a laboratory will be paid for by the Owner directly to the laboratory under the lump sum Reserve for Testing item force bid in the Bid Proposal.

3.8 FINAL ACCEPTANCE

All sample testing and repairs to the CIPP should be completed. All test results must have been received from the independent laboratory and meet the contract specified requirements prior to final acceptance of the installed CIPP.

A. All CIPP sample testing and repairs to the installed CIPP, as applicable, shall be completed before final acceptance, meeting the requirements of these specifications and documented in written form.
Prior to conducting the final CCTV, the contractor should thoroughly clean the newly installed CIPP. Sewage flow in the line should be minimized, and any standing water in sags should be cleared. The CCTV visual quality of the final inspection shall be as specified in the contract. If the quality does not meet the specified requirements, the contractor shall re-CCTV those sections that are unacceptable.

B. The Contractor shall perform a detailed closed-circuit television inspection, in accordance with ASTM standards, in the presence of the Owner after installation of the CIPP and reconnection of the side sewers. A radial view (pan and tilt) TV camera shall be used. The finished CIPP shall be continuous over the entire length of the installation and shall be free of significant visual defects, damage, deflection, holes, leaks and other defects. Unedited digital documentation of the inspection shall be provided to the Owner within ten (10) working days of the CIPP installation. The data shall note the inspection date, location of all reconnected side sewers, debris, as well as any defects in the CIPP, including, but not limited to, gouges, cracks, bumps, or bulges. If post installation inspection documentation is not submitted within ten (10) working days of the CIPP installation, the Owner may at its discretion suspend any further installation of CIPP until the post-installation documentation is submitted. As a result of this suspension, no additional working days will be added to the contract, nor will any adjustment be made for increase in cost. Immediately prior to conducting the closed circuit television inspection, the Contractor shall thoroughly clean the newly installed CIPP removing all debris and build-up that may have accumulated at no additional cost to the Owner.

Final CCTV inspection should be performed using high pressure water to eliminate standing water in sags and bellies while the line is being televised.

Leakage can be determined through visual inspection (water or air installations), hydrostatic testing (water installations), air testing (air installations) or infiltration testing (water or air installations). For small diameter sewers installed with air pressure (UV cure or steam cure), it doesn’t make sense to do hydrostatic (exfiltration) testing for leakage. This leaves visual inspection or air testing as viable alternatives. If any leakage is detected through visual inspection, further air testing can be performed to determine if the leakage rate is acceptable.

For large diameter sewers, visual inspection for leakage is the most common method. Air and hydrostatic testing should not be performed for sewers greater than 36” diameter because of worker safety. Any unacceptable leakage through the CIPP wall should be repaired as required in the contract documents or agreed to by the owner.
C. Bypass pumping or plugging from the upstream manhole shall be utilized to minimize sewage from entering the line during the inspection. In the case of bellies in the line, the pipe shall be cleared of any standing water to provide continuous visibility during the inspection.

D. Where leakage is observed through the wall of the pipe, the contractor shall institute additional testing including, but not limited to, air testing, hydrostatic (exfiltration) testing, localized testing (such as a grout packer) or any other testing that will verify that the leakage rate of the installed CIPP does not exceed acceptable tolerances specified in the contract. As an alternative to further leakage testing, the contractor may choose to repair any observed leaks.

3.9 TYPICAL BID ITEMS

Additional items such as pre-liner and flowable backfill can be added to specific contracts requiring these items.

A. Mobilization – Lump Sum - Includes all PWS information, submittals, safety plan, as-built drawings, testing samples, mobilization/demobilization of labor, equipment and materials to the project site. Generally limited to 5% of the total amount bid for the project.

B. Pre-Installation CCTV Inspection – Per linear foot - Includes pre-cleaning and post cleaning CCTV for Owner review. Does not include CCTV inspection just prior to CIPP installation. All inspections will be performed by PACP trained and certified personnel.

C. Dye Testing of Service Connections – Per each - Includes dye testing and documentation of existing service connection on each pipe length to be lined.

D. Point Repairs – Per each or by Lump Sum Contingency - Includes excavation and restoration of a section or sections of pipe that are beyond rehabilitation using CIPP. Note: Point repair items shall be categorized by pipe size, a minimum length of excavation and depth category of excavation to be paid for in the Proposal. If point repairs are not identified in the contract documents, payment shall be on a contingency basis.

E. Standard Pipe cleaning – Per linear foot for each pipe size category – including all labor, equipment, materials and cost of material disposal.

F. Heavy Pipe Cleaning – Per linear foot for each pipe category – including all labor, equipment, materials and cost of material disposal.
G. Inspector training – Lump Sum – includes all labor, equipment and materials required to train the Owner’s inspectors on the technology to be installed for a period of two days.

H. Pre-liner Installation – per linear foot installed by size category. Includes all labor, equipment and materials required.

I. Reinforced Pre-liner Installation - per linear foot installed by size category. Includes all labor, equipment and materials required.

J. Liner Installation – Per linear foot for each pipe size category - Includes all labor, equipment and materials required for the complete installation of a CIPP.

K. Flowable Fill – per cu. yd. of material installed and documented including all labor, equipment and materials required for the complete backfilling of soil voids.

L. Traffic Control –Lump Sum – Includes all labor, equipment and materials required to implement a traffic control plan for the entire project and shall include all costs associated with sub-contracted traffic control specialists.

M. Sewage Bypass – Lump Sum – Includes all labor, equipment and materials required to implement a flow bypass plan for the entire project, including the cost of all sub-contracted flow bypass specialists.

N. Service Reconnections – Per each – Includes reconnecting existing live sewer service connections to the installed CIPP. Owner shall review and verify those connections that are not live and will be left unopened.

O. Service connection sealing – Per each – Includes sealing the interface between the installed CIPP and the host pipe at the location of the service connection.

P. Manhole/Wall Interface Sealing – Per each – Includes sealing the interface between the installed CIPP and the manhole wall.

Q. Post Construction CCTV Inspection - Per linear foot - Includes post lining CCTV for submission to the Owner. All inspections will be performed by PACP trained and certified personnel.

R. Reserve for Testing – Lump Sum Reserve – For Owners use to include testing required as directed by the Owner, under this contract, by an independent laboratory. (The amount will be set by the Owner in the Bid Proposal)

**END OF SECTION**
Thanks to the following participants for the development of this document:

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Disclaimer

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PART 1 - GENERAL

1.1 Description of work and product delivery

1.1 A. These Specifications include the minimum requirements for the rehabilitation of lateral connections and their interface with the main-line pipes via Cured-In-Place-Pipe (CIPP) as shown on the plans and included as part of these [contract documents]. The lateral seal will include an Owner specified length of lateral pipeline that will also be rehabilitated in conjunction with the lateral/mainline connection, as a one piece integrated system.

1.1 B. The rehabilitation of lateral connections and a portion of the lateral pipeline shall be accomplished by the installation of a Cured-In-Place-Pipe (CIPP) system installed from the main-line pipeline extending up the specified length of the lateral. The system may or may not require the use of cleanouts on the lateral pipeline. The installed system shall be free of all defects that will affect the design, service life and operation of the lateral interface with the main-line and the specified length of the lateral pipe.

1.1 C. The liner may be inverted or pulled into place from the mainline sewer.

1.1 D. The installed system shall eliminate water leakage into the sewer system over the entire rehabilitated length of sewer.

1.1 E. The prices submitted by the Contractor, shall include all costs for the various bid items necessary for furnishing and installing, complete and in place, the system in accordance with these specifications, except for those specified otherwise by the Owner.

1.1 F. The furnished and installed system shall include all materials, manufacturer’s recommended equipment and manufacturer’s installation procedures.

1.1 G. At the discretion of the Owner, the system manufacturer may submit to the Owner, a minimum of 14 calendar days in advance of a bid date, all required product information to obtain pre-approval system status. Those systems that have been pre-approved will not need to be re-submitted as required in the submittal section of these specifications unless any of the system components have changed from those pre-approved by the Owner. All other component products will be required to meet the submittal requirements as contained herein.

1.1 H. At the discretion of the Owner, the system installer may submit to the Owner, a minimum of 14 calendar days in advance of a bid date, all required qualifications information to obtain pre-approval system installer status. Those system installers that have been pre-approved will be allowed to bid on the specified project scope.

1.1 I. The installed system shall be free of all defects that will affect the design, service life and operation of the lateral and applicable portion of the main-line.

1.1 J. The installed system shall eliminate infiltration and ex-filtration over the entire length of the system.
1.1 K. The system shall be designed against corrosion and typical chemicals found in domestic sewage, unless otherwise specified in the detailed section of the contract documents. The manufacturer of the system shall provide testing data that supports the chemical resistance in accordance with ASTM F1216.

1.1 L. The mainline and lateral portion of the system shall be designed for Partially or Fully Deteriorated design conditions per ASTM F1216 as specified by the Owner. Partially deteriorated designs conditions assume the CIPP liner is designed to support groundwater loads, while fully deteriorated design conditions assume the CIPP liner is designed to structurally replace the host pipe completely. Wall thickness design calculations stamped by a registered professional engineer shall be submitted. All design must be supported by third party testing and documentation for the exact product that is being submitted.

1.1 M. Flow entering the lateral or main-line shall be bypassed if necessary for the installation of the system.

1.1 N. All materials furnished as part of this contract shall be marked with detailed product information, stored in a manner specified by the manufacturer and tested to the requirements of this contract.

1.1 O. Testing shall be executed by the owner or by the contractor in the presence of the owner. Testing requirements will be provided by the Owner.

1.1 P. Warranty inspections shall be executed by the Owner or its representative. Any defects found shall be repaired or replaced by the Contractor according to manufacturer’s recommendations.

1.2 Performance Work Statement (PWS) Submittal

1.2 A. The Contractor shall submit, to the Owner, a Performance Work Statement (PWS) package at a predetermined time set by the Owner, which clearly defines the proposed system delivery in conformance with the requirements of the contract documents.

1.2 B. Clearly indicate that the system will conform to the project requirements as outlined in the Description of Work, Scope of Work Included and as further delineated in these contract documents.

1.2 C. Certify at the time of the bid, that the designated items included in the contract documents were visited, inspected and evaluated by the Contractor or Contractor’s Representative, prior to submitting a bid.

1.2 D. Where the scope of work is specifically delineated in the contract documents, a detailed installation plan describing all preparation work, cleaning operations, pre-inspections, sewage flow maintenance, traffic control, installation procedure, method of curing, quality control, testing to be performed, final inspection, warrantees furnished and all else necessary and appropriate for a complete system installation, shall be submitted.
1.2 E. A detailed installation schedule shall be prepared, submitted and conform to the requirements of these contract documents.

1.2 F. The manufacturer’s description of the system materials is to be furnished for the project. Material descriptions shall be sufficiently detailed in the submittals to verify conformance to these specifications and/or shall conform to the pre-approved system submission.

1.2 G. The Contractor’s experience with the system proposed for use in this contract. The name and experience of each lead individual performing work on this contract shall be submitted. If personnel are substituted after bid submittal the name and experience of the individual shall be submitted to the Owner for approval before starting any work.

1.3 Submittals (after contract award)

1.3 A. Product data submittals required for all rehabilitation lateral lining systems proposed for installation under this contract shall include:

1. System material type and manufacturer to be used including: catalog data sheets, ASTM references, material composition, manufacturers recommended specifications, component physical properties and chemical resistance.

2. Manufacturer’s detailed description of the recommended procedures for handling and storing materials

3. Manufacturers detailed description of the recommended system installation process

4. Copies of independent testing performed on the CIPP liner composite verifying the product meets the requirements as specified in these contract documents and the manufacturers design.

5. By-Pass Pumping Plan if applicable to the system being installed.

6. Traffic Control plan, if applicable for the system being installed.

7. Certified statement, from the manufacturer, that the contractor/installer is an approved installer of the system with certificates of completed training for each crew member involved. This requirement shall comply with the specific system requirements specified in the contract documents

8. Submittal of all quality assurance documentation and test reports for system installed. (After Rehabilitation Completion)

9. CIPP wall thickness design calculations based upon ASTM F1216 assuming either Fully or Partially Deteriorated conditions, as specified by the owner. The designs will be stamped by a Professional Engineer if required by the Owner.

10. Wetout/cure logs per liner providing details pertaining to the resin type and quantity, catalyst type and quantity, tube type, installation pressures, temperatures
and times (as applicable to the curing lateral lining system utilized), and pertinent Owner/User project specific data.

11. Third party testing of the physical properties, corrosion resistance and sealing method.

12. Health and Safety plan detailing the site specific safety requirements.

13. Qualifications of the Contractor to install the system.

14. Qualifications of the proposed system to meet the requirements of the Contract.

1.4 Quality Control Plan (QCP)

1.4 A. A detailed quality assurance plan (QCP) shall be submitted to the Owner that fully represents and conforms to the quality control requirements of these specifications. At a minimum the QCP shall include the following:
   1. How the system is prepared for installation
   2. How the system is installed
   3. How the completed system is confirmed to be in compliance with the requirements of the Contract.
   4. Training/Qualifications of personnel preparing and installing the system

1.4 B. Proposed procedures for quality control, product sampling and testing shall be defined.

1.4 C. Proposed methods for product performance controls, including method of and frequency of product sampling and testing as applicable.

1.4 D. Proposed methods and procedures for system repair or replacement, (as defined in Section 1.6) in the event of product defects or failure.

1.5 Lateral Lining System repair/replacement

1.5 A. Due to defects in preparation and/or installation, systems will occasionally need to be repaired or partially replaced. The Manufacturer shall outline specific repair or replacement procedures for potential issues that may occur during the installation of the system. Repair/replacement procedures shall be as recommended by the system manufacturer and shall be submitted as part of the PWS.

1.5 B. Issues, that may not affect the operation and long term life of the product, shall be identified and defined by the Manufacturer.

1.5 C. Repairable issues that may occur in the system shall be specifically based on Manufacturer's recommendations, including a detailed step-by-step repair procedure, resulting in a finished product meeting the estimated life cycle of the component and requirements of these contract specifications.

1.5 D. Un-repairable issues that may occur in the system shall be clearly defined based on the Manufacturer's recommendations. The Contractor, together with the
manufacturer, shall define the best recommended procedure for the total removal and replacement of the system.

1.5 E. The Contractor shall receive no additional compensation for the repair or replacement of system deemed non-conforming to the requirements of these contract documents and unacceptable by the Owner.

1.6 Safety

1.6 A. The Contractor shall conform to all work safety requirements of pertinent regulatory agencies, and shall secure the site for working conditions in compliance with the same. The Contractor shall erect such signs and other devices as are necessary for the safety of the work site.

1.6 B. The Contractor shall perform all of the Work in accordance with applicable OSHA safety standards. Emphasis shall be placed upon the requirements for entering confined spaces.

1.6 C. The Contractor shall have on the job site at all times at a minimum the following safety equipment:

1. Gas monitor capable of testing and detecting for combustible gas, oxygen deficiency and hydrogen sulfide.
2. Confined space access and retrieval winch system.
3. Ventilating fans with large diameter ventilating hose.
4. Safety harness and life lines.
5. Other equipment as may be required for a specific project
6. All equipment to be available for use, in sufficient quantity, by the Contractor, Engineer and Owner for the duration of the project.

1.6 D. All entries into or work within confined spaces shall be conducted in accordance with the U.S. Department of Health and Human Services/National Institute for Occupational Safety and Health [DHHS (NIOSH)] Publication No. 87-113, A Guide to Safety in Confined Spaces.

