WEST PALM BEACH
Public Utilities

401 CLEMATIS STREET
P.O. BOX 3366
WEST PALM BEACH, FL 33401
561.822.2200

DRAFT

Public Utilities

Completeness Review Checklist

SUFFICIENCY REQUIREMENTS

1._____ Utility plan at 24x36 page size with the ability to be reduced to 11x17 without cutting off any borders/information all while maintaining scale. Utility plan to include the City's existing system in relation to the system/improvements proposed under this project.

2._____ Water and Sewer Level of Service (LOS) Analysis with project name, address, and date of submittal noted. Calculations are performed using the City's Comprehensive Plan Element 5 – Utilities from:

https://www.wpb.org/Departments/Development-Services/Planning-Division/Comprehensive-Planning

Updated LOS to be resubmitted if modifications are made.

3._____ CCTV and pipe reports of the existing sanitary sewer system adjacent to the project property (at the minimum) per City requirements. Please coordinate with Sanitary Collections (bingraham@wpb.org) prior to scheduling CCTV of the City's system. **Additional CCTV may be required during the PPRC and ENG-DEVAP review process.**

All CCTV shall be performed by a NASSCO certified contractor. CCTV videos and pipe reports shall be in accordance with NASSCO standards and clearly denote the City's manhole asset IDs. Pipe reports shall also include the pipeline's NASSCO rating.

All CCTV shall be in accordance with the City's "CCTV, Manhole Rehabilitation, and Pipeline and Lateral CIPP Specification" section at the end of this document. CCTV or pipe reports that are not aligned with all of the aforementioned requirements will be rejected and resubmittal will be required.

a. ***Must be provided at the initial PPRC Submittal at the latest***

4._____ For projects that include fire lines, provide Fire Hydrant Flow Test report(s). Fire Hydrant Flow Test reports of existing Fire Hydrant(s) upstream and downstream of the proposed water main connection(s) to be per City Detail P-10.1 and AWWA M17. Fire Hydrant asset IDs to be noted in the reports.

5._____ Record drawings used for the design. Contact Yolanda Villamil (yvillamil@wpb.org) for City's available records, system maps, GIS asset IDs, Lift Station service area numbers, etc. City provided information is for reference only. Verification of City provided information for the design is the responsibility of the Engineer of Record (EOR).

6._____ The following plan sheets are included:

a. Cover Sheet

b. General Notes

c. Utility Plan and Profile(s)

i. Plan sheets to be 24x36 page size with the ability to be reduced to 11x17 without cutting off any borders/information all while maintaining scale

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ii. Plan view scale to be 1"=20'

iii. Profile view horizontal scale to match the plan view scale, vertical scale to be 1"=2'

d. Enlarged/Blow-up Plan & Profile for Water & Sewer Connections **(TO SCALE)**

i. ***May be provided during ENG-DEVAP Submittal***

e. Project Specific Utility Details (as applicable)

i. ***May be provided during ENG-DEVAP Submittal***

f. City of West Palm Beach Standard Details (latest revision)

7._____ All street names and property addresses of all surrounding properties are noted.

Completeness Review Acknowledgement Form

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Use of this checklist does not constitute approval, and the authors assume no liability for its use or misuse. Additional information may be required by the reviewing department as part of the plan review process.

By signature below, the EOR for the referenced project agrees that the submitted plans adhere to the items outlined in this document and the standards, details, and SOPs of the City. It is understood that the City will require resubmission of the plans for review if they do not align with all aforementioned items.

_____ _____

Engineer of Record Signature Date

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PPRC Submittal Checklist

GENERAL PLAN REVIEW REQUIREMENTS

1._____ The following CWPB Utility Notes are added to the Utility plan sheets:

"CWPB Utility Notes:

1. This project is located within the Lift Station (**insert LS# here**) service boundary.
2. Improvements/construction of City owned utilities shall conform to the latest revision of the City's Standard Details, Approved Material List (AML), Standard Operating Procedures (SOPs), and protocol. For conflicting general notes in relation to City owned utilities or City Right of Way (R/W), the City's standards and requirements shall govern.
3. It is the contractor's responsibility to protect and support existing City utilities and maintain continuous service during the entire course of the project. Contractor shall have materials on-site to make repairs in the event of service/main leaks and breaks, valve leaks, etc. as a result of their work prior to beginning any construction. An Emergency Response Plan (ERP) shall be submitted prior to the pre-construction meeting if required by the City. The contractor may not begin any construction without an ERP approved by City Public Utilities.
4. Extensive utility work involving City owned utilities including taps, linestops, and insertion valve installations shall be performed by a certified contractor with credentials acceptable to the City (typ. all taps, linestops, and insertion valves).
5. Plugging of existing corporation stops at the water main, tapping of any water main, linestopping/insertion valve installation, water main tie-ins, and all pipeline testing procedures shall be performed in the presence of a City representative. The City shall be notified a minimum of 48-hours in advance of all project work. Contractor shall submit pipe coupons and photos with the date of tap, labeled water main asset ID, coordinates, pipe outside diameter (OD) measurement, and water main Top of Pipe (T.O.P.) elevation at the coupon location. This information shall also be included on the as-builts.
6. All pre and post CCTV shall be performed by a NASSCO certified contractor with credentials acceptable to the City. CCTV videos and pipe reports shall be in accordance with NASSCO standards and clearly denote the City's manhole asset IDs. Pipe reports shall also include the pipeline's NASSCO rating.
7. Disinfection and sampling shall conform with FAC 62-555.340 and AWWA C651.
8. The location of sample points shall be submitted as part of the Pigging, Flushing, and Sampling Plan prior to the pre-construction meeting. Sample points shall be placed as close as possible to the point of connection and proposed water meter/backflow preventer assembly. Additional sample points may be required by the City due to field conditions.
9. Additional valves, fittings, and other appurtenances may be required due to construction sequencing and/or actual field conditions to minimize service interruption as required by the City."

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2._____ Datum is in NAVD88. Datum used and the datum conversion (NGVD29 to NAVD88) is noted on every sheet.

3._____ Benchmark/temporary benchmark information is shown and called out on all utility plan sheets.