1.7 Warranty

1.7 A. The materials used for the project shall be certified by the manufacturer for the specified purpose. The manufacturer shall warrant the SYSTEM materials to be free from defects in raw materials for one (1) year after installation or from the date of acceptance by the Owner, whichever is later. The Contractor shall warrant the system for a period of one (1) year.

1.8 Warranty Inspections

1.8 A. The Owner shall perform, at its own cost, warranty inspections with its own personnel or personnel independent of the installation contractor.

1.9 Measurement and payment

1.9 A. Typical bid items consist of:
1. Clean and CCTV of specified lateral, including specified length of lateral pipeline, per Each
2. Furnish and install system, including Owner specified length of CIPP lateral liner, per EA
3. Furnish and install CIPP lateral liner extending beyond item 2, per LF

1.9 B. Measurements for each item furnished and installed to the satisfaction of the Owner shall be at the units of measure contained in the Bid Proposal.

1.9 C. Payment for each item shall be in accordance with the contract documents at the unit or lump sum prices bid therefore in the Bid Proposal.

PART 2 - LATERAL LINING PRODUCTS

2.1 Lateral seals

2.1 A. General

1. The system seals the point of connection from a main-line pipe to a connecting lateral pipeline and is normally installed without excavation by the install of a resin-impregnated, flexible laminate installed into the existing service lateral, lapping over the main-line pipe, sealing the connection.

2. The system can be specified one of the following:
   (a) Tee/full wrap section with a full circumferential CIPP liner inside the main pipe and a tube which shall extend continuously from the sewer main into the lateral for an Owner specified distance
   (b) Flange/brim CIPP connection seal and tube which shall extend continuously from the sewer main into the lateral for an Owner specified distance.
   (c) A system that is similar to those listed above and acceptable to the Owner.

3. The system shall extend an Owner specified length into the lateral.

4. The Contractor will determine the need for a clean out on the lateral(s) specified for rehabilitation.

5. The system shall be capable of sealing a combination of “tees” and “wyes” of varying angles. The resin shall be cured to form the tube into a hard impermeable pipe-within-a-pipe.

6. When cured, the system shall seal the connection of the lateral to the mainline in a continuous tight-fitting, watertight pipe-within-a-pipe to eliminate any visible leakage between the lateral and mainline and shall provide a leak-proof seal to prevent root intrusion, infiltration, and ex-filtration between the liner and host pipe.
7. Systems that use polyester and vinylester resins shall include a method of sealing the connection and the end of the laterals liner as recommended by the manufacturer of the system. The product used in the sealing method shall be installed in accordance with manufacturer’s recommendations. The sealing method shall be tested by simulating groundwater pressure using a third party and stamped by an engineer.

8. Systems that use silicate or epoxy shall prepare the host pipe in accordance with manufacturer’s recommendations. Third party testing shall be provided to prove the bond strength between the resin and surface it is to bond to.

9. The installation of the system will require the product to be capable of installing without access to the upstream side of the lateral pipe and capable of navigating bends or other transitions in alignment as identified by the owner in the contract bid documents.

2.1 B. References

1. ASTM F1216 – Standard practice for rehabilitation of existing pipelines and conduits by the inversion and curing of a resin-impregnated tube.

2. ASTM F1743 – Standard practice for rehabilitation of existing pipelines and conduits by pulled-in-place installation of cured in place thermosetting resin pipe.

3. ASTM D543 – Practices for evaluating the resistance of plastics to chemical reagents.


5. ASTM D5813 – Specification for cured in place thermosetting resin sewer piping systems.

6. ASTM F2019 – Standard practice for rehabilitation of existing pipelines and conduits by the pulled in place installation of glass reinforced plastic (GRP) cured in place thermosetting resin pipe.

7. NASSCO Guideline Specification for the installation of cured in place pipe (June 2011).

8. NASSCO Guideline Specifications for cleaning and televising pipelines

2.1 C. Materials

1. Non-woven fabric tube
(a) The fabric tube shall consist of one or more layers of absorbent non-woven felt fabric, felt/fiberglass or fiberglass and meet the requirements of ASTM F 1216, ASTM F 1743, ASTM D 5813 & ASTM F2019. The fabric tube shall be capable of absorbing and carrying resins, constructed to withstand installation pressures and curing temperatures and have sufficient strength to bridge missing pipe segments, and stretch to fit irregular pipe sections.

(b) The wet-out fabric tube shall have a uniform thickness and excess resin distribution that when compressed at installation pressures will meet or exceed the design thickness after cure.

(c) The fabric tube shall be manufactured to a size that when installed will tightly fit the internal circumference, meeting applicable ASTM standards or better, of the original pipe or the existing lined pipe. Allowance shall be made for circumferential stretching during installation. The tube shall be properly sized to the diameter of the existing pipe and the length to be rehabilitated and be able to stretch to fit irregular pipe sections and negotiate bends. The Contractor shall determine the minimum tube length necessary to effectively span the designated run. The Contractor shall verify the lengths in the field prior to ordering and prior to impregnation of the tube with resin, to ensure that the tube will have sufficient length to extend the entire length of the run. The Contractor shall also measure the inside diameter of the existing pipelines in the field prior to ordering liner so that the liner can be installed in a tight-fitted condition.

(d) The outside and/or inside layer of the fabric tube (before installation) shall be coated with an impermeable, flexible membrane that will contain the resin and facilitate vacuum impregnation and monitoring of the resin saturation during the resin impregnation (wetout) procedure.

(e) No material shall be included in the fabric tube that may cause de-lamination in the cured CIPP. No dry or unsaturated layers shall be acceptable upon visual inspection as evident by color contrast between the tube fabric and the activated resin containing a colorant.

(f) The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made. The hue of the color shall be dark enough to distinguish a contrast between the fully resin saturated felt fabric and dry or resin lean areas.

(g) Seams in the fabric tube, if applicable, shall meet the requirements of ASTM D5813. H.

(h) The outside of the fabric tube shall be marked with the name of the manufacturer of the CIPP lateral lining system, manufacturing lot and/or production footage, as applicable. The print must be visible during final CCTV inspection.

(i) The minimum length of the fabric tube shall be that deemed necessary by the installer to effectively span the distance specified by the Owner.
(j) The nominal fabric tube wall thickness shall be constructed, as a minimum, to the nearest 0.5 mm increment. Wall thickness transitions, in 0.5 mm increments or greater as appropriate, may be fabricated into the fabric tube between installation entrance and exit access points. The quantity of resin used in the impregnation shall be sufficient to fill all of the felt voids for the nominal felt thickness.

(k) The liner shall be constructed with transitions where applicable.

2. Resin

(a) The resin shall be a corrosion resistant polyester, vinyl ester, silicate or epoxy resin and catalyst system and hardener system that, when properly cured within the tube composite, meets the requirements of ASTM F1216, ASTM F1743 or F2019, the physical properties herein, and those, which are to be utilized in the design of the CIPP for this project. The resin shall produce CIPP, which will comply with or exceed the structural and chemical resistance requirements of this specification.

(b) The method of cure may either be from a manufacturer recommended heat source, light cure or by ambient temperature. Method of cure instructions along with a cure log shall be on-site at all times.

(c) The resin to tube ratio, by volume, shall be furnished as recommended by the manufacturer.

3. Structural requirements

(a) The physical properties and characteristics of the finished liner will vary considerably, depending on the types of resin and tube used. It shall be the responsibility of the Contractor to provide a CIPP lateral lining system which meets or exceeds the minimum properties specified herein.

(b) The CIPP shall be designed per ASTM F1216. The CIPP design shall assume no bonding to the original pipe wall.

(c) The lateral CIPP shall be designed assuming the following minimum design data, unless otherwise modified by the Owner:

(i) Factor of Safety = 2
(ii) Soil Modulus = 1,000 psi
(iii) Soil Density = 120 pcf
(iv) Live Load = H20
(v) Depth of Cover = as specified
(vi) Groundwater = ½ depth of cover
(vii) Ovality = 2%

(d) The design engineer shall set the long term (50 year extrapolated) Creep Retention Factor at 50% of the initial design flexural modulus as determined
Performance Specification Guideline for Lateral Rehabilitation – Lateral Seals

by ASTM D-790 test method. This value shall be used unless the Contractor submits long term test data (ASTM D2990) to substantiate a different retention factor.

(e) The cured pipe material (CIPP) shall, at a minimum, meet or exceed the structural properties, as listed below.

(i) Flexural modulus of elasticity: 250,000 psi
(ii) Flexural strength: 4,500 psi

4. The structural performance of the finished pipe shall be adequate to accommodate all anticipated loads throughout its design life. No cured-in-place pipe rehabilitation technology will be allowed that requires bonding to the existing pipe for any part of its structural strength.

PART 3 - EXECUTION

3.1 Lateral seals

3.1 A. General

1. Lateral seals are typically installed from the lined main-line with a lateral CIPP portion that extends up the lateral at an Owner specified distance.

2. Clean-outs are recommended but not always required to successfully install a lateral seal. Clean-outs shall be installed at the Owners’ discretion. If the Owner decides clean outs are preferred, the owner shall specify the type of cleanout.

3.1 B. Preparation

1. Preparation, cleaning, inspection, sewage by-passing and public notification are the responsibility of the Contractor, with the assistance of the Owner. The Contractor shall clean the interior of the existing host pipe prior to installation of the system. All debris and obstructions, that will affect the installation and the final product shall be removed and disposed of. All preparation shall be in accordance with the manufacturer’s written installation procedures.

2. The system shall be constructed of materials and methods, that when installed, shall provide a jointless and continuous structurally sound CIPP able to withstand all imposed static and dynamic loads on a long-term basis, as specified by the Owner.

3. The Contractor may, under the direction of the Owner, utilize any of the existing manholes in the project area as installation access points or excavate access points at predetermined locations.

4. Pre-Cleaning CCTV – The Contractor shall request utility locating (as required by the Owner or local Government) to identify potential cross-bore utilities within the
proximity of the service lateral to be cleaned for rehabilitation, if applicable. Prior to cleaning, the Contractor shall to all extents possible, televise the service lateral to confirm that cleaning the lateral will not damage or breach a conflicting utility bored through the sewer lateral (such as natural gas or power) when the utility locate indicates a potential conflict.

5. Cleaning of Pipe Lines - The Contractor shall remove all internal debris from the pipe line that will interfere with the installation and the final product delivery of the system as required in these specifications. The Contractor shall make use of commercially available industry standard cleaning equipment to prepare the pipe for system installation. Solid debris and deposits shall be removed from the pipeline, if possible, and disposed of properly by the Contractor. Precaution shall be taken, by the Contractor in the use of cleaning equipment to avoid damage to the existing pipe. If the pipe cannot be cleaned sufficiently using industry standard cleaning equipment then additional cleaning will be considered changed conditions.

6. Post-Cleaning CCTV – Upon completion of the cleaning, the Contractor shall then perform a Post-Cleaning CCTV Inspection, which typically acts as the Pre-rehabilitation CCTV Inspection.

7. Existing Sewage Flows – The Contractor shall provide flow diversion or stoppage requirements to the owner to assist in developing plan including notifying upstream users to temporary stop using their water/wastewater during the system installation.

8. Bypass Existing Sewage Flows - When circumstances require continuous service, for the flow of the service connection (such as medical facilities or laboratories), the Contractor will install a temporary sewage by-pass system, if required by the Owner. Once the rehabilitation process has begun, existing sewage flows shall be maintained, until the system is fully installed. The Contractor shall coordinate sewer bypass and flow interruptions with the Owner at least 7 days in advance and with the property owners and businesses at least 1 business day in advance. The pump and bypass lines shall be of adequate capacity and size to handle typical flows.

9. Contractor shall perform post-cleaning video inspections of the pipelines. Only PACP certified personnel trained in locating breaks, obstacles and service connections by closed circuit television shall perform the inspection. The Contractor shall provide the Owner a copy of the pre-cleaning and post-cleaning video and suitable log, and/or in digital format for review prior to installation of the CIPP and for later reference by the Owner, if specifically required by the Owner.

10. Line Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions that will interfere with the installation and long-term performance of the system. If pre-installation inspection reveals an obstruction, misalignment, broken or collapsed section or sag that was not identified as part of the original scope of work and will prohibit proper installation of the system, the Contractor may be directed by the Owner to correct the problem(s) prior to installing the system by utilizing open cut repair methods. This work will be considered
changed conditions, or if there is an existing bid item for this work, the Contractor shall be compensated under the particular pay item designated for open cut point repairs.

11. The Contractor shall be responsible for confirming the locations of all branch service connections prior to installing and curing the CIPP. If required in the contract documents, each connection will be dye tested to determine whether or not the connection is live or abandoned. The cost for dye testing of existing service connections shall be compensated at the unit price bid. In the event the status of a service connection cannot be adequately defined, the Owner will make the final decision, prior to installation and curing of the liner, as to the status. Typically only service connections deemed “active” shall be reopened by the Contractor. Reinstatement in small diameter pipes typically requires a cleanout for external reinstatement.

12. The Contractor shall be allowed use water from an owner-approved fire hydrant in the project vicinity. Use of an approved double check backflow assembly shall be required, unless an open gap exists in the Contractor’s equipment. Contractor shall provide his own approved assembly. Contractor shall pay current market price for all water usage, unless otherwise specified by the Owner.

3.1 C. Install

1. The entire liner shall be wetout using vacuum impregnation including the lateral and mainline portions.

2. The system shall be loaded inside and/or on a pressure apparatus. The pressure apparatus, attached to a robotic device, shall be positioned in the mainline pipe at the service connection. The robotic device, together with a CCTV camera, shall be used to align the lateral portion of the system with the service connection opening. Air pressure, supplied to the pressure apparatus through an air hose, shall be used to invert or expand the resin impregnated CIPP into the lateral pipe, and push the main-line portion of the system against the main-line pipe (typically lined pipe). The pressure shall be adjusted to the manufacturer’s recommended installation pressure to fully install the CIPP into the lateral pipe and hold the system tight to the pipe walls. Care shall be taken during the curing process not to over-stress the tube.

3. After lateral CIPP installation is completed, manufacturer’s recommended pressure is maintained on the impregnated CIPP for the duration of the curing process. Curing method shall be compatible with the resin selected and shall be in accordance with manufacturer’s recommendations. The initial cure shall be deemed to complete when the CIPP has been exposed to the UV light, heat source or held in place for the time period specified by the manufacturer.

4. The Contractor shall cool (if heat cured) the hardened CIPP before relieving the pressure in the apparatus. Cool-down may be accomplished by the introduction of cool air into the pressure apparatus. Care shall be taken to maintain proper pressure throughout the cure and cool-down period.
5. If cured by ambient-cure process, the Contractor shall maintain bladder pressure until CIPP has completely cured per manufacturer’s recommendations before relieving the pressure in the pressure apparatus.

6. The finished CIPP shall be free of dry spots, lifts and de-lamination. The system shall not inhibit the closed circuit television post video inspection of the mainline or service lateral pipes. Frayed ends of the system shall be removed prior to acceptance.

7. Contractor shall maintain a visible, written log of all activities in accordance with manufacturers’ recommendations and shall include time/location of wet out, time of insertion, time/location of lateral insertion, bladder pressure requirements, required cure time, actual cure time, and cool down duration.

8. During the warranty period, any defects which will affect the integrity of strength of the system and allow leaks shall be repaired at the Contractor’s expense in a manner mutually agreed upon by the Manufacturer, City and the Contractor.

9. After the work is completed, the Contractor will provide the City with the specified video format showing the completed work including the restored conditions.

3.1 D. Finish

1. The installed system shall be continuous over the specified length of the sewer line section (including main-line and lateral) and be free from visual defects such as foreign inclusions, dry spots, pinholes, major wrinkles and de-lamination. The system shall be impervious and free of any leakage from the pipe to the surrounding ground or from the ground to inside the lined pipe.

2. Any defect, which will or could affect the structural integrity or strength of the system or allow leaks, shall be repaired at the Contractor’s expense,

3. The system shall provide a watertight seal at the connection to the main-line pipe and for the length of the lateral CIPP lined. The following methods/materials are recommended for ensuring a water tight seal:

   (a) 100% Solids Epoxy providing an adhesive bond between the system and the host pipe, installed/applied per the manufacturer’s recommendations.

   (b) Hydrophilic materials installed/applied per the manufacturer’s recommendations

4. Branch lateral connections or any other pre-existing connection to the service lateral shall be reinstated by a remote controlled robotic cutting device, either from within the pipeline or externally through a cleanout. The reinstated connection shall be brushed to allow for a smooth edge.

5. Cured samples of the CIPP may be required for testing physical properties in accordance with the requirements specified herein. The test shall be performed by
an independent 3rd party laboratory, if required by the Owner and as recommended by the system manufacturer.
MANHOLE REHABILITATION

PERFORMANCE SPECIFICATION GUIDELINE

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A. The rehabilitation of manholes can be complicated and the selection of the correct product or technology can, at times, be confusing. There are many methods available for the rehabilitation of manholes. Each method must be evaluated to determine its applicability to provide the correct solution for the best available price. The following steps can be taken to develop the best approach towards rehabilitation and what family of products best meet specific project requirements.

1. Thoroughly evaluate the condition of the manhole to be rehabilitated using the Manhole Assessment Certification Program (MACP) as developed by NASSCO for providing a uniform coding for the defects typically found in a manhole structure.

2. Define the type of defects as structural defects, operational & maintenance defects, construction features and other.

3. Based on the defined defects classify each manhole into the general rehabilitation technology or technologies to be considered. Technologies can be classified into general rehabilitation needs including grouting, cementitious reconstruction, polymer coatings/linings, cured-in-place lining, panel liners, mechanical seals and bench and channel inserts.

4. Select the correct solution based on the problems identified.

5. What are the problems being addressed?

6. Does the selected technology provide the desired long-term solution to the problem?

7. Does the selected technology go beyond solving the immediate need and if so, is there a reasonable cost for the added benefit?

8. Does the selected technology ensure compatibility of all materials being used to complete the repair?

9. Is the selected technology Contractor friendly? Is it relatively well suited for the project site conditions?

10. Select products and/or technologies that have viable, proven installation techniques.

11. Can the Contractor capabilities and experience be quantifiable during the bid process?

12. Can the qualifications of the personnel, working for the Contractor and applying the product be verified?

B. There are many products technologies and variations available. Only generic categories of technologies are included in these sample specifications. Technology and product applicability, to each project, should be verified by contacting the manufacturer of each product, and discussing the proposed application to verify product compatibilities. Supporting documentation and third party testing should always be reviewed prior to selection. In some cases multiple technologies will be required to totally rehabilitate the manhole structure. Products and Technologies are generally referred to herein as Rehabilitation Component Systems (SYSTEM’s) and include the following:
1. **Chemical Grouting** – Generally used when the existing manhole is structurally sound but has leakage or I&I problems. Grout types and longevity in different soil conditions must be verified through the grout manufacturer.

2. **Cementitious Manhole Restoration** – Cementitious materials can be Portland Cement, Microsilica enhanced, Calcium Aluminate, or Geopolymer based. The Geopolymer, Calcium Aluminates and Microsilica cements typically have a higher resistance to corrosion and typically attain high structural strength after curing which facilitates top-coating in a relatively short period of time. Standard Portland cements typically require a 28 day cure before top coating. Cementitious materials can be trowelled, sprayed, spun cast or poured in place. This type of technology is generally used for structural reconstruction, elimination of I&I and prevention against low levels of corrosion. In some cases, cementitious materials are used as a base coating to level or smooth out the existing structure surface before applying a polymer top coat.

3. **Polymers (Epoxy, Polyurethane, Polyurea Coatings)** – Generally used for corrosion protection and to eliminate I&I. Epoxies and urethanes can have structural benefit when applied sufficiently thick. When applying multiple components to rehabilitate a manhole it is extremely important that all components are compatible with each other and each is properly cured and prepared before the application of the next product. Application of polymers on new manhole and concrete structures requires specific attention to off-gassing of the concrete causing unwanted pin-holing in the material during and immediately after application. As a general rule, cured concrete will off-gas air when the structure temperature is rising and will inhale when the concrete temperature drops. New or green concrete typically off-gasses almost continually and often requires penetrating primers to densify the surface prior to coating application. The Manufacturer of each system should be contacted to determine what the effect off-gassing has on the product and the best procedures for the application of polymers directly onto new concrete structures. The Contractor should be experienced in coating both new and old concrete structures.

4. **Cured-In-Place Liners** – Generally used for structural reconstruction of a manhole, I&I removal and corrosion protection. The process includes the installation of a specifically designed fabric liner, saturated with a thermosetting resin, that is heat cured under pressure and molded tightly to fit the inside shape of the existing manhole.

5. **Panel Liners** – Generally non-structural liners used for corrosion protection and elimination of I&I. Usually installed in the form of panels, thermally welded at the seams and mechanically anchored or glued to the manhole wall using a special adhesive.

6. **Chimney Seals** – Used for defects in the adjustable portion of the manhole. Seals can be used as a stand-alone product or in conjunction with a cementitious or polymer product. Seals can be applied both internally and externally to the manhole structure and can be comprised of polymer applied, cured-in-place or rubber mechanical composition.
7. Barrel Joint Seals – Includes joints between pre-cast manhole sections where leaking joints are contributing groundwater infiltration and no structural deficiencies are present.

8. Bench and Channel Inserts - Preformed corrosion resistant inserts installed in the bench and channel of the manhole.

9. Dish Inserts – Manhole opening cover. Prevents water from entering through the manhole cover holes.

References:
NASSCO Manhole Assessment Certification Program (MACP) - A certification program administered by NASSCO to train manhole inspection personnel on the standard coding of defects found in the manhole structure.

PART 1 - GENERAL

A. These Specifications include the minimum requirements for the rehabilitation of manholes as shown on the plans included as part of these [contract documents].

B. The rehabilitation of manholes shall be accomplished by the application or installation of rehabilitation components either individually or together. These may include grouts, protective coatings, a variety of linings, inserts, seals and mechanical devices that, when installed, shall protect the manhole structure, seal it from I & I, rebuild it structurally (if needed) and provide chemical resistance for the length of time specified. Several manhole components such as frames, covers and steps will typically be replaced rather than rehabilitated. The Contractor is responsible for the accurate and complete installation, and warranty of each manhole Rehabilitation Component System (SYSTEM) specified by the Owner.

C. The manhole SYSTEM’s installed shall cause no adverse effects to any of the Owner’s processes or facilities either during or after application. The use of the product, by the Contractor, shall not result in the formation or production of any detrimental compounds or by-products at the wastewater treatment plant. The Contractor shall notify the Owner and identify any by-products produced as a result of the installation operations, test and monitor the levels, and comply with any and all local waste discharge requirements. The Contractor shall cleanup, restore existing surface conditions and structures, and repair any of the manhole SYSTEM’s installed and determined to be defective. The Contractor shall conduct installation operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians, businesses, and property owners or tenants.

D. The prices submitted by the Contractor, shall include all costs of permits, labor, equipment and materials for the various bid items necessary for furnishing and applying, complete in place, manhole SYSTEM’s, in accordance with these specifications. All items of work not specifically mentioned herein which are required
to make the product perform as intended and deliver the final product as specified herein shall be included in the respective lump sum and unit prices bid in the Proposal. These Specifications include the minimum requirements for the rehabilitation of manholes defined herein and as shown on the plans included as part of these contract documents.

1.1 DESCRIPTION OF WORK AND PRODUCT DELIVERY

A. These Specifications cover all work necessary to furnish and install, a variety of protective manhole SYSTEM’s. The Contractor shall deliver a finished product(s) including all materials, labor, equipment, and services necessary for traffic control, bypass pumping and/or diversion of sewage flows, cleaning equipment, product installation, all quality controls and samples for performance of required material tests, final inspection and warranty work, all as specified in these contract documents and at the quantities of each component contained in the Bid Proposal.

B. The SYSTEM’s furnished shall be complete integrated and compatible systems including all materials, manufacturer’s recommended equipment and manufacturer’s installation procedures. The SYSTEM manufacturer may submit to the Owner, a minimum of 14 calendar days in advance of a bid date, all required product information to obtain pre-approval SYSTEM status. Those SYSTEM’s that have been pre-approved will not need to be re-submitted as required in the submittal section of these specifications unless any of the system components have changed from those pre-approved by the Owner. All other component products will be required to meet the submittal requirements as contained herein.

C. The SYSTEM’s installed shall be free of all defects that will affect the design and service life and operation of the manhole.

D. The SYSTEM installed shall eliminate water leakage into the manhole and prevent water or vapors to leak out of the manhole through pin-holes or other defects. If leakage occurs either in or out of the manhole the Contractor shall seal these areas to stop all leakage using a material compatible with the SYSTEM applied and as specified by the manufacturer. If leakage occurs through any SYSTEM applied to the manhole, the SYSTEM shall be repaired or removed as recommended by the manufacturer. All repair materials shall have the same estimated life expectancy than the SYSTEM installed. Final approval of the SYSTEM installation will be based on meeting the acceptance test requirements for each SYSTEM applied/installed.

E. The SYSTEM (applied to the intended structure) shall be designed against corrosion and typical chemicals found in domestic sewage, unless otherwise specified in the detailed section of the contract documents. The manufacturer of the SYSTEM shall provide testing data that supports their SYSTEM’s design and service life.
F. SYSTEM’S may be designed to rehabilitate the existing manhole against corrosion, I&I structural build-back, or a combination of the three. In certain cases the preparation, certification and submission of design calculations by a registered professional engineer is required for manhole replacement and rehabilitation technologies. All design must be supported by third party testing and documentation for the exact product that is being submitted.

1. A manhole is specified to be structurally replaced, being able to sustain all earth, hydrostatic and dynamic loading without support by the existing structure. Certification and submission of design calculations by a registered professional engineer is required
2. A manhole is specified to be structurally rebuilt, with build-back materials, or rehabilitated to sustain hydrostatic loading by groundwater. Certification and submission of design calculations by a registered professional engineer is required
3. A manhole is specified to receive a corrosion protective coating sufficiently thick to totally protect the existing host structure from further corrosion, deterioration and water vapor transmission. Certification and submission of design calculations by a registered engineer may be required
4. A manhole is specified to receive a coating to renew mortar or other deteriorated components of a manhole but has no specified longevity or corrosion resistance requirement. The manufacture’s third party testing will be acceptable for application suitability.
5. A manhole is specified to receive patch repair materials for portions of the manhole. The manufacture’s third party testing will be acceptable for application suitability.

G. All manhole steps shall be removed prior to a coating or lining application.

H. Flow from existing active service connections entering the manhole shall be maintained or bypassed if the flow will affect proper SYSTEM application/installation.

I. All component materials furnished, as part of this contract shall be marked with detailed product information, stored in a manner specified by the manufacturer and tested to the requirements of this contract.

J. Testing shall be executed by the owner or by the contractor in the presence of the owner. Warranty inspections shall be executed by the Owner or its representative. Any defects found shall be repaired or replaced by the Contractor.

K. The Contractor shall furnish all samples for product testing as required in the contract documents. The Owner shall take possession of the samples for testing and shall maintain a chain of custody, deliver the samples and pay an approved laboratory for all material and product testing performed under this contract.
L. Compensation for all work required for providing test samples shall be included in the various SYSTEM items contained in the Bid Proposal.

1.2 SCOPE OF WORK INCLUDED

A. A detailed description of each SYSTEM included in the contract, complete with estimated quantities.

1.3 PERFORMANCE WORK STATEMENT (PWS) SUBMITTAL

A. The Contractor shall submit, to the Owner, a Performance Work Statement (PWS) at the pre-construction meeting, which clearly defines the proposed manhole SYSTEM delivery in conformance with the requirements of these contract documents. Unless directed otherwise by the Owner, the PWS shall at a minimum contain the following:

B. Clearly indicate that the SYSTEM will conform to the project requirements as outlined in the Description of Work, Scope of Work Included and as further delineated in these contract documents.

C. Certify at the time of the bid, that the designated manholes, included in the contract documents, were visited, inspected and evaluated by the Contractor or Contractor's Representative, prior to submitting a bid.

D. Where the scope of work is specifically delineated in the contract documents, a detailed installation plan describing all preparation work, cleaning operations, pre-inspections, sewage flow maintenance, traffic control, installation procedure, method of curing, quality control, testing to be performed, final inspection, warrantees furnished and all else necessary and appropriate for a complete SYSTEM application/installation, shall be submitted.

E. A detailed installation schedule shall be prepared, submitted and conform to the requirements of these contract documents.

F. The manufacturer's description of the SYSTEM materials are to be furnished for the project. Material descriptions shall be sufficiently detailed in the submittals to verify conformance to these specifications and/or shall conform to the pre-approved SYSTEM submission.

G. The Contractor's experience for each type of rehabilitation component shall be as more specifically delineated in the detailed specifications. The name and experience of each lead individual performing work on this contract, for each component, shall be submitted with the PWS. If personnel are substituted after submittal of the PWS, the name and experience of the individual shall be submitted to the Owner for approval before starting any work.
H. Engineering design calculations may be requested for verification of structural design submittals. These calculations shall be in accordance with the applicable ASTM or industry standard for each structural design component/system to be installed. These calculations shall be performed and certified by a registered Engineer.

I. Information on the SYSTEM and all tools and equipment required for a complete application/installation, shall be submitted. The PWS shall identify which tools and equipment will be redundant on the job site in the event of equipment breakdown. The Contractor shall outline the mitigation procedure to be implemented in the event of key equipment failure during the installation process.

J. A detailed description of the Contractor’s proposed procedures for cleaning and preparing the manhole structure, prior to applying/installing the SYSTEM shall be submitted as part of the PWS. The Contractor will describe in detail what substrate testing will be performed by the contractor to verify acceptability of the SYSTEM material to be applied.

K. Compensation for all work required for the SYSTEM submittal of the PWS shall be included in the Mobilization Item contained in the Bid Proposal.