4._____ A legend with all utility linetypes (existing vs proposed lines [shaded vs bold/black], water, sanitary, storm, dry utility linetypes, symbols, etc.) is included on all utility plan sheets.

5._____ For projects that include fire lines, provide Fire Hydrant Flow Test report(s). Fire Hydrant Flow Test reports of existing Fire Hydrant(s) upstream and downstream of the proposed water main connection(s) to be per City Detail P-10.1 and AWWA M17. Fire Hydrant asset IDs to be noted in the reports.

6._____ Existing vs proposed water and sewer flow demand calculations, peaking factors, and fire flow demand per the MEP Engineer are shown on the utility sheet(s). Calculations are performed using the City's Comprehensive Plan Element 5 – Utilities from:

https://www.wpb.org/Departments/Development-Services/Planning-Division/Comprehensive-Planning

Updated LOS to be resubmitted if modifications are made. Reflect all updates in the plan view table and provide a dated revision footnote.

7._____ Linework is consistent for existing vs proposed utilities (shaded/phantom vs bold/black linework).

8._____ All existing and proposed underground/aboveground utilities are called out with their size, material, and type (water/wastewater pipes, electrical conduit, gas mains, duct banks, etc.). Additionally, proposed City owned utilities or removal are called out with their length. Examples:

a. EXIST. 12" DIP WM
b. EXIST. 8" PVC SAN. SEWER
c. REMOVE 100 LF OF EXIST. 8" PVC SAN. SEWER
d. EXIST. 24" W x 18" H FPL CONCRETE DUCT BANK
e. EXIST. 2" PLASTIC FPL CONDUIT
f. EXIST. OVERHEAD ELECTRIC
g. PROP. (OR CONST.) 100 LF OF 12" DIP WM
h. PROP. (OR CONST.) 100 LF OF 8" PVC SAN. SEWER @ 0.40% SLOPE

9._____ All City-owned facilities are shown and legible (valves/valve boxes, fire hydrants, water services, meter boxes/vaults, manholes, sanitary laterals/services, clean-outs, etc.)

10._____ Asset IDs for all existing City owned manholes (sanitary, storm, ARVs) and fire hydrants are called out. All existing valves are called out with their size (asset IDs are not required for valves).

11._____ **All horizontal and vertical clearances are measured from OD to OD (typ. ALL utilities, in both plan and profile).**

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12._____ All existing water services currently serving the project property, if not used, are called out to be cut and capped at the water main. Services larger than 2-in are called out to be removed from the City's R/W.

13._____ CCTV videos and reports are in accordance with the City's **"CCTV, Manhole Rehabilitation, and Pipeline and Lateral CIPP Specification"** within this document.

14._____ All existing sanitary sewer laterals, clean-outs, and service connections (including the wye) are shown in plan view per the obtained CCTV and pipe reports.

15._____ All sanitary laterals currently serving the project property, if not used, are called out to be cut and capped at the sanitary main, and the lateral piping and cleanouts to be removed.

16._____ All existing sanitary mains to be connected to under this project are:

a. Called out to be lined from manhole to manhole

b. The manholes are called out to be rehabilitated (interior coated and tested, ring and cover adjusted, bench repaired/adjusted, etc.)

c. The existing laterals connected to the main, to be reused, are called out to be televised and lined

d. *****Additional lining/rehabilitation may be required as determined by the City.*****

e. *****Existing City owned sanitary mains may require replacement or upsizing due to condition or project demand as determined by the City.*****

17._____ The City's point of service (POS) for both water and sanitary sewer are clearly shown and called out.

18._____ The latest City Standard Details are used and included in the plan from:

www.wpb.org/Departments/Engineering/Engineering-Standards-Details

CONFIRM ALL DESIGN ELEMENTS ALIGN WITH THE LATEST DETAILS

19._____ City to determine system impacts/improvements as required.

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PPRC Submittal Acknowledgement Form

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_____ _____

Engineer of Record Signature Date

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Public Utilities

ENG-DEVAP Submittal Checklist

GENERAL PLAN REVIEW REQUIREMENTS

1._____ ENG-DEVAP permit number is noted on all plan sheets.

2._____ Signed & sealed calculations to support/validate proposed size of water and sewer connections, selected meter sizes, thrust collar designs, ARV sizes, etc.

3._____ A plan view is provided that includes all of the following existing and proposed utilities up to the City's point of service:

a. Water Mains
b. Water Services
c. Sanitary Force Mains
d. Sanitary Mains
e. Sanitary Laterals
f. Storm Water Mains
g. Dry Utilities (gas mains, underground conduit, duct banks, overhead wire, etc.)
h. All associated wet and dry utility underground and aboveground structures (manholes, vaults, power/light poles, transformers, etc.)
i. Existing and proposed fittings and appurtenances (bends, valves, hydrants, ARVs, etc.)
j. Lift Stations (wetwell, valve vault, associated electrical equipment, etc.)

4._____ A profile view is provided that includes all of the following existing and proposed utilities up to the City's point of service:

a. Water Mains
b. Water Services (Location of tap at the main)
c. Sanitary Force Mains
d. Sanitary Mains
e. Sanitary Laterals (Location of connection at the main)
f. Storm Water Mains
g. Dry Utilities (gas mains, underground conduit, duct banks, etc.)
h. All associated wet and dry utility underground structures (manholes, vaults, etc.)
i. Existing and proposed fittings and appurtenances (bends, valves, hydrants, ARVs, etc.)
j. Lift Stations (wetwell, valve vault, points of inflow and outflow, etc.)

5._____ Soft digs / test holes are shown on the plans and at all points where proposed City owned utilities will cross with or be in close horizontal proximity with any existing utility. Soft dig / test hole reports to be included with the initial ENG-DEVAP submittal.

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6._____ Survey sheets are included as part of the construction document plan set.

7._____ **PLEASE NOTE**: A plan revision / modification must be submitted through EPL during construction if actual field conditions do not align with the plans. Please be aware this may add +/-2 weeks to the construction schedule. This approximation includes time for the EOR to make plan revisions, time for Public Utilities to review, etc.

Construction field modifications MAY NOT BE PERFORMED until City Public Utilities approves of the plan modification. The City WILL NOT ACCEPT any construction field modifications without a proper Public Utilities approved plan modification through EPL.