1.4 SUBMITTALS

A. Product data submittals required for all rehabilitation SYSTEM’s proposed for installation under this contract shall include:

1. SYSTEM material type and manufacturer to be used including: catalog data sheets, ASTM references, material composition, manufacturers recommended specifications, component physical properties and chemical resistance. (PWS)

2. Manufacturer’s detailed description of the recommended procedures for handling and storing materials including a proposed method for monitoring temperatures of the storage location, if applicable to the specific SYSTEM material. (PWS)

3. Manufacturers detailed description of the recommended material installation/application process including mixing, additives, set time, cure time (return to service) and all equipment required for quality product delivery. (PWS)

4. Technical data sheet describing each rehabilitation component to be applied/installed, stating the expected longevity of the component in a wastewater environment. Data shall be based on independent third party tests. (PWS)

5. Manufacturer's detailed description of all required field testing processes and procedures. (PWS)

6. Copies of independent testing performed on the rehabilitation component, indicating that the product meets the requirements as specified in these contract documents and the manufacturers design. (PWS)
7. Technical data sheet and project specific data for manhole repair materials to be used in conjunction with each rehabilitation component(s) including application cure time and surface preparation procedures. (PWS)  
8. Certification that backup installation equipment is available on the job site or can be delivered to the job site by the morning of the next business day. (PWS)  
9. Shipping information including: (Jobsite)  
   a. Shipped item, including manufacturer, stock and lot number  
   b. Date shipped including origination and delivery locations  
   c. Shipping method and carrier  
   d. All shipping, storage and safety requirements including MSDS documents.  
   e. Date delivered to project site including name and signature of receiver  
10. By-Pass Pumping Plan if applicable to the SYSTEM’s being installed. (PWS)  
11. Traffic Control plan, if applicable for the SYSTEM’s being installed.  
12. Certified statement, from the manufacturer, that the contractor/installer is an approved installer of the SYSTEM with certificates of completed training for each crew member involved in each rehabilitation component. This requirement shall comply with the specific SYSTEM requirements specified in the contract documents. (PWS)  
13. For each manhole rehabilitation, a complete and accurate record of all SYSTEM’s installed/applied shall be prepared by the Contractor. The record shall include identifying manhole number, location, quantities of rehabilitation components installed.  
14. Submittal of all quality assurance documentation and test reports for SYSTEM’s installed. (After Rehabilitation Completion)  
15. Compensation for all work required for product submittals and the submittal of a By-Pass Pumping Plan and a Traffic Control Plan shall be included in the Mobilization Item contained in the Bid Proposal.  
16. Refer to section 1.1.F for design requirements.  

1.5 QUALITY CONTROL PLAN (QCP)  

A. A detailed quality assurance plan (QCP) shall be submitted to the Owner that fully represents and conforms to the quality control requirements of these specifications. At a minimum the QCP shall include the following:  

B. A detailed description of the proposed quality controls to be performed by the Contractor.  

C. Defined responsibilities, of each of the Contractor’s personnel, for assuring that all quality control requirements, for this contract, are met. These shall be assigned, by the Contractor, to his specific personnel.  

D. Proposed procedures for quality control, product sampling and testing shall be defined.
E. Proposed methods for product performance controls, including method of and frequency of product sampling and testing both in raw material form and cured product form as applicable.

F. A scheduled performance and product test result reviews between the Contractor and the Owner at a scheduled job meeting.

G. Inspection forms and guidelines for quality control inspections shall be prepared in accordance with the standards specified in this contract and submitted with the QCP.

H. Inspector training, by a qualified trainer, for the Owner’s inspectors shall be provided as further defined in Section 1.9. This training shall be prior to SYSTEM installation, include both technical and field training and include all key aspects of visual inspection and sampling procedures for testing requirements. On smaller projects having an estimated duration of less than two (2) weeks of rehabilitation work, the system manufacturer shall furnish a check list containing key elements of the SYSTEM criteria, represented in the QCP, for the Owner’s representative to ensure that quality control and testing requirements are performed in accordance with the contract documents.

I. Proposed methods and procedures for SYSTEM repair or replacement, (as defined in Section 1.6) in the event of product defects or total failure.

1.6 SYSTEM REPAIR/REPLACEMENT

A. Due to mechanical damage or defects in application, SYSTEM's will occasionally need to be repaired or replace a portion of the installed product. The Manufacturer shall outline specific repair or replacement procedures for potential issues that may occur during the application of the SYSTEM. Repair/replacement procedures shall be as recommended by the SYSTEM Manufacturer and shall be submitted as part of the PWS.

B. Issues, that may not affect the operation and long term life of the product, shall be identified and defined by the Manufacturer.

C. Repairable issues that may occur in the SYSTEM shall be specifically based on Manufacturer’s recommendations, including a detailed step-by-step repair procedure, resulting in a finished product meeting the estimated life cycle of the component and requirements of these contract specifications.

D. Un-repairable issues that may occur in the SYSTEM shall be clearly defined based on the Manufacturer’s recommendations. The Contractor together with the manufacturer shall define the best recommended procedure for the total removal and replacement of the SYSTEM.
E. The Contractor shall receive no additional compensation for the repair or replacement of SYSTEM’s deemed non-conforming to the requirements of these contract documents and unacceptable by the Owner.

1.7 REFERENCES

A. ASTM and other applicable standard documents, that are listed in the detailed specifications, are made a part of these specifications by reference to the extent stated herein and shall be the latest edition thereof. Where there are differences between codes, standards and these specifications, these specifications shall govern.

1.8 DELIVERY, STORAGE AND HANDLING

A. Rehabilitation component materials are to be kept dry, protected from weather and stored under cover and in accordance with manufacturer's recommendations.

B. Polymer and Cementitious protective coating materials are to be stored at temperatures as recommended by the manufacturer and handled according to their material safety data sheets. Do not store near flame, heat or strong oxidants.

1.9 INSPECTOR TRAINING

A. The Contractor shall provide training by a manufacturer's approved trainer for the Owner's representatives/inspectors on the specific product being installed.

B. The inspector training shall include sufficient amount of classroom time to instruct the inspector’s on the basic concepts of the technology and what aspects are important to review and inspect in the field while the SYSTEM is being installed by the Contractor. The inspector training shall also include a sufficient amount of time to instruct the inspectors on what needs to be inspected in the field, what needs to be inspected for each SYSTEM and what documentation is needed to verify that the SYSTEM has been installed in accordance with the contract documents.

C. Compensation for inspector training shall be at the number of days specified and the unit price Bid in the Proposal.

1.10 SAFETY

A. The Contractor shall conform to all work safety requirements of pertinent regulatory agencies, and shall secure the site for working conditions in compliance with the same. The Contractor shall erect such signs and other devices as are necessary for the safety of the work site.
B. The Contractor shall perform all of the Work in accordance with applicable OSHA safety standards. Emphasis shall be placed upon the requirements for entering confined spaces and with the equipment being utilized for manhole rehabilitation components. Confined space, defined as any space having one or more of the following characteristics:
1. Limited openings for entry and exit.
2. Unfavorable natural ventilation.
3. Not designed for continuous worker occupancy.

C. The Contractor shall have on the job site at all times at a minimum the following safety equipment:
1. Gas monitor capable of testing and detecting for combustible gas, oxygen deficiency and hydrogen sulfide.
2. Confined space access and retrieval winch system.
3. Ventilating fans with large diameter ventilating hose.
4. Supplied air respirator, MSHA/NIOSH approved type.
5. Safety harness and life lines.
6. Other equipment as may be required for a specific project.
7. All equipment to be available for use, in sufficient quantity, by the Contractor, Engineer and Owner for the duration of the project.

D. All entries into or work within confined spaces shall be conducted in accordance with the U.S. Department of Health and Human Services/National Institute for Occupational Safety and Health [DHHS (NIOSH)] Publication No. 87-113, A Guide to Safety in Confined Spaces.

E. The Contractor shall submit a proposed Safety Plan to the Owner, as part of the PWS and prior to beginning any work, identifying all competent persons, equipment and operating procedures. The plan shall include a description of a daily safety program and daily safety meeting for the job site and all emergency procedures to be implemented in the event of a safety incident. All work shall be conducted in accordance with the Contractor’s submitted Safety Plan.

F. Compensation for all work required for the submittal of the Safety Plan shall be included in the Lump Sum item for Mobilization contained in the Bid Proposal.

1.11 WARRANTY

A. The materials used for the project shall be certified by the manufacturer for the specified purpose. The manufacturer shall warrant the SYSTEM to be free from defects in raw materials for one (1) year after installation or from the date of acceptance by the Owner, whichever is later. The Contractor shall warrant the installation of the rehabilitation component for a period of one (1) year. During the one (1) year warranty period if the rehabilitation component, fails, delaminates, peels or
shows any defect, which may materially affect the integrity, strength, function and/or operation of the manhole structure, it shall be immediately repaired at the Contractor’s expense in accordance with procedures included in Section 1.6 Rehabilitation Component Repair/Replacement.

B. After a manhole has been renewed and for a period of time up to one (1) year following completion and final acceptance of the project, the Owner may inspect all or portions of the renewed manholes. The specific locations will be selected at random by the Owner and will include all types of structures from this project.

C. If any of the rehabilitation components have developed defects since the time of "Quality Assurance And Testing," the defects shall be repaired and/or the component shall be replaced as defined in Section 1.6 Rehabilitation Component System (SYSTEM) Repair/Replacement. Owner may inspect all manholes where SYSTEM’s have been applied/installed under this contract.

D. All verified defects shall be repaired and/or replaced by the Contractor and shall be performed in accordance with Section 1.6 Rehabilitation Component System Repair/Replacement and per the original specifications, all at no additional cost to the Owner.

1.12 WARRANTY INSPECTIONS

A. Visual inspection to determine integrity of SYSTEM materials and water-tightness will be conducted within 3 months before the expiration of the guarantee period.

B. If possible, inspection should be performed in the spring during high groundwater and frequent rainfall events.

C. The Owner shall perform, at its own cost, warranty inspections with its own personnel or personnel independent of the installation contractor.

D. Ten (10) percent of manholes rehabilitated shall be inspected, at locations randomly selected, by the Owner.
   1. No infiltration or inflow shall be visible in the renewed manhole.
   2. If any SYSTEM fails the warranty inspection, the Owner shall inspect all SYSTEM’s installed in the contract, together with Contractor.

1.13 MEASUREMENT AND PAYMENT

A. Measurements for each item furnished and installed to the satisfaction of the Owner shall be at the units of measure contained in the Bid Proposal. Manhole coatings and linings will be measured over the entire installed length. Coating and/or lining of the channel shall be at the Lump Sum price per each bid therefore in the Proposal.
B. Payment for each SYSTEM furnished and installed, in accordance with the contract documents and to the satisfaction of the Owner, will be at the unit or lump sum prices bid therefore in the Bid Proposal.

PART 2 - REHABILITATION COMPONENT SYSTEM PRODUCTS

A. The SYSTEM’S defined herein include those identified as commercially accepted methods for manhole rehabilitation. Methods or products not defined herein must be pre-approved by the Owner before use on this project under these specifications.

2.1 CHEMICAL GROUTS

A. REFERENCES
   ASTM F2414-03 Standard Practice for Sealing Sewer Manholes Using Chemical Grouting

B. CHEMICALGROUT TYPES
   1. The Contractor shall specifically define the type of chemical grout that will be furnished for the project. Depending on the specific application either Acrylic or Acrylate Based Grout or Urethane Based Grout shall be furnished. The type of grout to be used shall be in accordance with the manufacturer’s recommendation for the specific application area of the project.
   2. Contractor shall deliver materials to job site in undamaged, unopened containers bearing manufacturer's original labels. Materials used as chemical grout shall be transported, stored, mixed and applied in manner prescribed by the manufacturer of the specified materials, as detailed in published data provided by manufacturer.

C. MATERIALS
   1. Contractor shall provide a chemical sealant solution containing principal chemical sealant constituent, initiator (trigger) and catalyst specifically recommended for the purpose of sealing leaks in manholes. Chemical sealant constituent, initiator (trigger) and catalyst shall be compatible when mixed. Solution shall have ability to tolerate dilution and react in moving water. After final reaction, it shall be a stiff, impermeable, yet flexible gel. The grout proportions shall be such that dilute aqueous solutions, when properly catalyzed will form stiff gels. Materials provided shall gel in a predetermined time period when exposed to normal groundwater pH ranges, and be capable of formula adjustments to compensate for changing conditions. Final reaction shall produce a continuous, irreversible, impermeable stiff Gel and shall not be rigid or brittle.
   2. The grout shall exhibit the following properties:
a. Controllable reaction times and shrinkage through the use of chemicals supplied by the same manufacturer. The minimum set time shall be established so that adequate grout travel is achieved.
b. Resistance to chemicals, to most organic solvents, mild acids and alkali.
c. The grout shall be non-toxic in its cured form.
d. Sealing material shall not become rigid or brittle when subjected to a dry environment. The material shall be able to withstand freeze/thaw and moving load conditions as verified by third party testing.

3. The Contractor shall identify the type of grout and additives used on the contract and furnish references of successful use in similar applications. The Contractor shall select the choice of materials based on chemical and physical properties and expected performance for the requirements of the contract documents.

4. Grout conditions may be adjusted for catalyzing the reaction, inhibiting the reaction, lowering the freezing temperature the grout solution, adding fillers, providing strength or for inhibiting root growth according to the instructions of the grout manufacturer and in the specified quantities as recommended by the grout manufacturer.

D. MIXING & HANDLING
1. Mixing and handling of chemical grout, which may be toxic under certain conditions, shall be done in such a manner as to minimize any hazard to personnel and shall be in accordance with the manufacturer’s recommendations. It is the responsibility of the Contractor to provide appropriate protective measures to ensure that chemicals are handled only by trained and authorized personnel. All equipment used to install the grout shall be as recommended by the manufacturer and only personnel thoroughly familiar with all aspects of the grouting material and meeting the qualification requirements specified herein, shall perform the actual grouting operation.

2.2 CEMENTITIOUS MANHOLE RESTORATION

A. REFERENCES
ASTM F2551 Standard Practice for Installing a Protective Cementitious Liner System in Sanitary Sewer Manholes
ASTM C150 Standard Specification for Portland Cement Type I
ASTM C33-86 Standard Specification for Concrete Aggregates
ASTM C78 Standard Test Method for Flexural Strength of Concrete; Using Simple Beam with Third Point Loading
B. GENERAL
1. The Contractor shall provide a cementitious restoration material designed for structural build-back, I&I abatement, corrosion resistance, and repairing inverts to design requirements. All materials applied to a structure shall be compatible, as specified by the manufacturer.

C. MANHOLE REPAIR MATERIALS
1. Infiltration Control – Cementitious Material
   a. All fast setting materials furnished shall be designed specifically for leak control, to be applied in dry powder form, with no prior mixing of water, directly to active leaks under hydrostatic pressure in manholes or related structures, in accordance with the manufacturer’s recommendations.

2. Infiltration Control - Oakum Water Plugs
   a. Rapid setting, oil free oakum and hydrophilic grout to seal active water leaks prior to applying other SYSTEM’s
   b. Oil-free oakum meeting Federal Specification HH-P-117
   c. Two-part urethane resin.

3. Invert Repair and Patching
   a. All material furnished, by the Contractor, shall be designed to fill large voids in manhole walls and to repair or reconstruct inverts where no hydrostatic
pressure exists. Material shall consist of rapid setting cements, monocrystalline quartz aggregates, and various accelerating agents. Material shall not contain chlorides or metallic particles and shall be applied in accordance with the manufacturer’s recommendations.

b. Repair and Patching Materials shall have its bond strength tested to substrate failure according to ASTM C952 and be compatible with all other material components applied to the manhole.

4. Grouting mix:
   a. For stopping severe infiltration, the Contractor shall provide a polymer solution that reacts freely with water to form a strong film, gel, or foam of polyurethane. See specification section 2.1 Grouts.

5. Cementitious Coating Restoration Materials for manhole walls, channels, corbels, chimneys and benches. The Contractor shall install cementitious restoration materials that shall be specifically designed for the rehabilitation of manholes and other related wastewater structures. Liner materials shall be cement based, poly-fiber reinforced, shrinkage compensated, and enhanced with chemical admixtures and siliceous aggregates. Liner materials shall be mixed with water per manufacturer’s written specifications and applied using equipment specifically designed for, troweling, low-pressure spray or centrifugal spin casting application. All cementitious liners shall be troweled to densify and smooth out the surfaces. The liner thickness shall be 1/2 inch or as recommended by the manufacturer whichever is greater.

6. Refer to section 1.1.F for design requirements.

2.3 CAST-IN-PLACE CONCRETE RESTORATION

A. GENERAL
   1. This method includes a formed in place seamless concrete manhole within the existing manhole extending from the manhole bench to the frame, utilizing an internal forming system for forming a new and structurally independent wall within the existing structure conforming generally to the existing inside and shape of the manhole.

   2. The new interior wall shall have a cross-sectional dimension of sufficient thickness to be structurally independent and allow for the maximum new finished inside diameter. It shall be constructed of high strength ready mix concrete and specifically designed to be applicable for municipal and industrial sewer collection systems.

B. REFERENCES
   ASTM C-39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
   ASTM C-94 Standard Test Method for Ready-Mix Concrete
   ASTM C-143 Standard Test Method for Slump of Hydraulic Cement Concrete

C. MATERIALS
   1. Concrete - The concrete shall be Type I&II Portland cement concrete with 5/8 inch minus coarse aggregate with fiber reinforcement and plasticizers. Other
formulations and filler materials may be selected to meet specific needs as recommended by the manufacturer.

D. FORMWORK
   1. Segmented forms in cylindrical and conical sections
   2. Provide adequate annular space for concrete.
   3. Finished manhole opening shall not be less than 20 inches
   4. The liner shall be sealed at the existing bench and pipe openings to form a long term water-tight connection.
   5. Removable from within new cast concrete manhole wall.

E. PLASTIC INTERIOR WALL SURFACE
   1. Provide PVC or Polyethylene liner on new manhole interior wall surface.
      a. Refer to section 1.1.F for design requirements.
      b. Ribbed or studded for embedment into the concrete liner.
      c. Fit securely to exterior of concrete forms.
      d. Heat fuse or extrusion weld seams

2.4 POLYMER SYSTEMS

A. REFERENCES
   ASTM D543 - Resistance of Plastics to Chemical Reagents.
   ASTM D638 - Tensile Properties of Plastics.
   ASTM D695 - Compressive Properties of Rigid Plastics.
   ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics.
   ASTM D2240 - Standard Test Method for Rubber Property—Durometer Hardness
   ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abrader
   ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages
   ASTM D7234 - Pull-off Strength of Coatings Using a Portable Adhesion Tester.
   SSPC SP-13/NACE No. 6 – Surface Preparation of Concrete
   NACE SP0188 - For performing holiday detection
   CIGMAT - Evaluation of Liner System for Wastewater Concrete and Clay Brick Facilities
   ASTM G210 - Severe Wastewater Analysis Test

B. EXISTING SUBSTRATE PREPARATION
   1. Standard Portland cement or new concrete (not quick setting high strength cement) must cure a minimum of 28 days prior to application of the coating product(s).
   2. Remove existing coatings prior to application of the SYSTEM which may affect the performance and adhesion of the SYSTEM.
3. Thoroughly clean, removing all laitance and prepare existing products to effect a mechanical bond with the SYSTEM.


C. REPAIR AND RESURFACING PRODUCTS
   1. Repair products shall be used to fill voids, bug holes, and/or smooth transitions between components prior to the installation of the SYSTEM. Repair materials must be properly cured and must be compatible with the SYSTEM and shall be used and applied in accordance with the manufacturer’s recommended requirements.
   2. Resurfacing products shall be used to fill large voids, lost mortar in masonry structures, smooth deteriorated surfaces and to rebuild severely deteriorated structures.
   3. The following products may be accepted and approved as compatible repair and resurfacing products for use within the specifications:
      a. 100% solids, solvent-free polymer grout specifically formulated for epoxy polymer top coating compatibility.
      b. Factory blended, rapid setting, high early strength, fiber reinforced, non-shrink repair mortar that can be trowelled or pneumatically spray applied maybe approved if specifically formulated to be suitable for polymer top coating with the specified polymer product. The length of resurfacing material cure required before polymer top-coating, shall be as recommended by the manufacturer.
      c. All repair and resurfacing materials should be properly cured and prepared for surface top-coat application.

D. COATING PRODUCTS
   1. Refer to section 1.1.F for design requirements.

E. SYSTEM APPLICATION
   1. Polymer System manufacturer shall provide System application procedures and requirements.
   2. Manufacturer recommended and approved application equipment.
   3. Hard to reach areas, primer application and touch-up may be performed using hand tools.

2.5 CURED-IN-PLACE MANHOLE LINERS
A. REFERENCES
   ASTM D-638-03 Standard Test Method for Tensile Properties of Plastics
   ASTM D695-02a Standard Test Method for Compressive Properties of Rigid Plastics
B. PRE-MADE LINERS
1. Pre-Made liners can be custom fabricated and can accommodate a variety of manhole shapes and sizes.
2. The liner is designed and fabricated for each specific manhole and must be installed in that manhole.

C. TUBE LINERS
1. The tube liner system includes a constant diameter tube design that is stretched to fit a range of manhole sizes and lengths.
2. The tube typically consists of stretchable resin absorbing textile material.

D. MATERIALS
1. Manhole interior walls and benches shall be patched with compatible patching/plugging compounds as specified elsewhere herein. Manhole interior surfaces shall have all defects such as leaks, holes, mortar joints, bug holes, etc. patched with compatible cementitious patching/plugging compounds as specified elsewhere herein.
2. Channel reconstruction cement shall be as specified elsewhere herein.
3. As a minimum the manhole liner systems shall be composed of a multiple layered composite consisting of felt, an impervious membrane, and fiberglass as required.
4. The fibrous layer will be impregnated with a polymer resin. Add fiberglass and resin, for additional liner thickness.
5. Refer to section 1.1:F for design requirements.

2.6 COMPOSITE LINER
(Fiberglass Reinforced Epoxy Composite)

A. The protective liner shall be a multi layered composite comprised of layers of epoxy and fiberglass/carbon fiber cloth, hand crafted, constructed in place and cured at ambient temperature.

B. Manhole interior surfaces shall have all defects such as leaks, holes, mortar joints, bug holes, etc. patched with cementitious patching/plugging compounds as specified elsewhere herein.

C. Manhole invert channels shall be reconstructed with cements as required and specified elsewhere herein.
D. Manhole corbel and joints shall be surface prepped and resurfaced to an even and nearly smooth profile with cements as required and specified elsewhere herein.

2.7 CONCRETE PROTECTIVE LINERS

A. REFERENCES
ASTM C579 - Compressive Strength of Chemically Setting Silicate and of Shotcrete
ASTM C307 - Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings
ASTM D412-06a Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
ASTM D638 - Standard Test Method for Tensile Properties of Plastics
ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D4833-00e1 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D4787 Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates
ACI 506.2-77 - Specifications for Materials, Proportioning, and Application Silica Chemical Resistant Mortars.

B. HIGH DENSITY POLYETHYLENE (HDPE)
1. Protective liners shall be integrally extruded complete with anchoring studs. The minimum thickness of liner sheet with anchoring studs and the joint overlaps shall be recommended by the manufacturer. All joints shall be sealed using thermal welding as recommended by the manufacturer.
2. HDPE Material Properties. Manufacturer shall submit design for minimum density, elongation, and abrasion resistance.
   a. Minimum annular space clearance when filling with flow-able concrete or grout shall be as required by manufacturer.
   b. Anchor bolt penetration of concrete in manhole wall shall be to manufacturer specifications.
   c. Countersink screws to mount liner to profiles
3. Manufacturer shall submit Cement and Grout material requirements to fill annular space between the liner and the manhole wall.

C. POLYVINYL CHLORIDE (PVC) PROTECTIVE SHEET LINERS
1. The minimum liner thickness shall be determined by the manufacturer.
2. All joints and seams to be thermally sealed as recommended by the manufacturer.
3. Manufacturer Refer to section 1.1.F for design requirements.
4. Apply primer and two part mastic to seal liner to manhole wall.
2.8 FRP MANHOLE INSERTS

A. REFERENCES
   ASTM D3753-05e1 Standard Specification for Glass-Fiber Reinforced Polyester Manholes and Wet Wells

B. WALL CLEANING
   1. Wall Cleaning as recommended by manufacturer

C. BENCH-FORMING AND REPAIR MATERIALS
   1. Concrete shall be Type V, in accordance with the manufacturers recommendations.
   2. Leak repair material as recommended by the manufacturer

D. FRP INSERT MATERIAL
   1. Inserts shall comply with ASTM D3753 and the following:
      a. Inserts shall be single piece barrel and [concentric] [eccentric] reducer construction without seams, joints, or sections, comprised of chopped strand and continuous fiber glass reinforcement within isophthalic polyester resin containing finely-graded sand. Materials shall be resistant to corrosive attack from sanitary sewage and sewer gases including sulfuric acid and shall satisfy the 100,000 hour criterion in ASTM D 3753.
      b. Interior and exterior surfaces shall be relatively smooth and be free of sharp projections and protruding glass fibers. No blisters or de-laminations shall be visible.
      c. Inserts shall be sized to fit inside existing manholes and allow grade rings and frame between the top and finish grade. Wall thickness shall provide for an AASHTO H-20 load rating and wall stiffness of 36psi minimum.
   2. Sealants
      a. A sealant, as recommended by the manufacturer shall be inserted between the FRP reducer and frame
      b. Sealant between FRP insert and the surfaces of the manhole base shall be a quick-setting grout as recommended by the manufacturer.
   3. Grout
      a. Grout shall meet the specifications as required by the manufacturer.

2.9 MANHOLE CHIMNEY SEALS

A. REFERENCES
   ASTM C923-07 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
   ASTM D412-06a Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers -Tension
   ASTM D638-03 Standard Test Method for Tensile Properties of Plastics
B. GENERAL
1. Manhole frame sealing includes the sealing of the frame joint area and the chimney above the cone of the manhole with either a manufactured or applied internal flexible seal.
2. The seal shall be designed to prevent leakage of water into the manhole.

C. MECHANICAL FRAME SEAL MATERIAL
1. The flexible sleeve portion of the seal shall be extruded or molded from a high quality rubber compound, which conforms to the resilient material properties prescribed in ASTM C 923 Table 1.
2. The sleeve shall have an unexpanded vertical height sufficient to seal the entire grade adjustment area and be corrugated or pleated to allow for vertical and horizontal movement.
3. The upper and lower sections of the sleeve that compress against the frame casting, and manhole chimney or cone shall have an expansion band recess capable of restraining the band during expansion and after installation.
4. Any extension used in conjunction with the sleeve to increase chimney coverage shall be manufactured of the same material in conformance with ASTM C923, Table 1 and be designed with an extension flap which fits into or behind the expansion band recess allowing for joining the components with an expansion band.
5. The expansion bands used for compressing the sleeve and extensions against the manhole shall be fabricated stainless steel, conforming to the applicable section 4.2 of ASTM C 923. The manufacturers mechanism used to expand the bands shall have the capacity to develop sufficient pressure to create a watertight seal. The bands shall be permanently held in the expanded position with a positive locking mechanism that conforms to the applicable section 4.2 of ASTM C 923.
6. The installed internal seal or its appurtenances shall not extend far enough into the manhole opening to prevent or unduly restrict manhole entry. If the seal is constructed of another flexible material, it shall have both tensile and tear strength

ASTM D395-03 Standard Test Methods for Rubber Property - Compression Set
ASTM D695-02a Standard Test Method for Compressive Properties of Rigid Plastics
ASTM D2240-05 Standard Test Method for Rubber Property - Durometer Hardness
ASTM D638-03 Standard Test Method for Tensile Properties of Plastics
equal to or greater than that of the natural or synthetic rubber when tested in accordance with the applicable ASTM procedures.

7. Physical Properties
   a. Extruded or molded from a high grade rubber compound as per ASTM C923.

8. The installed seal shall remain flexible, to allow for repeated vertical movements of the frame due to frost lift, ground movement, or other causes and/or repeated horizontal movement of the frame due to thermal movement of pavement or other causes.

D. POLYMER CHIMNEY SEAL
   1. Polymer manhole chimney seals shall be designed to prevent leakage of water into the manhole through the frame joint area and the area above the manhole cone including all extensions to the chimney area. Extensions shall include but are not limited to lifting rings, brick and/or block material that may have been used to achieve grade.
   2. The polymer chimney seal material shall be corrosion resistant.
   3. Mil thickness shall be determined by the manufacturer. Refer to section 1.1.F for design requirements.
   4. The polymer chimney seal may require a primer resin applied to the entire surface before application. The sealing system shall line the interior of the adjustment area from the cone/top of the manhole and onto the inside of the casting. If the manhole has been relined prior to the seal installation the seal shall cover a minimum of 6 vertical inches to cover casting cone interface.

E. CURED-IN-PLACE CHIMNEY SEAL
   1. The liner shall be continuous in length and consist of one or more layers of a stretchable absorbent textile material and resin. The liner is designed to prevent I&I, withstand hydrostatic pressures, bridge missing mortar or brick segments, withstand multiple freeze/thaw cycles, and conform to the contours of the existing structure. The saturated liner shall have uniform thickness and have excess resin distribution that when compressed at installation pressures will meet or exceed the design thickness after cure.
   2. The exposed layer of the stretchable liner shall be coated with an impermeable, translucent, flexible membrane. The liner shall be marked correlating to the address or manhole identification number, and date of installation.
   3. The liner shall be a one-piece assembly sewn in the shape of a tube at a predetermined length to seal the casting and to overlap onto the cone/corbel. The sewn seams shall be sealed using a tape compatible with the liner coating. The liner wall thickness shall be uniform throughout. The liner will be capable of conforming to offset bricks and grade rings, missing mortar gaps, and disfigured and deteriorated chimneys.
   4. The resin system shall be a corrosion resistant silicate resin containing 100% solids and no VOC’s. The resin system contained within the stretchable liner, when
properly cured, shall form a tenacious mechanical bond with properly prepared surfaces and withstands multiple freeze/thaw cycles without cracking.

5. Refer to section 1.1.F for design requirements.

F. COMPOSITE CHIMNEY SEAL

1. The protective liner shall be a multi layered composite comprised of layers of epoxy and fiberglass cloth, hand crafted, constructed in place and cured at ambient temperature to mitigate curing stresses. The liner, when cured, shall prevent I & I by withstanding hydrostatic pressure as well as conforming to the shape and bonding tightly to the chimney substrate.

2. The chimney interior surfaces shall have all defects such as leaks, holes, mortar joints, bug holes, etc. patched with compatible patching/plugging compounds as specified elsewhere herein for use in manholes and compatible with the epoxy contained in the fiberglass or carbon fiber cloth.

3. The chimney seal shall, when cured, create a monolithic liner which ties the casting and the length of the chimney together with the first 3 inches of the corbel.

2.10 REPLACE MANHOLE FRAME AND COVER

A. REFERENCE

ASTM A48/A48M-03 Standard Specification for Gray Iron Castings Class 35B
AASHTO Standard Specifications for Highways and Bridges

B. CONDITION

1. The manhole casting shall be free from sand or blow holes and other defects. The machine bearing surfaces of the frame and cover shall have even bearing.