PLAN VIEW REQUIREMENTS

1._____ All horizontal clearances meet FAC 62-555.314 and City Details. These clearances are called out in plan view.

a. All proposed City owned utilities have their designed horizontal clearances from all other utilities and aboveground/underground obstructions (power poles, building footers, trees, curbs, etc.) called out in plan view.

b. For clearance requirements that conflict with each other, the design should conform to the more stringent requirement.

2._____ All utility conflicts/crossings with City owned infrastructure are indicated and designed vertical clearances are called out. For proposed City owned utilities, vertical clearances meet FAC 62-555.314 and City Details.

3._____ A minimum of 3-ft from the edge of tapping sleeves/saddles to the edge of all other fittings (bends, sleeves, other saddles/taps, joints, valves, etc.) is provided.

NOTE: It is understood that pipeline bell joints are not typically shown via records. Please note that during construction, plan modifications may be required in order to meet the City's clearances requirements away from bell joints.

4._____ Existing water mains have been called out to be restrained as required.

5._____ A blow-up detail is included for each proposed water main pipe connection and includes all of the aforementioned information.

PROFILE VIEW REQUIREMENTS

1._____ All City owned utilities are designed with a minimum of 36-in of cover from T.O.P. to finished grade. Actual design cover is noted throughout the profile(s).

2._____ All utility conflicts/crossings with City owned infrastructure are indicated and designed vertical clearances are called out.

3._____ All vertical clearances meet FAC 62-555.314 and City Details. These clearances are called out in profile view.

a. All proposed City owned utilities have their designed vertical clearances from all other utilities (gas mains, underground conduit, duct banks, irrigation lines, other water/stormwater/wastewater utilities, etc.) called out in profile view.

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b. For clearance requirements that conflict with each other, the design should conform to the more stringent requirement.

c. **City owned utilities DO NOT conflict with/cross under existing or proposed underground and above ground structures (manholes, vaults, power/light poles, transformers, building footers, trees, etc.)**

ENG-DEVAP Submittal Acknowledgement Form

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City of West Palm Beach

CCTV, Manhole Rehabilitation, and Pipeline and Lateral CIPP Specification

SECTION 02751

PREPARATORY CLEANING AND ROOT REMOVAL

PART 1 - GENERAL

1.1 SCOPE

A. This Section covers the preparatory cleaning of sewer lines and manholes as needed prior to the internal survey of the sewer lines by closed-circuit television. It also covers the preparatory cleaning and root removal from sewer lines and laterals and the cleaning of manholes prior to rehabilitation. The CONTRACTOR shall furnish all necessary material, labor, equipment and services required for cleaning the specific sewer lines.

1.2 GENERAL

A. Sewer Line Cleaning: The intent of sewer line cleaning is to remove foreign materials from the lines and restore the sewer to a minimum of 95% of the original carrying capacity or as required for proper lining operation. Since the success of other phases of work depends a great deal on the cleanliness of the lines, the importance of this phase of the operation is emphasized.

1.3 HYDRAULIC CLEANING EQUIPMENT

A. Hydraulically Propelled Equipment: The equipment used shall be of a movable dam type and be constructed in such a way that a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer. The movable dam shall be equal in diameter to the pipe being cleaned and shall provide a flexible scraper around the outer periphery to insure removal of grease. If sewer cleaning balls or other equipment which cannot be collapsed is used, special precautions to prevent flooding of the sewers and public or private property shall be taken.

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

C. Mechanically Powered Equipment: Bucket machines shall be in pairs with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an overload device. Machines with direct drive that could cause damage to the pipe will not be allowed. A power rodding machine shall be either a sectional or continuous rod type capable of holding a minimum of 750 feet of rod. The rod shall be specifically heat-treated steel. To insure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. The designated sewer manhole sections shall be cleaned using hydraulically propelled, high-velocity jet, or mechanically powered equipment. The equipment shall be capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the sewer lines and manholes. If cleaning of an entire sewer section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted.

3.2 CLEANING PRECAUTIONS

A. During all cleaning and preparation operations all necessary precautions shall be taken to protect the sewer from damage. During these operations, precautions shall also be taken to insure that no damage is caused to public or private property adjacent to or served by the sewer or its branches.

B. Satisfactory precautions shall be taken in the use of cleaning equipment. When hydraulically propelled cleaning tools (which depend upon water pressure to provide their cleaning force) or tools which retard the flow in the sewer line are used, precautions shall be taken to insure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. When possible, the flow of sewage in the sewer shall be utilized to provide the necessary pressure for hydraulic cleaning devices. When additional water from fire hydrants is necessary to avoid delay in normal work procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.

3.3 MATERIAL REMOVAL

A. All sludge, dirt, sand, rocks, grease, roots, and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing material from manhole section to manhole section, which could cause line stoppages, accumulations of sand in wet wells, or damage pumping equipment, shall not be permitted.

B. Under no circumstances shall sludge or other debris removed during these operations be dumped or spilled into the streets, ditches, storm drains or other sanitary sewers.

C. The CONTRACTOR is advised that he shall not dispose of this material by legal or illegal dumping on private or public property, by sale to others, or any means other than those given in 3.04 Disposal of Materials. Any load of material, or any portion thereof, disposed of in a non-permitted fashion will result in a charge to the CONTRACTOR in the amount of $500.00 per load, or any portion thereof, which sum will be deducted by the OWNER from any monies due the CONTRACTOR.

D. The CONTRACTOR shall keep his haul route and work area(s) neat and clean and reasonably free of odor, and shall bear all responsibility for the cleanup of any spill which occurs during the transport of cleaning/surface preparation by-products and the cleanup of any such material which is authorized by or pursuant to this Contract and in accord with applicable law and regulations. The CONTRACTOR shall immediately cleanup any such spill, or waste. If the CONTRACTOR fails to cleanup such spill, or waste immediately, the City shall have the right to cleanup or arrange for its cleanup and may charge to the CONTRACTOR all costs, including administrative costs and overhead, incurred by the City in connection with such cleanup. The City may also charge to the CONTRACTOR any costs incurred, or penalties imposed on the City as a result of any spill, dump or discard. Under no circumstances is this material to be discharged into the waterways or any place other than where authorized to do so by the appropriate authority. The term "CONTRACTOR" as used in this section shall include the CONTRACTOR's subcontractors and other Contractors.

E. The general requirements for vehicles hauling such waste materials are as follows: Transport vehicles must be of type(s) approved for this application by the political jurisdictions involved. General requirements are that the vehicles have watertight bodies, that they be properly equipped and fitted with seals and covers to prohibit material spillage or drainage, and that they be cleaned as often as is necessary to prevent deposit of material on roadways. Vehicles must be loaded within legal weight limits and operated safely within all traffic and speed regulations.

F. The routes used by the CONTRACTOR for the conveyance of this material on a regular basis shall be subject to approval by the governing authority having jurisdiction over such routes.

3.4 DISPOSAL OF MATERIALS

A. All solids or semisolids resulting from the cleaning operations shall be removed from the site and disposed of by the CONTRACTOR in a legal and sanitary manner as approved by appropriate authorities, at the CONTRACTOR's cost. Copies of records of all disposal shall be furnished to the OWNER, indicating disposal site, date, amount and a brief description of material disposed. All materials shall be removed from the site no less often than at the end of each workday. Under no circumstances will the CONTRACTOR be allowed to accumulate debris, etc., on the site of work beyond the stated time, except in totally enclosed containers and as acceptable to the ENGINEER.

3.5 ROOT REMOVAL

A. Roots shall be removed in the designated sections and manholes where root intrusion is present. Special attention should be used during the cleaning operation to assure almost complete removal of roots from the joints. Procedures may include the use of mechanical equipment such as rodding machines, bucket machines and winches using root cutters and porcupines, and equipment such as high-velocity jet cleaners. CONTRACTOR shall capture and remove all roots from the line.

3.6 ACCEPTANCE OF CLEANING OPERATION

A. Acceptance of sewer line cleaning shall be made upon the successful completion of the television survey and shall be to the satisfaction of the ENGINEER. If television survey shows the cleaning to be unsatisfactory, the CONTRACTOR shall be required to reclean and reinspect the sewer line until the cleaning is shown to be satisfactory.

B. In addition, on all those lines which have sags or dips, to an extent that the television camera lens becomes submerged for three (3) or more feet during the television inspection, the CONTRACTOR shall pull double squeegee and/or sponges through the line in order to remove the water from those dips or sags. Water removal through squeegees and/or sponges shall be performed until the television camera lens will not longer be submerged. This requirement may be waived by the ENGINEER if the water in which the camera lens is submerged, is clear enough to allow the identification of pipe defects, cracks, holes and location of service taps.

- END OF SECTION -

SECTION 02752

TELEVISION SURVEY FOR CURED IN-PLACE PIPE LINING

PART 1 - GENERAL

1.1 SCOPE

A. The work consists of furnishing all labor, materials, accessories, equipment, tools, transportation, services and technical competence for performing all operations required to execute the internal closed circuit television survey to inspect the entire barrel of storm sewers up to 30 inches in diameter.

B. The survey shall show all defects and determine amount of infiltration entering the sanitary sewer and storm sewer system.

1.2 GENERAL

A. After preparatory Cleaning (including special cleaning involving the mechanical removal of roots, grease, and/or tuberculation where authorized), and before and after rehabilitation work, the pipe sections shall be visually surveyed by means of closed-circuit television in the presence of the ENGINEER and/or OWNER. The survey shall be performed one manhole-to-manhole / catch basin-to-catch basin section at a time and the flow in the section being surveyed shall be suitably controlled as described in Section 02750 – “Flow Bypass Pumping System (Sanitary Sewer)” and Section 02734 - "Flow Bypass Pumping System (Drainage)".

B. Pre- and post-construction survey video on CD-ROM shall be delivered to the ENGINEER and OWNER on a “one line per CD-ROM” basis and pre- and post-TV log, for each storm sewer line surveyed. The video on CD-ROM shall be direct from a live video source into a video file, format MPEG1, and of good quality for viewing. Video tapes shall not be accepted.

C. The television equipment operator shall be certified under the NASSCO (National Association of Sewer Survey Companies) PACP (Pipe Line Assessment and Certification Program).

1.3 EQUIPMENT

A. The television camera used for the survey shall be one specifically designed and constructed for such survey and shall be of the pan and tilt type. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing a minimum 700 line resolution color video picture. The CONTRACTOR shall maintain camera in clear focus at all times. Picture quality and definition shall be to the satisfaction of the ENGINEER and/or OWNER; and if unsatisfactory, equipment shall be removed and replaced with adequate equipment at no additional cost to the OWNER.

B. The video camera shall include a title feature capable of showing on the tape the following information:

1. City and State

2. Date/Time

3. CONTRACTOR's Name

4. Line Size, Material, and Depth

5. Manhole / Catch Basin Identification (both manholes / catch basins)

6. On-going Footage Counter

1.4 SUBMITTALS

A. The CONTRACTOR shall submit shop drawings and other information in accordance with Section 01340 - Submittals. The CONTRACTOR's submittals shall include description of the software to be used and a sample of the video titles to be used, along with a sample of the television survey log to be used.

PART 2 - PRODUCTS

All inspection information and data (including video) written to digital media (CD-ROM).

PART 3 - EXECUTION

3.1 PRECONSTRUCTION SURVEY

A. Procedure

1. Prior to any repair work, the entire storm sewer line (from manhole to manhole / catch basin to catch basin) shall be televised. The camera shall be placed at the center of the manhole and videotaping shall commence prior to entering the pipe. The CONTRACTOR shall show the inside of the manhole / catch basin walls and the pipe connection to the wall at both the upstream and downstream manhole / catch basin.

2. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the storm sewer's condition. In no case shall the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, powered rewinds and tractors or other devices that do not obstruct the camera view or interfere with proper documentation of the storm sewer conditions shall be used to move the camera through the storm sewer line. If the camera is being pulled through the storm sewer line by a hydraulic cleaning unit hose the cleaning nozzle shall be located a minimum of eight (8) feet away from the camera to allow a clear, unobstructed view. Jet nozzle shall be used in front of camera while televising through a dip to draft out water. If, during the survey operation, the television camera will not pass through the entire manhole / catch basin section, the CONTRACTOR shall set up his equipment so that the survey can be performed from the opposite manhole / catch basin.