2.11 MANHOLE ADJUSTMENT MATERIALS

A. REFERENCE

ASTM D4976-06 Standard Specification for Polyethylene Plastics Molding and Extrusion Materials
AASHTO Standard Specifications for Highways and Bridges

B. MATERIALS

1. Manhole frame adjustments shall be HDPE, PVC, EPP, rubber, brick, block, cement or poured concrete as shown in detail on the contract documents.

2. Measurement shall be by vertical linear inch of adjustment materials provided and/or installed.

3. Payment shall be at the price per vertical linear inch or as a lump sum as stated in the bid documents.

2.12 MANHOLE STEPS
A. REFERENCES
ASTM C478-07 Standard Specification for Pre-cast Reinforced Concrete Manhole Sections
ASTM A615/A615M-07 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
AASHTO M199

B. MATERIAL
1. Reinforcing bar manhole steps shall conform to the minimum requirements of ASTM C478, Para, 11. The reinforcing bar shall be grade 60, deformed 1/2inch reinforcing bar conforming to the requirements of ASTM A615

PART 3 - EXECUTION

A. GENERAL
1. Maintain all flow in the manhole throughout duration of project.
2. Provide 48 hour notice to the Owner prior to start of work for Inspector to review and document materials and equipment to be used, for Quality Assurance and testing requirements.

B. CONTRACTOR EXPERIENCE
1. Current documentation, from the SYSTEM product manufacturer, certifying that the Contractor’s training, the Contractor’s personnel and equipment comply completely with their product Quality Assurance requirements.
2. For a manhole coating or lining product to be considered for this project, a minimum of 1000 vertical feet of documented manhole rehabilitation must have been completed by the Contractor in the previous three (3) year period.
3. For all SYSTEM products, to be considered for this project, a minimum of a three (3) year successful installation history must be documented.
4. In all cases a minimum of five (5) recent verifiable references of the Contractor’s work is required, indicating the successful application of the SYSTEM products of the same material type as specified herein or to be furnished by the Contractor and applied in a similar project environment as included in these contract specifications.

C. MANHOLE PREPARATION
1. Bypass Pump sewage, in the manhole, as required
2. Clean interior surfaces of manhole of debris, dirt, oil, grease, remains of old coating materials, and any other extraneous materials.
3. Pressure wash manhole walls to remove loose mortar, concrete and debris. Pressure washing levels, used for cleaning, shall be as recommended by the manufacturer.
4. Repair irregularities in manhole using materials, compatible with proposed resurfacing material, as recommended by the manufacturer.
5. Repair leakage in manhole using materials, compatible with proposed resurfacing material, specified in these contract specifications.

6. Trim and grout incoming laterals and pipes as required and/or specified.

7. Remove debris from manhole and incoming sewer connections.
   a. Handle cleaning water to prevent water and residue from causing damage.
   b. Do not discharge debris downstream through the sanitary sewer system.
   c. Filter solids-laden water through a de-silting device.
   d. Properly dispose of debris and residue from cleaning and other construction operations in a manner satisfactory to Owner and authority having jurisdiction over area where work site is located.

3.1 CHEMICAL GROUT

A. GENERAL
   1. Grouting should only be performed on a structurally sound manhole unless the grout is used to prevent water from entering the manhole during application of a lining or coating system. All structural repairs, adjustments to the frame and cover and installation of grade rings shall be completed prior to beginning the grouting operation. Normal grouting operations shall be performed at the temperatures as recommended by the manufacturer.

B. CHEMICAL GROUTING APPLICATION
   1. Grouting applications may include sealing a manhole from infiltration/Inflow prior to application of a coating or lining or other structural rehabilitation component or using the grout for sealing the entire manhole structure. If the entire manhole is to be sealed, grouting shall include corbel, wall, pipe seals, bench and invert as recommended by the manufacturer of the grouting material.

C. DRILLING AND GROUT INJECTION
   1. Drilling grout injection holes in the manhole in strategic locations to re-direct flow coming through cracks and other defects in the wall, or to seal the entire exterior surface of the manhole, shall be in accordance with the recommendations of the grout manufacturer.
   2. Grout shall be injected through the drilled holes using the recommended probe and applying pressures that will effectively inject the grout but, not cause damage to the manhole structure or the surrounding area.
   3. Grout typically, shall be injected through the lowest holes first, working the grout higher until the manhole is externally sealed with grout. Additional holes may be required to verify that the grout has encompassed the entire outside of the manhole.
   4. The injection holes shall be cleaned and patched as recommended by the manufacturer.
D. TESTING AND ACCEPTANCE
   1. Visual inspection – all leakage into the manhole must be eliminated.

3.2 CEMENTITIOUS RESTORATION

A. GENERAL
   1. Before starting any patch work or liner application install a perforated device, catch bucket, or other straining device to prevent construction debris from entering downstream pipes.
   2. Provide all materials, labor, equipment, etc. required to perform the work as recommended by the manufacturer and as required by the contract documents.
   3. Inspect each manhole to determine methods of stopping leaks and applying patch repairs.
   4. Promptly inform Owner of errors or discrepancies between the contract documents and the field conditions found, in order that changed conditions can be evaluated and revised directives issued in a timely manner.
   5. Install all products in accordance with manufacturer’s instructions regarding surface preparation, product application and curing.
   6. Confirm that all material to be used, for the rehabilitation of the manhole are compatible with each other. Do not use any materials that have not been verified for compatibility.

B. SEALING ACTIVE LEAKS
   1. The work consists of hand applying a dry quick-setting cementitious mix designed to instantly stop running water or seepage in all types of concrete and masonry structures. The applicator shall apply material in accordance with manufacturer’s recommendations in accordance with the following minimum specifications.
      a. The area to be repaired must be clean and free of all debris per the guidelines set forth elsewhere in these specifications.
      b. Once cleaned, prepare crack or hole by chipping out loose material to a minimum depth recommended.
      c. As recommended by the manufacturer, place a generous amount of the dry quick-setting cementitious material to the active leak, with a smooth fast motion, maintaining external pressure for 30 seconds, repeat until leak is stopped.
      d. Proper application should not require any special mixing of product or special curing requirements after application.
      e. Use of Oil-free Oakum Water Plugs.
         1) Saturate oakum with resin following approved submittals.
         2) Use additives as required.
         3) Place and cure following manufacturer’s recommendations.

C. INVERT REPAIR
1. The work consists of hand mixing and applying a rapid setting, high early strength, non-shrink patching material to fill all large voids and repair manhole channels prior to spray lining of the manhole. For invert repairs, flow must be temporarily restricted by inflatable or mechanical plugs prior to cleaning.
   a. The area to be repaired must be cleaned and free of all debris per the guidelines set forth in Section A, 1 Manhole Cleaning and Preparation.
   b. Mix water shall be clean potable water and require no additives or admixtures for use with cementitious patching materials.
   c. Cementitious material shall be mixed in a mortar tub or 5 gallon pail with water per manufacturer’s specifications. Material should be mixed in small quantities, to avoid setting prior to placement in voids or channels.
   d. Once mixed to proper consistency, the materials shall be applied to the invert or void areas by hand or trowel. In invert applications, care should be taken to not apply excessive material in the channel, which could restrict flow. Once applied, materials should be smoothed either by hand or trowel in order to facilitate flow.
   e. Flows in channels shall be re-established when material has cured enough to withstand the flow as determined by the manufacturer.

D. APPLICATION OF CEMENTITIOUS MANHOLE LINER
1. The work consists of troweling, spray applying and/or centrifugally spin-casting a cementitious based liner to the inside of the existing manhole. The necessary equipment and application methods to apply the cementitious based liner materials shall be only as recommended and approved by the material manufacturer.
2. Material shall be mixed with water in accordance with manufacturer’s specifications. Once mixed to proper consistency, the materials shall be pumped via a rotor-stator style progressive cavity pump through a material plaster hose for delivery to the appropriate and / or selected application device. The equipment shall be as recommended by the manufacturer, matched for the material being applied.
3. If a chimney seal is required in conjunction with the lining technology, the Contractor should contact the chimney seal manufacturer to determine the proper preparation required for effectively installing the chimney seal after the coating has been applied and cured.

E. SPRAY APPLICATION OF THE CEMENTITIOUS MATERIAL.
1. All material shall be applied and finished, by the Contractor, using equipment specified by the manufacturer.
   a. Material hose shall be coupled to a low-velocity spray application nozzle. Pumping of the material shall commence and the mortar shall be atomized by the introduction of air at the nozzle, creating a low-velocity spray pattern for material application.
   b. Spraying shall be performed by starting at the manhole invert and progressing up the wall to the corbel and chimney areas.
c. Material shall be applied to a specified uniform minimum thickness as required by the manufacturer and as necessary for proper curing and application. Material shall be applied to the bench area in such a manner as to provide for proper drainage.

d. Material shall be troweled smooth to compact material into voids. A brush or broom finish may be applied when a top coating is desired.

F. SPIN CASTING APPLICATION OF THE CEMENTITIOUS MATERIAL

1. All material shall be applied and finished by the Contractor using equipment specified by the manufacturer.

a. Material hose shall be coupled to a high speed rotating applicator device. The rotating casting applicator shall then be positioned within the center of the manhole at either the top of the manhole chimney or the lowest point elevation corresponding to the junction of the manhole bench and walls.

b. The high speed rotating applicator shall then be initialized and pumping of the material shall commence. As the mortar begins to be centrifugally cast evenly around the interior of the manhole, the rotating applicator head shall be raised and / or lowered at a controlled retrieval speed conducive to providing a uniform material thickness on the manhole walls.

c. Controlled multiple passes are then made until the specified minimum finished thickness is attained. If the procedure is interrupted for any reason, simply stop the retrieval of the applicator head until flows are recommenced.

d. Material thickness may be verified at any point with a depth gauge and shall be no less than a uniform ½-inch. If additional material is required at any level, the rotating applicator head shall be placed at that level and application shall recommence until that area is thickened.

e. Material shall be applied only when manhole is in a saturated surface dry (SSD) state, with no visible water dripping or running over the manhole walls.

f. The low-velocity spray nozzle and the centrifugal spin casting head may be used in conjunction to facilitate uniform application of the mortar material to irregularities in the contour of the manhole walls and bench areas.

g. Troweling of materials shall begin immediately following the spray application. Initial troweling shall be in an upward motion, to compress the material into voids and solidify manhole wall. A brush or broom finish may be applied if top coating is desired.

h. Curing will take place once the manhole cover has been replaced. It is important that the manhole cover is replaced no more than 10-20 minutes after troweling is complete to avoid moisture loss in the material due to sunlight and winds.

i. Material shall not be applied during freezing weather conditions. Material shall not be placed when the ambient temperature is 37 degrees Fahrenheit and falling or when the temperature is anticipated to fall below 32 degrees Fahrenheit during 24 hours.
G. TESTING AND ACCEPTANCE
   1. Visual inspection – verify no infiltration, cracks, or loose material.
   2. Vacuum Testing, as required in the contract documents
   3. Cementitious Material Physical Property Testing

3.3 CAST-IN-PLACE CONCRETE LINER

A. PREPARATION
   1. The Contractor shall employ adequate cleaning to remove loose material and
debris from the manhole. Existing steps which 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.
   2. If a chimney seal is required in conjunction with the lining technology, the
Contractor should contact the chimney seal manufacturer to determine the proper
preparation required for effectively installing the chimney seal after the liner has
been installed and cured.

B. EQUIPMENT
   1. 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 shape of the existing manhole.

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, as specified. The finished opening shall have a minimum
diameter of 20 inches.
   3. The form shall be positioned, sealed and finished at the manhole 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. The bench shall receive an overlay of concrete as proposed by the Contractor at
a minimum thickness as specified.
   7. Prior to installation of the new concrete wall, a water stop 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.

D. FINISH
1. The resultant concrete interior wall shall be smooth and free of honeycomb and areas of segregated aggregate.

E. CLEANUP
1. Upon completion, the Contractor shall clean up the work site and properly dispose of any excess material or debris.

F. SAFETY
1. The assembled internal manhole 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.

G. TESTING AND ACCEPTANCE
1. Visual Inspection
2. Vacuum Testing, as specified in the contract documents
3. Material Physical Property Testing during and after installation

3.4 POLYMER LINERS

A. GENERAL
1. Contractor shall comply with local, state and federal regulatory and other applicable agencies with regard to environment, health and safety during work.
2. New Portland cement concrete structures shall have cured a minimum of 28 days since manufacture prior to commencing coating installation or as recommended by the manufacturer.
3. Any active flows shall be dammed, plugged or diverted as required to ensure all liquids are maintained below or away from the surfaces to be coated.
4. Temperature of the surface to be coated should be maintained between 40 deg F and 120 deg F or as recommended manufacturer.
5. Specified surfaces should be shielded to avoid exposure of direct sunlight or other intense heat source. Where varying surface temperatures do exist, coating application shall be scheduled when the temperature is falling and not rising or as recommended by the manufacturer.
6. Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify Owner, in writing, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

B. SURFACE PREPARATION
1. Oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants which may affect the performance and adhesion of the coating to the substrate shall be entirely removed.
2. Concrete and/or mortar damaged by corrosion, chemical attack or other means of degradation shall be removed so that only sound substrate remains.

3. Choice of surface preparation method(s) should be based upon the condition of the structure and concrete or masonry surface, potential contaminants present, access to perform work, and required cleanliness and profile of the prepared surface to receive the specified polymer coating product, as recommended by the manufacturer.

4. Surface preparation methods or combination of methods that may be used include high pressure water cleaning, high pressure water jetting, abrasive blasting, shot blasting, grinding, scarifying, detergent water cleaning, hot water blasting and others as described in NACE No. 6/SSPC SP-13. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound clean neutralized surface with sufficient profile to promote an acceptable bond with the specified polymer coating.

5. Infiltration shall be stopped by using a material which is compatible with the repair products and is suitable for top-coating with the epoxy coating product. The manufacturer shall verify the product compatibility, in writing, to the Owner.

6. Manhole Chimney Joint and Casting: The area between the manhole and the manhole ring and the manhole casting shall be a termination point of the specified epoxy coating product.

C. APPLICATION OF REPAIR AND RESURFACING PRODUCTS

1. Areas where reinforcing bars have been exposed shall be repaired in accordance with the manufacturer’s recommendations.

2. Areas where rebar has been exposed and is corroded shall be first prepared as required elsewhere in these specifications. The exposed rebar shall then be abrasive blasted and coated with the polymer coating product specified as recommended by the manufacturer.

3. Repair products shall be used to fill voids, bugholes, and other surface defects which may affect the performance or adhesion of the epoxy coating product.

4. Resurfacing products shall be used to repair, smooth or rebuild surfaces with rough profiles to provide a concrete or masonry substrate suitable for the polymer coating product to be applied. These products shall be installed to minimum thickness as recommended within the manufacturer’s published guidelines. Should structural rebuild be necessary, these products shall be installed to a thickness as specified in the contract documents. Structural rebuild should be specified in advance of bid whenever feasible, and paid for at a separate unit price in the Bid Proposal.
   a. Repair and resurfacing products shall be handled, mixed, installed and cured in accordance with manufacturer recommendations.
   b. All repaired or resurfaced surfaces shall be inspected for cleanliness and suitability to receive the coating product(s). Additional surface preparation may be required prior to coating application.
5. If a chimney seal is required in conjunction with the lining technology, the Contractor should contact the chimney seal manufacturer to determine the proper preparation required for effectively installing the chimney seal after the coating has been applied and cured.