3. Whenever non-remote powered and controlled winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two manholes / catch basins of the section being surveyed to insure good communications between members of the crew.

4. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole / catch basin, will not be allowed. Measurement meters shall be accurate to tenths of a foot over the length of the section being surveyed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, electronic distance meter or other suitable device. Manhole / catch basin numbers and linear footage shall be shown on screen during taping.

5. Movement of the television camera shall be temporarily halted for a minimum of ten seconds at each visible point source of infiltration and/or inflow until the leakage rate from that source is quantified. The camera shall be stopped at all service connections and the service lateral shall be inspected with the pan and tilt camera. The camera shall also be stopped at active service connections where flow is discharging. If the discharge persists, the property involved shall be checked to determine whether or not the discharge is sewage. If no flows are being discharged from the building, it shall be considered that the observed flow is infiltration/inflow.

B. Field Documentation

1. Television Inspection Forms (Survey Logs). Printed and electronically stored location records shall be kept by the CONTRACTOR and will clearly show the location in relation to an adjacent manhole / catch basin of each infiltration point observed during survey. Upstream footage at face of manhole / catch basin (0) and downstream footage at face of manhole / catch basin (e.g., 250) shall be shown on the log. The television inspection forms to be utilized by the CONTRACTOR shall be those mandated by NASSCO's PACP. Both the "Header" and "Details" information of the form shall be entered as indicated in the PACP standards. The survey logs shall include, but not be limited to the following information:

   a. Correct pipe segment/manhole/catch basin numbers

   b. Correct address of manhole / catch basin location

   c. Pipe size, length and material

   d. Manhole / catch basin depth (up and downstream)

   e. UAZ (Utilities Analysis Zone) number

   g. CD number and index

   h. Footage locations, descriptions and estimated leak rates for visible point sources of infiltration inflow

   i. Footage locations and descriptions of structural defects such as obstructions, any remaining root intrusion, offset joints, cracked pipe, fractured pipe, holes, collapses, sags, protruding service connections and/or blockages in the pipe.

   The terminology to be used shall follow NASSCO's PACP standards. All information will be recorded and a copy of such electronic records and a hard copy will be supplied to the ENGINEER and OWNER.

2. Photographs. Digital photographs of the television picture of problems shall be taken by the CONTRACTOR upon request of the ENGINEER and/or OWNER.

3. Video Recordings. The purpose of video (CD-ROM) recording shall be to supply a visual and audio record of problem areas of the lines that may be replayed. CD-ROM recording playback shall be at the same speed that it was recorded. Slow motion or stop motion playback features shall be supplied by the CONTRACTOR. Once recorded, the CD-ROM becomes property of the OWNER. The CONTRACTOR shall have all CD-ROM and necessary playback equipment readily accessible for review by the ENGINEER and/or OWNER during the Project.

The observation terminology utilized during audio narration shall be consistent with NASSCO's PACP standards. The television inspection shall be video recorded on high quality CD-W. The CD shall be clearly labeled with the lift station number and individual manhole / catch basin numbers clearly listed. The CDs are to be furnished to the ENGINEER and OWNER with a printed hard copy (Survey Logs) and electronic data inspection report.

Video CDs displaying poor video quality will be deemed unacceptable and no payments will be made until lines are re-televised and a new CD is submitted. Poor video quality refers to, but is not limited to, the following: grease or debris on the lens, camera under water, picture too dark, excessive camera speed through the line, lines improperly cleaned, poor/no audio, etc.

4. Audio. All CD-ROM shall have audio record. As a preamble, at the beginning of the CD-ROM, the CONTRACTOR shall state the following: "(Contractor's Name) is performing a pre/post TV survey for Job No. 12-009 (provided by the OWNER), City of West Palm Beach". State date, time, operator's name, area, upstream manhole / catch basin number to downstream manhole / catch basin number, pipe size and material, upstream manhole / catch basin depth, and TV survey will be from up- to downstream, or down- to upstream. The CONTRACTOR shall verbally state station and position of all laterals and defects. At the end of each line, state: "End of line", upstream manhole / catch basin number to downstream manhole / catch basin number, and total linear footage.

3.2 POST CONSTRUCTION SURVEY

A. Procedure

1. The same procedures shall be used as indicated in Section 3.01 PRECONSTRUCTION SURVEY.

2. In addition, the CONTRACTOR shall stop camera at all point repairs, sectional repairs, and reinstated laterals, and inspect entire repaired pipe section.

3. The CONTRACTOR shall invert white foreground to black as needed in the line section with light background.

4. In the case of a post-liner survey, the CONTRACTOR shall fully televise both ends of the liner at the manhole / catch basin so that the fit of the liner to the host pipe can be evaluated. At the conclusion of a television survey for a given liner, the CONTRACTOR shall physically turn the camera around to film the liner end, so that the camera is facing back in the direction it just traversed, to ensure an adequate and complete picture.

5. The post-liner television survey shall be done within 2 weeks of liner installation.

B. Documentation

1. The same documentation shall be provided as indicated in Section 3.01 PRECONSTRUCTION SURVEY.

END OF SECTION

SECTION 02760

SERVICE LATERAL TELEVISION SURVEY

PART 1 - GENERAL

1.1 SCOPE

A. The work consists of furnishing all labor, materials, accessories, equipment, tools, transportation, services and technical competence for performing all operations required to execute the internal closed circuit television survey to inspect service laterals.

B. The survey shall show all defects and determine amount of infiltration entering the service laterals.

1.2 GENERAL

A. The lateral shall be visually surveyed by means of closed-circuit television in the presence of the ENGINEER. The survey shall be performed one lateral at a time.

1.3 EQUIPMENT

A. The television camera used for the lateral survey shall be one specifically designed and constructed for such survey. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing a minimum 700-line resolution color video picture. The CONTRACTOR shall maintain camera in clear focus at all times. Picture quality and definition shall be to the satisfaction of the ENGINEER; and if unsatisfactory, equipment shall be removed and replaced with adequate equipment.