D. APPLICATION OF POLYMER COATING PRODUCT
1. Application procedures shall conform to the recommendations of the epoxy coating product manufacturer, including environmental controls, product handling, mixing, application equipment and methods.
2. Spray equipment shall be specifically designed to accurately ratio, apply the polymer coating product, shall be in proper working order and shall be as recommended by the product manufacturer.
3. Contractors qualified in accordance with these specifications shall perform all aspects of polymer coating product installation.
4. Prepared surfaces shall be coated by spray application of the coating product(s) described herein to a minimum as recommended by the manufacturer to meet the requirements of these contract documents.
   NOTE: Coating thickness recommendations are available through the polymer coating product manufacturer based upon project assessment. Contact the manufacturer of the polymer coating for project specific recommendations.
5. Subsequent top coating or additional coats of the polymer coating product shall occur within the product’s recoat time. Additional surface preparation procedures will be required if this recoat time is exceeded. The polymer manufacturer’s re-coat time for the specific application, based on temperature and project conditions, shall be strictly followed by the applicator.
6. The polymer coating product shall mechanically bond with adjoining construction materials throughout the manhole structure to effectively seal and protect concrete or masonry substrates from infiltration and attack by corrosive elements. Procedures and materials necessary to effect this bond shall be as recommended by the polymer coating product manufacturer. No hollow spots will be accepted.
7. Contractor must submit manufacturers recommended method for terminating a coating or lining in a manhole
8. If required sewage flow shall be stopped, bypassed or diverted for application of the polymer coating product to the invert and interface with pipe materials.

E. TESTING AND ACCEPTANCE
1. Visual Inspection - Installed liner system shall be completely free of pinholes and hollow spots/voids and other defects that will reduce the life expectancy of the applied system.
2. Film thickness Measurements – (either wet or dry) Liner thickness shall be the minimum value as specified in the contract documents.
3. Holiday Detection Test (Spark Testing), to identify pinholes, thin material and any defects that will affect the life of the installed system.
4. Adhesion Testing – To verify that the system has consistently mechanically bonded to the host structure.
5. Dye Testing – For non-bonded systems to verify no leakage from an annular space
6. Vacuum Testing as specified in the contract documents

3.5 CURED-IN-PLACE MANHOLE LINERS (CIPM)

A. MAINTAINING WASTEWATER FLOWS
   1. The Contractor shall be fully responsible for maintaining the normal sewage flow through the manhole where the specified rehabilitation work demands such flow control. The Contractor shall plan his work in order to maintain flows and to not interrupt sewer service. This may include night work. The cost of any night work required will be included in the contract price of the applicable item. The Contractor shall not perform work to manholes until plans for bypass pumping or flow restriction have been submitted to the Owner and accepted. No plugging of existing Utility System Gravity Mains will be made without submitting a plan to the Owner for review.
   2. 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 manhole through the wall and trim the pipe opening to restore flow.
   3. Lined flow channel. Plug the pipes entering the manhole and line the flow channel to the edge of the pipe. Trim all pipe openings and restore the flow.

B. PRE-INSPECTION
   1. Prior to beginning work, the manhole shall be visually inspected and any areas of apparent structural damage that will affect the installation of the liner shall be reported to the Owner for proceeding with the work.
   2. All manhole steps shall be removed before the CIPM liner is installed.

C. INFILTRATION CONTROL
   1. The stopping of active hydrostatic infiltration shall be accomplished by using a quick set cementitious material compatible to the liner material being installed or using compatible expansion type grouts

D. CHANNEL RECONSTRUCTION
   1. Specifications should include a separate line item for Channel Rebuild which is sometimes required.
   2. Remove all loose grout and rubble of existing channel. Rebuild channel by shaping and repairing slope of shelves or benches. Work shall include alignment of inflow and out flow ports in such manner to prevent the deposition of solids at the transition point(s). All inverts shall follow the grades of the pipe entering the manhole. Changes in direction of the sewer and entering branch or branches shall have a true curve of as large a radius as the size of the manhole will permit.
Channels shall be shaped to allow entrance of maintenance equipment into pipes including buckets, TV camera, etc.

3. Channels shall only be lined where indicated on the plans “lined channels”.

E. CIPM PREMADE LINER INSTALLATION
1. The Contractor shall furnish all materials, equipment, tools, and labor as required for the rehabilitation of the manholes specified, including the installation of the CIPM liner.
2. The installation of the selected liner system shall be in strict accordance with the manufacturer’s instructions. This shall include the preparation, installation, inflation, curing, and finishing, required for the complete installation of the CIPM liner. Custom fabricate liner to individual manhole dimensions.
3. Line bench area with material placed in the bottom of the manhole and extending a minimum of 6 inches up the manhole wall,
4. Saturate liner with resin, place into manhole, pressurize with air or water and cure with hot water, steam or hot air following manufacturer’s recommendations
5. When finished, liner forms a monolithic structure from the manhole frame to the bench.
6. All safety rules and regulations applicable laws and insurance requirements shall be observed, by the Contractor, in storing, handling, use and application of the liner materials, resins and any solvents.

F. CIPM TUBE LINER INSTALLATION
1. The manhole is prepared by pressure washing, sand blasting, and filling large voids.
2. The manhole depth is measured and the technicians cut the liner from a bulk roll to match the depth of the manhole.
3. Resin is mixed and introduced into the liner under a controlled vacuum impregnation process.
4. The liner tube has the ability to stretch and accommodate barrel sections while adapting to an eccentric or concentric corbel section of a manhole.
5. The tube liner is inverted through the center of the retaining ring until the liner is fully turned inside out and positioned within the manhole
6. CIPM Tube Liner is fully inverted
7. The inflation device is inserted within the manhole tube liner.
8. Pressure is applied causing the one-size liner to conform to the manhole.
9. The tube liner is cured at ambient temperatures typically within two hours from mixing or accelerated with steam and can be installed during cold winter months as well as warm summer months.
10. The inflation device is removed and the CIPM tube liner is trimmed at the top of the manhole casting flush with the casting lid seat.

G. TESTING AND ACCEPTANCE
1. Visual Inspection. Liner should be free of severe wrinkles, areas deficient of resin, delamination of the fabric layers, infiltration, large hollow areas behind the liner and any other defects that will affect the life expectancy of the CIPM
2. Spark test to identify pin-holes and defects
3. Adhesion test to verify bonding to the host structure if specified
4. Core sample to verify thickness
5. Vacuum Testing as specified in the contract documents
6. Dye Testing – For non-bonded systems to verify no leakage from an annular space

3.6 COMPOSITE LINER
(Fiberglass/Carbon Fiber Reinforced epoxy composite)

1. The protective composite liner shall be hand crafted in place to follow the shape and contour of the manhole. A layer of epoxy, shall be placed and firmly troweled to force the epoxy into and even out any and all imperfections of the final prepped surface and ensure 100% bonding with no gaps or voids. A fiberglass fabric coated with a chemical binder shall be applied and incorporated into the epoxy (encapsulated) by application of another layer of epoxy.
2. Refer to section 1.1.F for design requirements.

A. TESTING AND ACCEPTANCE
1. Visual Inspection. Liner should be free of severe wrinkles, areas deficient of resin, delamination of the fabric layers, infiltration, large hollow areas behind the liner and any other defects that will affect the life expectancy of the Composite Liner.
2. Spark test to identify pin-holes and defects
3. Adhesion test to verify bonding to the host structure if specified
4. Core sample to verify thickness
5. Vacuum Testing as specified in the contract documents
6. Dye Testing – For non-bonded systems to verify no leakage from an annular space

3.7 PROTECTIVE PANEL LINERS

A. HIGH DENSITY POLYETHYLENE (HDPE)
1. All manhole steps shall be removed prior to installing the protective liner.
2. A bonding agent compatible with grout or concrete shall be applied to manhole wall before placing liner sheets.
3. Adequate annular space between liner sheet and manhole wall shall be provided to allow placement of concrete or grout.
4. The liner sheet supports shall be secured to the manhole walls.
5. The liner sheets shall be inserted into the manhole and supported as per the manufacturer’s recommendations.
6. Secure the liner sheets to the installed supports.
7. Form liner sheet seams in accordance with the manufacturers recommendations.
8. Place the concrete or grout, as recommended by the manufacturer, with no wrinkling of liner. Vibrate, as required, to prevent voids.
9. After the concrete or grout has cured, remove the internal forms or supports and finish all seams as recommended by the manufacturer.

B. POLYVINYL CHLORIDE (PVC) PROTECTIVE SHEET LINERS
1. Apply mastic primer to manhole wall and cure following manufacturers recommendations.
2. Apply mastic to primed manhole wall.
3. Apply liner to mastic.
4. Embed anchoring extensions in mastic.
5. Wrinkling of liner not permitted.
6. Finish liner seams following manufacturer’s recommendations

C. TESTING AND ACCEPTANCE
1. Visual Inspection – To verify that there are no loose panels, peeling, bubbles, or other areas that may hinder the performance of the liner.
2. Weld inspection – Performed by using a putty knife to verify weld is solid.
3. Liner thickness shall be the minimum value as specified herein.
4. Spark test – To verify liners are pinhole free and welds are sealed.
5. Adhesion Test – To verify bonding.
6. Vacuum Testing, as specified in the contract documents
7. Dye Testing – For non-bonded systems to verify no leakage from an annular space.

3.8 PRECAST INSERTS

A. DIVERSION PUMPING
1. Install and operate sewage diversion pumping equipment to maintain sewage flows without backup, overflow, or spillage.

B. CLEANING AND SURFACE PREPARATION
1. Remove dirt, grease, and debris from floor and interior walls of manhole using high pressure water and cleaners and cleaning methods as recommended by the manufacturer.
2. Deteriorated invert and bench surfaces shall be abrasive blasted to profile the surface. Compressed air shall be supplied from compressors fitted with oil/moisture separators. Surfaces shall be cleaned of dust and grit particles by dry air blast cleaning, vacuum cleaning, or wiping with a tack doth. Used abrasives shall be collected and removed without allowing any to enter the sewage flows in the manhole.

C. REPAIRS
1. Active leaks, if present, shall be sealed by application of leak repair material in accordance with the manufacturer's instructions.

2. Repair and reshape manhole inverts and benches. Inverts shall be U-shaped and have a minimum depth of 1/2 pipe diameter. Benches shall have smooth surfaces without defects that allow debris to accumulate.

D. PRECAST INSERT INSTALLATION

1. Remove pavement if present. Excavate around the manhole as necessary to prevent soil and debris from falling into manhole while frame and grade rings are removed. Set aside frame and cover for reuse in rehabilitated manhole.

2. Cut the insert or chip the concrete benches so that the insert will be evenly supported when lowered into place. Accurately locate incoming and outgoing sewer lines and cut the insert for a close fit within 1 inch to both. Seal the cut edges with resin as recommended by the manufacturer.

3. Lower the insert into a 4-inch deep layer of quick-setting grout mixture, making sure that the sewer lines and insert openings align.

4. Place a 6-inch deep layer of quick-setting grout at the bottom of the annular space between the insert and the wall.

5. Seal the sewer openings with Oakum soaked in sealing gel.

6. Fill the remaining annular space with grout. Consolidate the grout without damage to the insert.

7. Install the grade rings, frame, and cover, sealing the surfaces between the reducer, the grade rings, and the frame.

8. Replace pavement if any was removed

E. PROTECTIVE COATING, CHIMNEY BENCH AND INVERT

1. All oil and grease shall be removed from the chimney surface by detergent cleaning with solvent, vapor, alkali, emulsion, or steam.

2. Follow detergent cleaning with abrasive blast cleaning to remove laitance and deteriorated concrete and to roughen the surface to manufacturer specifications.

3. All surfaces shall be clean and dry before applying the protective coating.

4. Apply a quick set grout to the chimney, bench and invert and seal the bottom edge of the insert. Apply two (2) coats of filler/sealer with a squeegee as necessary and as recommended by the manufacturer, to achieve a smooth void free surface. Apply additional coats of filler/sealer to achieve a total applied thickness as recommended by the manufacturer.

F. TESTING AND ACCEPTANCE

1. Visual Inspection – Inserts shall be inspected for workmanship and no leakage.

2. Vacuum Testing, as specified in the contract documents

3.9 MANHOLE CHIMNEY SEALS

A. MECHANICAL FRAME SEAL
1. The contact surfaces for the sleeve and/or extensions shall be reasonably clean and smooth, circular and free from excessive voids or defects. If the masonry surface is rough or irregular and will not provide an effective sealing surface, it shall be smoothed with a single component non-shrink quick set repair mortar designed for vertical and overhead use. Realign manhole frame and cover if offset is greater than Three (3) inches between the frame and top of the manhole structure.

2. After any surface preparation is completed and the rubber sleeve has been placed in the proper position, the lower band is positioned in the band recess and expanded as required to provide a water tight seal. If an extension or extensions are being used, place the extension in the proper position, insert the band into the lower band recess and expand as required to provide a watertight seal.

3. Extension flap shall be placed into or behind the expansion band recess to allow for the compression of both the extension flap and sleeve against the manhole surface by the expansion band. Continue by placing the upper band or bands in the recess, insuring the seal is properly placed on the manhole cone, chimney and frame and expand as required to provide an effective seal.

4. Installation procedures shall be in accordance with the manufacturer's recommended instructions.

5. TESTING AND ACCEPTANCE
   a. Visual Inspection
   b. Leakage test - Following the expansion of the lower band a quality assurance test shall be performed to insure effective sealing by pulling the upper section of the seal or extension inward to create a recess behind the seal where water can be poured. Pour the water behind the seal and observe the lower sealing area for any visible leaks. The sealing shall be considered effective if no water leaks from behind the seal at the lower sealing area.

B. POLYMER CHIMNEY SEAL
   1. All loose and protruding mortar and brick that would interfere with the polymer chimney seal's performance shall be removed. Any lips for gravel pan supports shall be cut off flush with the manhole casting. All loose material or excessive voids shall be repaired using patching cement, as recommended by the manufacturer. The Contractor shall obtain from the polymer chimney seal manufacture, in writing, the material compatibility and the recommended time required for the patching cement to properly cure prior to installing the polymer chimney seal.

   2. Preparation of the chimney surface and casting may include using high pressure water, sandblasting, wire brushing, or other methods as described by the manufacturer, to ensure a clean surface. Active leaks (infiltration) shall be sealed by a method as recommended by the polymer chimney seal manufacturer prior to installing the chimney seal. After water or sandblasting, pressure wash the entire area remove any loose sand that may have been deposited. The substrate surface must be free of sand, loose debris, latencies, dust, oil, grease or chemical
contamination. A blower may be required to completely dry the substrate surface or as recommended by manufacturer.

3. The polymer chimney seal shall require the proper mixing of several components, is recommended by the manufacture. If a primer is required, ensure that all surfaces are clean and dry before applying. After proper curing of the primer, the polymer chimney seal may be applied evenly by brush over the entire chimney area, including the frame joint area and the area above the manhole cone including all extensions to the chimney area.

4. Installation procedures shall be in accordance with the manufacturer’s recommended instructions.

5. TESTING AND ACCEPTANCE
   a. Visual Inspection - Final liner system shall be completely free of pinholes or voids
   b. Holiday Detection Test
   c. Adhesion Testing

C. CURED-IN-PLACE (CIPM) CHIMNEY LINER
   1. The installation shall include a coated non-woven textile liner of a length specific to each manhole and a silicate based thermo-set resin. The liner is vacuum impregnated (saturated) on-site with the thermo-set resin. The saturated liner is then lowered into the manhole and is temporarily held in position. The installation device is then lowered and properly positioned inside of the liner. The bladder on the installation device is then pressurized so that the liner is pressed against the existing structure. Once the resin-saturated liner is cured, the installation device is removed. The liner is then trimmed flush with the manhole cover seat.

   2. All surfaces to be lined must be stringently pressure washed as recommended by the manufacturer. Other alternatives to clean the structure may be used along with pressure washing such as abrasive blasting. The existing casting shall be cleaned using a grinder or by sand blasting. Large voids and missing bricks shall be filled with hydraulic cement to provide an area that liner can press up against. Smaller voids and missing mortar may go un-patched, since these areas will be filled with excess resin. Steps that are located in the area to be lined shall be removed.

   3. The liner shall be vacuum impregnated (saturated) on-site under controlled conditions. The resin shall be pre-measured at the manufacturing plant prior to shipment. The volume of resin used shall be sufficient to fill all voids in the liner material at nominal thickness and diameter. No dry or unsaturated areas in the liner shall be acceptable upon visual inspection.

   4. Installation Device – The liner is placed with the saturated resin side facing the substrate to allow for resin migration. Once the liner is placed in the manhole and rested on the spacing rings, then the installation device is inserted inside the liner. The spacing rings located on top of the manhole allow the installation device to rest at the correct depth. Once the installation device inserted, the bladder is pressurized. The installation device stays in place and pressurized until the liner is cured.
5. **Curing** – The liner is cured at ambient temperatures as it is pressed firmly against the structure. The curing time must take into consideration the resin system, ground conditions (temperature and moisture level), and weather conditions. Typically, one hour is needed to cure the liner. A curing log shall be document the cure time, pressure, resin usage, and other pertinent information.

6. **Trimming** – Once cured, the installation device is removed and the liner is trimmed at the manhole cover seat.

7. The finished cured-in-place manhole chimney liner shall be continuous from the manhole cover seat to the overlap onto the cone/corbel section. The liner shall provide a smooth surface that conforms to the existing structure. The liner shall be free of dry spots and de-laminations. The finished product must provide an air and watertight corrosion resistant liner protecting the manhole chimney.

8. **TESTING AND ACCEPTANCE**
   a. Visual Inspection to insure bonding, resin saturation, complete cure and a smooth surface free from cracks or hollow spots.
   b. The liner shall be subjected to several freeze/thaw cycles either in the field or simulated in a freezer with no cracking or bond breakage. This test or equivalent test shall be as recommended by the manufacturer and the test results recorded in writing by the Owner representative.
   c. Adhesion Testing
   d. Dye Testing – For non-bonded systems to verify no leakage from an annular space

D. **COMPOSITE CURED IN PLACE CHIMNEY SEAL**
   1. The protective composite liner shall be hand crafted in place to follow the shape and contour of the manhole. A layer of epoxy, shall be placed and firmly troweled to force the epoxy into and even out any and all imperfections of the final prepped surface and ensure 100% bonding with no gaps or voids. A fiberglass fabric coated with a chemical binder shall be applied and incorporated into the epoxy (encapsulated) by application of another layer of epoxy.
   2. Refer to section 1.1.F for design requirements. Greater thickness can be accomplished by either increasing the thickness of the epoxy layers or by using additional fiberglass layers.
   3. **TESTING & INSPECTION**
      a. Visual Inspection to insure bonding, resin saturation, complete cure and a smooth surface free from cracks or hollow spots.
      b. The liner shall be subjected to several freeze/thaw cycles either in the field or simulated in a freezer with no cracking or bond breakage. This test or equivalent test shall be as recommended by the manufacturer and the test results recorded in writing by the Owner representative.
      c. Adhesion testing
      d. CIP Material Property Tests
      e. Dye Testing – For non-bonded systems to verify no leakage from an annular space
3.10 REPLACE FRAME AND COVER

A. The manhole frame and cover shall be manufactured and installed to the dimensions shown on the contract documents.

B. Measurement shall be by each manhole frame and cover removed and replaced.

C. Payment shall be at the unit price each Bid in the Proposal.
   1. Payment includes removal of existing frame and cover, replacing frame and cover, and disposal of old frame and cover as required.

3.11 MANHOLE ADJUSTMENT MATERIALS

A. ADJUSTMENT MATERIAL INSTALLATION
   1. The contractor shall furnish all materials, equipment, tools and labor required for the adjustment of rings and covers to grade.
   2. The ring and cover to be adjusted shall be located and clearly marked.
   3. The existing road or ground surface shall be cut all around the ring & cover, either by triangular, square or round cut (being careful to not create stress fracture points in the corners by over-cutting) to an adequate depth that will allow the desired adjustments to be accomplished. If the cut is not deep enough, the increase in depth may be accomplished with the use of various digging investments.
   4. All of the road or ground inside of the cut shall be removed to allow safe working conditions during the adjustment and restoration to the proper height or level.
   5. The ring shall be positioned, either by suspension or by placement on the correct amount of adjustment rings. If the positioning is accomplished by suspension, the required retainer shall be installed properly.
   6. Once the ring is properly positioned and secured, the open area shall be filled and properly compacted with the materials prescribed in the bid documents and finished off in a manner to meet the requirements of the specs.
   7. If the area has been filled (in whole or in part) with poured concrete and/or asphalt, it shall be adequately protected by control devices for a period of time that will allow the fill to properly cure before allowing traffic to resume.

3.12 MANHOLE STEPS

A. Manhole steps shall be driven into pre-cast or drilled holes. Steps shall be installed no more than 16 inches apart vertically on the interior of the manhole wall at a point 4" below the base flange of the manhole casting.

B. Measurement shall be for each manhole step provided

C. Payment shall be at the price per each Bid in the Proposal.
1. Payment includes the removal and replacement of manhole steps per each Bid in the Proposal.

3.13 QUALITY ASSURANCE AND TESTING

A. GENERAL
1. The Contractor shall test the installed SYSTEM's as specified by these contract documents. 10% of the installed SYSTEM's shall be tested using a testing procedure as further delineated below. If more than 5% of the tested SYSTEM's fail the test than an additional 10% of the manholes are selected for further testing. This process continues until the SYSTEM's tested meet the requirements of these contract documents, to the satisfaction of the Owner.

B. CHAIN OF CUSTODY
1. The Contractor shall perform all testing in the presence of the Owner's representative. The Owner's representative shall receive test samples from the Contractor and transmit samples to a third party testing laboratory. The Owner's representative will maintain the chain of custody of all samples that are transmitted and tested to verify SYSTEM compliance with these contract documents.

C. TEST REQUIREMENTS
1. Visual Inspection
   a. All manholes shall be visually inspected. Any leakage into themanhole in areas where SYSTEM's were installed by the Contractor shall be identified.
   b. The Contractor shall provide samples for testing to the Owner from the actual installed SYSTEM. Samples shall be provided, at a minimum from one location per every ten (10) SYSTEM's installed.
2. Cementitious Material Property Testing
   a. Where specified one 2 X 2 inch sample cube shall be taken for every 50 bags of material used. Samples shall be sprayed from nozzle, identified in the presence of the Owner's representative and sent, by the Owner's representative, to an independent test laboratory for compression strength testing as described in ASTM C-109.
3. Vacuum Testing
   a. Where specified if the entire manhole including invert and pipe penetrations is rehabilitated to as new condition then a Vacuum Test may be performed according ASTM F1244. If vacuum test fails then the contractor shall spray entire manhole with a soap solution and retest to determine where air is entering the manhole. Inspector shall determine if failure was due to improper rehabilitation or poor pipe condition or improperly seated plugs. If inspector determines that the failure is due to improper rehabilitation then the Contractor shall repair manhole according to manufacturer recommendations and retest until a successful vacuum test is achieved. If inspector determines that the
failure was due to poor condition of the pipes, or annular space between the pipe and its liner, or the inability to seat the plugs properly and that there are no visible defects in the applied product then it will be determined that the manhole has passed.

4. Film thickness Measurements
   a. Where applicable and specified during application a wet film thickness gauge, meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used. Measurements shall be taken, in the presents of the Owner’s representative, documented and attested to by Contractor for submission to Owner.

5. Holiday Detection Test
   a. Where specified Holiday Detection shall be performed for all coating systems installed in corrosive environments.
   b. After the epoxy coating product have set in accordance with manufacturer instructions, all surfaces shall be inspected for holidays with high-voltage holiday detection equipment. Reference NACE RPO 188-99 for performing holiday detection.
   c. All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional coating can be hand applied to the repair area.
   d. All touch-up/repair procedures shall follow the coating manufacturer's recommendations.
   e. Documentation on areas tested, results and repairs made shall be provided to the Owner, in writing, by Contractor.

6. Adhesion Testing
   a. Where specified a minimum of 10% of the manholes coated shall be tested for adhesion/bond of the coating to the substrate. Testing shall be conducted in accordance with ASTM D4541, ASTM D7234, or NACE SP018. Owner’s representative shall select the manholes to be tested.
   b. A minimum of three (3) - 50 mm dollies shall be affixed to the coated surface at the cone area, mid section and at the bottom of the structure or in areas suspect from non-destructive evaluation and testing. The adhesive used to attach the dollies to the coating shall be rapid setting with tensile strengths in excess of the coating product and permitted to cure in accordance with manufacturer recommendations. The coating and dollies shall be adequately prepared to receive the adhesive.
   c. Failure of the dolly adhesive shall be deemed a non-test and require retesting. Prior to performing the pull test, the coating shall be scored to the substrate by mechanical means without disturbing the dolly or bond within the test area.
   d. Two of the three adhesion pulls shall exceed 300 psi or concrete failure with more than 50% of the subsurface adhered to the coating.
   e. Should a structure fail to achieve two successful pulls as described above, additional testing shall be performed at the discretion of the Owner. Any areas detected to have inadequate bond strength shall be evaluated by the Owner.
f. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Contractor.
7. All testing shall conform to these contract specifications and the submitted PWS.

3.14 SAMPLE BID ITEMS

A. Mobilization – Lump Sum – Includes all PWS info, submittals, safety plan, as built drawings, test samples and mobilization/demobilization of labor, equipment and materials to the project site.

B. SYSTEM (One for each SYSTEM Specified)– Lump Sum – per each vertical foot including all labor, materials and equipment required by the Contractor to furnish a leak proof manhole to the Owner, complete.

C. SYSTEM Inspector Training (One for each SYSTEM Specified) – price per day – includes the cost of all labor, equipment and materials required to train the Owner’s inspectors on the SYSTEM technology, at the Owner’s project location.

D. Replace Manhole Frame and Cover – Lump Sum – per each manhole including all labor, materials and equipment required by the Contractor to remove and dispose of the existing manhole frame and cover and furnish and install a new manhole frame and cover to the Owner, complete.

E. Manhole Adjustment Materials – per vertical inch – includes all labor, equipment and materials required, by the Contractor, to adjust each manhole as required by the Owner, complete.
   1. Bench Rebuild – Some manholes may require structural construction of a bench to promote proper flow. Merely lining the existing flat bench is not consistent with good rehabilitation practice

F. Manhole Steps – per each – includes all labor, equipment and materials required, by the Contractor, to install each manhole step as required by the Owner, complete

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<th>PIPE DIAMETER (INCHES)</th>
<th>MANHOLE DIAMETER (FEET)</th>
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**REBUILD SHELF OF LINE - THROUGH MANHOLE**

**CITY OF CONCORD**

**STANDARD DETAIL**

**REBUILD SHELF OF LINE - THROUGH MANHOLE**
EXHIBIT C
LIST OF SEWER LINE SECTIONS FOR CIPP AND MANHOLES
FOR REHABILITATION
## 2020 Lining List

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## 2020 Manhole Rehab

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**Total = 595.17**
EXHIBIT D

MAPS
EXHIBIT E

GENERAL CONDITIONS

Please reference online at


Dated: 01/05/2010
EXHIBIT F

STANDARD FORM OF PERFORMANCE BOND
STANDARD FORM OF PERFORMANCE BOND

Date of Execution of this Bond

Name and Address of Principal (Contractor)

Name and Address of Surety

Name and Address of Contracting Body

Amount of Bond

Contract

That certain contract by and between the Principal and the Contracting Body above named dated______________ for ________________

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL and SURETY above named, are held and firmly bound unto the above-named Contracting Body, hereinafter called the Contracting Body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal entered into a certain contract with the Contracting Body, identified as shown above and hereto attached;

NOW THEREFORE, if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the Contracting Body, with or without notice to the Surety, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of the contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, then, this obligation to be void; otherwise, to remain in full force and virtue.
STANDARD FORM OF PERFORMANCE BOND: (Continued)

THIS PERFORMANCE BOND is made and given pursuant to the requirements and provisions of Section 129 of Chapter 143 of the General Statutes of North Carolina and pursuant to Article 3 of Chapter 44-A of the General Statutes of North Carolina, and each and every provision set forth and contained in Section 129 of Chapter 143 and in Article 3 of Chapter 44-A of the General Statutes of North Carolina is incorporated herein, made a part hereof, and deemed to be conclusively written into this Bond.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals as of the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned and representative, pursuant to authority of its governing body.

WITNESS:

Principal (Name of individual and trade name, partnership, corporation, or joint venture)

BY ______________________________ (SEAL)
Printed Name________________________

TITLE
(Owner, Partner, Office held in corporation, joint venture)

(Corporate Seal of Principal)

ATTEST: (Corporation)

BY ______________________________
Printed Name________________________

TITLE
(Corporation Secretary or Assistant Secretary Only)

Surety (Name of Surety Company)

BY ______________________________
Printed Name________________________

TITLE Attorney in Fact

(Corporate Seal of Surety)

COUNTERSIGNED:

(Address of Attorney in Fact)

N.C. Licensed Resident Agent
EXHIBIT G

E-VERIFY
STATE OF NORTH CAROLINA
COUNTY OF CABARRUS

AFFIDAVIT

I, _________________________________(the individual signing below), being duly authorized by and on behalf of __________________________________________ (the legal name of the entity entering the contract, "Employer") after first being duly sworn hereby swears or affirms as follows:

1. Employer understands that E-Verify is the federal E-Verify program operated by the United States Department of Homeland Security and other federal agencies, or any successor or equivalent program used to verify the work authorization of newly hired employees pursuant to federal law in accordance with NCGS §64-25(5).

2. Employer understands that Employers Must Use E-Verify. Each employer, after hiring an employee to work in the United States, shall verify the work authorization of the employee through E-Verify in accordance with NCGS§64-26(a). Employer attests that Employer is in compliance with the requirements of the federal and state laws relevant to E-verify.

3. Employer is a person, business entity, or other organization that transacts business in the State of North Carolina. Employer employs 25 or more employees in this State. (mark Yes or No)
   a. YES _____, or  b. NO _____.

4. Employer attests that all subcontractors employed by it as part of this contract comply with the requirements of E-Verify, and Employer will ensure compliance with E-Verify by any subcontractors subsequently hired by Employer as part of any contract with the City of Concord.

5. Employer shall have a continuing duty to inform the City of Concord of any changes to this sworn information. This ____ day of _______________, 20___.

______________________________
(Signature of Affiant)
Print or Type Name: ____________________________

State of North Carolina  County of Cabarrus

Signed and sworn to (or affirmed) before me, this the _____

do _________, 20___.

My Commission Expires:

______________________________
Notary Public

G-2
EXHIBIT H

TAX FORM(S)
EXHIBIT I

CERTIFICATE OF INSURANCE

4824-4465-9749, v. 1