B. The camera system shall be able to inspect 3, 4, and 6-inch lateral connections up to 70 feet from the sewer mainline. The launcher shall be mounted on a tread tractor that moves through main sewers and positions the inspection camera launcher opposite the lateral line connection.

C. The camera system shall have mini black and white or color, fixed position, positioning camera to observe and place the mini color, push, Ainspection@ camera at the lateral. The inspection camera shall be attached to an 80-foot long push cable with a fiberglass rod core for cable rigidity. The camera head shall point forward while traveling through the sewer mainline.

D. The camera used from a cleanout shall be able to be launched from the cleanout and travel down to the sewer mainline, up to 100 feet.

E. The video camera shall include a title feature capable of showing on the tape the following information:

1. City and State

2. Date/Time
3. CONTRACTOR's Name
4. Pipe Size (Diameter)
5. Upstream Manhole Number & Distance to Lateral
6. On-going Footage Counter

1.4 SUBMITTALS

A. The CONTRACTOR shall submit shop drawings and other information in accordance with Section 01340 – Shop Drawings, Product Data and Samples. The CONTRACTOR's submittals shall include video tape and a sample of the video titles to be used, along with a sample of the television survey log to be used.

PART 2 - PRODUCTS

2.1 VIDEO DVD

A. Extra High Grade DVD shall be supplied for all television surveys.

B. All DVD's shall be submitted to the ENGINEER and will become the property of the OWNER.

2.2 VIDEO LOGS

A. Video reports or logs are to be neat and completely filled out and submitted to the ENGINEER along with the DVD.

PART 3 - EXECUTION

3.1 POST CONSTRUCTION SURVEY

A. Procedure

1. The entire service lateral (from mainline to property line / cleanout, whichever is farther from the mainline) shall be televised.

2. Measurement for location of defects shall be above ground by means of a meter device. Measurement meters shall be accurate to tenths of a foot over the length of the section being surveyed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device. Linear footage shall be shown on screen during taping.

3. Movement of the television camera shall be temporarily halted for a minimum of ten seconds at each visible point of flow until the source and flow rate from that point are determined.

4. The inspection shall be performed from either the main sewer or the cleanout with

proper equipment specified. All costs of material, equipment, labor, and other costs due to unspecified field conditions shall be borne by the CONTRACTOR.

5. The CONTRACTOR shall invert white foreground to black as needed in the line section with light background.

B. Documentation

1. Television Survey Logs: Location of the lateral by indicating the upstream manhole number, distance from the upstream manhole, lateral connection to the main line (left, center or right), and address of the customer serviced by the lateral, shall be noted on the television survey log. Printed location records shall be kept by the CONTRACTOR and will clearly show the location, in relation to the cleanout or the mainline of each infiltration point observed during survey. Footage shall be shown on the log. The CONTRACTOR shall measure the depth of the upstream and downstream manholes. Measurements shall be from the invert of the pipe to the top of the manhole rim and shall be recorded on the survey log.

2. Photographs: Instant developing, 35 mm, or other standard-size photographs of the television picture of problems shall be taken by the CONTRACTOR upon request of the ENGINEER.

3. Videotape Recordings: The purpose of video recording shall be to supply a visual and audio record of problem areas of the lines that may be replayed. Videotape recording playback shall be at the same speed that it was recorded. Slow motion or stop motion playback features shall be supplied by the CONTRACTOR. Once videotaped, the tapes become property of the OWNER. The CONTRACTOR shall have all videotapes and necessary playback equipment readily accessible for review by the OWNER during the Project.

4. Audio: All tapes shall have audio record. As a preamble, at the beginning of the tape, the CONTRACTOR shall state the following: “(Contractor’s Name) is performing a post TV survey for City of West Palm Beach. State date, time, operator’s name, area, pipe size and material, upstream manhole number and depth. The CONTRACTOR shall verbally state the position of the lateral with respect to the upstream manhole and describe defects. At the end of each line, state: “End of line” and total linear footage.

END OF SECTION

SECTION 02765

CURED-IN-PLACE-PIPE (CIPP) LINING FOR GRAVITY PIPE

PART 1 – GENERAL

2.1 WORK INCLUDED

A. The work specified in this section includes all labor, materials, accessories, equipment and tools necessary to install and test cured-in-place pipe lining in gravity mains. The finished pipe liner shall be fabricated from materials which when cured will, be chemically resistant to withstand internal exposure to the typical fluid within the host pipe (domestic sewage or stormwater) and designed to handle all internal and external pressures.

B. Furnish all labor, materials, equipment, and incidentals required to conduct testing, pre- and post-rehabilitation CCTV inspections, and other requirements described herein for final gravity main lining acceptance

C. CIPP installation of the primary main will take place prior to all manhole coating work and adjacent lateral/service lining work. Lined-through manholes shall be opened prior to manhole coating work.

2.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including the General Conditions and Terms and Division 1 Specification sections, apply to this section.

B. The following sections are referenced in this specification:

1. 01340 – Submittals
2. 01610 - Delivery, Storage and Handling
3. 02734 – Flow Bypass Pumping System (Drainage)
4. 02750 – Flow Bypass Pumping System (Sanitary Sewer)
5. 02751 – Preparatory Cleaning and Root Removal
6. 02752 – Television Survey for Cured In-Place Pipe Lining
7. 02760 – Service Lateral Television Survey
8. 02770 - Cured-In-Place-Pipe (CIPP) Lining for Laterals
9. 02775 – Manhole Rehabilitation

2.3 REFERENCED DOCUMENTS

This specification references standards from the American Society for Testing and Materials.

A. ASTM D543 (Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents)

B. ASTM D638 (Standard Test Method for Tensile Properties of Plastics)

C. ASTM D695 (Standard Test Method for Compressive Properties of Rigid Plastics)

D. ASTM D696 (Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C with a Vitreous Silica Dilatometer)

E. ASTM D790 (Test Methods for Flexural Properties of Un-Reinforced and Reinforced Plastics and Electrical Insulating Materials)

F. ASTM D1044 (Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion)

G. ASTM D2990 (Tensile, Compressive, and Flexural Creep and Creep- Rupture of Plastics)

H. ASTM D5813 (Cured In Place Thermosetting Resin Sewer Pipe) ASTM F1216 (Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin Impregnated Tube)

I. ASTM F1743 (Rehabilitation of Existing Pipelines and Conduits by Pulled- in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP))

J. ASTM F2454 (Sealing Lateral Connections and lines from the mainline Sewer Systems by the Lateral Packer Method, Using Chemical Grouting)

K. City of West Palm Beach Approved Materials List

L. ASTM F1216 (Standard Practice for Rehabilitation of Existing Pipeline and Conduits by the Inversion and Curing of a Resin – Impregnated Tube)

All of the above are made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.

2.4 CONTRACTOR SUBMITTALS

Furnish Submittals in accordance with Section 01300 – Submittals and the following supplemental requirements:

This specification references standards from the American Society for Testing and Materials.

A. Certification showing the Contractor or lining Subcontractor is currently licensed by the National Association of Sewer Service Companies (NASSCO) to perform CIPP installation. All certifications shall be submitted to the Engineer before any materials are ordered.

B. Shop drawings, plans, equipment catalog data, and written descriptions detailing short and long-term properties (providing all supporting test data) of all components,

materials and composite materials, and recommendations for material storage and temperature control, CIPP handling, insertion, curing, trimming, and finishing, and QA/QC procedures. The Contractor shall submit design calculations to the Engineer for review after field verification of sizes and prior to ordering any material from the manufacturer for the required minimum thickness for the CIPP to be installed in each pipe reach based on the internal inspection data and the CIPP manufacturer's specifications:

1. CIPP lining supplier's name and a list of material manufacturers.
2. CIPP lining schedules including field-verified lengths and diameters for all CIPP linings and appurtenances required. Plans should include map(s) showing insertion points, equipment and storage locations, and field wet-out locations for all CIPP installations.
3. Detailed installation procedures including CIPP lining production schedule, acceptable inversion heads and pressures, inversion procedures, curing and cool-down procedures and temperatures, and times for each process stage.
4. If a field wet-out procedure will be used for liner impregnation, submit a complete description of the proposed wet-out procedure with detailed information on equipment and material storage locations, resin volumes and/or weights, liner length, start times,
   finish times, resin injection locations, and any other pertinent data documenting the wet-out procedure.
5. Design data and specification data sheets listing all parameters used in the CIPP liner design and thickness calculations based on ASTM F1216.
6. Certification stating CIPP tube has been manufactured in accordance with ASTM F 1216 and resin is suitable for its intended use and this specification.
7. Procedure and materials to reinstate connecting sewers and laterals and for sealing at manhole and lateral connections.
8. Detailed method for addressing CIPP sampling requirements including location and size of each sample, method of removal, and method of liner repair and procedure for testing CIPP Liner.
9. Pre-installation and post-installation CCTV Inspection reports.
10. A complete list of service laterals, including relevant footage and diameter shall be submitted to the Owner and Engineer prior to initiating CIPP lining.
11. Stormwater and sewage bypass plans in accordance with this specification and with Section 02734 – Flow Bypass Pumping System (Drainage) and Section 02750 – Flow Bypass Pumping System (Sanitary Sewer) respectively.
12. Test Results. Prior to using any materials, furnish the proposed material's test results from an independent laboratory in conformance with these specifications. All submitted test data shall have been performed on field installed samples within the last 12 months. Testing by an independent

laboratory shall verify the products to be used meet all minimum strength standards as set forth in ASTM F1216, Table 1. Testing shall also verify any product to be used on the project meets the minimum chemical resistance requirements as established in ASTM F1216, where the testing is in accordance with ASTM D543.

13. Pipe Cleaning Narrative. Submit a narrative describing in sufficient detail the proposed methods for root cutting and cleaning the existing gravity mains. Prepare such narrative to include the degree of cleaning as recommended by the lining manufacturer. Such narrative shall indicate the lining manufacturer's technical representative's approval for the proposed cleaning methods.
14. Manufacturers' shipping, storage, and handling recommendations for all CIPP system components.
15. A safety plan and MSDS sheets (Safety Data Sheets) for all hazardous chemicals used or expected to be on-site including resin, catalyst, cleaners, and repair agents.
16. Technical procedure or information regarding the control and mitigation of shrinkage and wrinkling during installation and cure of CIPP liner. Copies of previous physical properties tests as well as chemical resistance tests.
17. An odor control plan describing how odors will be minimized at the project site upon request from the City.
18. All pipelines and structures shall be listed by the City's asset name in all submittal documentation.
19. CIPP manufacturer's statement accepting five (5) years warranty responsibility.

C. All gravity main lining design calculations shall be sealed and signed by a Florida registered professional engineer.

D. Submit a copy of the initial customer notification as described in Section 3.01.

E. Post-lining inspection data. Submit the final television inspection that shows the rehabilitated pipe per Section 02760.

2.5 QUALITY ASSURANCE

A. The Contractor shall have a minimum of three (3) years of continuous experience installing the CIPP liners in pipe of a similar size, length and configuration as contained in this contract and a minimum of five (5) years of continuous experience installing the CIPP liners in pipe of a similar size, length and configuration as contained in this contract if the project includes any of the following: pipes with a diameter of 36-in or larger, pipes installed with 10-ft or more of cover, pipes installed outside of the Owner's right-of-way and pipes installed within a railroad right-of-way. A minimum of 200,000 linear feet of liner installation experience in Florida is required including past completed project references. The lead personnel including the

superintendent, the foreman and the lead crew personnel for the CCTV inspection, resin wet-out, the CIPP liner installation, liner curing and the robotic service reconnections must have a minimum of three (3) 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.

B. The CIPP liner manufacturer shall have a minimum installation history of two (2) years 100,000 linear feet of furnished product in the sizes applicable for this Project. Verifiable experience shall be submitted to the Owner upon request.

C. All CIPP linings (including lining for laterals) shall be from a single manufacturer. The Engineer and/or Owner may inspect the CIPP lining after delivery and reject any or all of the lining products if they fail to meet the requirements specified herein.

2.6 WARRANTY

A. The liner shall be certified by the manufacturer for specified material properties for a particular job. The manufacturer shall warrant the liner to be free from defects in raw materials for five (5) years-from the date of acceptance. The Owner may conduct TV inspections within the warranty period. During the warranty period, any defects that affect the integrity or strength of the pipe shall be repaired at the Contractor's expense in a manner mutually agreed by the Owner and the Contractor. Any defects replaced at that time shall be fully warrantied by the Contractor and manufacturer for one year from the date the defect was repaired. During the non-prorated warranty period, any defects which affect the integrity, strength or water tightness of the installed pipe shall be repaired at the Contractor’s expense.

B. Wrinkles, blisters, dry spots in resin, or other defects in the finished gravity main, which in the Owner’s opinion, negatively affect the gravity main’s integrity or strength or the pipe’s flow capacity or performance of solids passage are unacceptable. Contractor will be responsible to remove and repair, at Contractor’s expense, all such defects in a manner satisfactory to the Owner. Defects also include but are not limited to the following:

1. Leakage through the lining or between lining and pipe
2. More than 10 percent reduction in the lining thickness
3. Lining separating from the pipe
4. Excessive wrinkles inhibiting flow (greater than 3% outside of lower 120 degrees of pipe and greater than 2% within lower 120 degrees of pipe or at Owner’s discretion).
5. Foreign Inclusions
6. Dry spot (area devoid of resin)

C. The lining shall be as free as commercially practicable from visual defects such as

foreign inclusions, dry spots, pinholes, and delamination. The lining shall have a smooth surface free from leaks, cracks, and crazing. Some minor waviness that, in the Owner's opinion, will not appreciably decrease the flow cross-section or affect the flow characteristics shall be permissible.

2.7 DELIVERY, STORAGE AND HANDLING

A. If the flexible tube is impregnated with resin at the factory, it shall be transported, installed, and cured before expiration of the shelf life.

B. The certified CIPP Contractor or Subcontractor shall be responsible for the delivery, storage and handling of all materials for CIPP lining in accordance with the written requirements of the manufacturer.

C. The Contractor shall exercise adequate care during transportation, handling and installation to ensure the CIPP material is not torn, cut, or otherwise damaged. If any part or parts of the CIPP material becomes torn, cut or otherwise damaged before or during insertion, it shall be repaired or replaced in accordance with the manufacturer's recommendations and approval by the Engineer before proceeding.

D. The CIPP lining shall be maintained at a proper temperature in refrigerated facilities and protected from ultraviolet light at all times prior to installation to prevent premature curing. Any CIPP lining showing evidence of premature curing shall be rejected for use and immediately removed from the site.

E. Storage and handling shall be in accordance with Section 01610 Delivery, Storage and Handling.

PART 2 - PRODUCTS

2.1 CIPP LINER

A. The CIPP liner is to be provided per the City of West Palm Beach's Approved Materials List or approved equivalent.

B. The outside reach of CIPP liner tube shall be labeled by the liner manufacturer with the location of the liner manufacturer, the liner thickness, and the liner diameter. The outside of the flexible tube shall be marked along its full length at regular intervals not to exceed five (5) feet.

C. The flexible tube shall be one or more layers of needled felt or equivalent non-woven material manufactured under quality- controlled conditions set by the manufacturer and be capable of holding resin and withstanding installation pressures and curing temperatures. The tube shall be compatible with the resin system used and shall contain no intermediate layers that delaminate after resin curing. The liner tube will be lined on one side with a translucent impermeable chemically resistant waterproof coating that is compatible with the tube/resin material. This coating will be on the inside of the lined pipe after curing is completed. The coating will provide a smooth and seamless inner wall.

D. Tube material shall be able to stretch to fit irregular pipe sections and negotiate bends. The tube shall be fabricated to a size so that, when installed, it will fit snugly inside the circumference and length of the existing gravity main and produce the required thickness after the resin is cured. Allowance should be made for circumferential stretching during installation and shrinkage of resin during curing and aging so that the final cured product is snug against the wall of the host pipe and free of fins and buckles.

E. The minimum length of the flexible tube shall be as necessary to effectively and fully span the distance between manholes, with allowance for proper stretching or shrinkage due to pressure or expansion.

F. The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly, or the probe or knife blade moves freely between the layers. If the layers separate during field sample testing, new samples will be required to be obtained from the installed pipe. Any reoccurrence may cause rejection of the work.

G. The felt tubing shall be vacuum impregnated with a thermosetting resin system. The resin used shall be compatible with CIPP system used and designated for use in the host pipe (sewer or storm).

H. The resin will be a corrosion resistant thermo-set polyester, vinyl ester or epoxy resin designed for use in the host pipe (sewer or storm) applications including all required catalysts, initiators that when cured within the tube create a composite that satisfies the requirements of ASTM F1216, ASTM D5813 and ASTM F1743, the physical properties herein, and those which are to be utilized in the submitted and approved design of the CIPP for this project. The resin shall not contain fillers, except those required for viscosity control or fire retarding. The resin shall be formulated to have a gel (pot) life appropriate for the scope of the work. The resin shall be heat cured by an internal exothermic chemical reaction initiated by steam. The resin shall produce a CIPP that will comply with the structural and chemical resistance requirements of this specification. The resin shall be resistant to abrasion from solids, grit, and sand in wastewater and stormwater. The resin shall have proven resistance to the municipal wastewater environment.

I. The reinforced / seam stitched / heat welded seam tape / felt liner tube and resin will meet and or exceed prior to and upon installation minimum testing standards as required by ASTM (ASTM F1216 and ASTM D5813) and ANSI/NSF International. All materials must have 3rd. party testing provided by an independent laboratory. The materials must be ANSI/NSF Standard-14 approved.

J. The wet- o u t tube shall have a relatively uniform thickness that when compressed at installation pressures will equal or exceed the calculated minimum design CIPP wall thickness.

K. The CIPP shall be designed as per ASTM F1216, Appendix X.1. The CIPP

design shall assume no bonding to the original pipe wall. Contractor shall submit to the Engineer the design calculations for approval prior to procuring materials for the project.

L. The Contractor must have performed long-term testing for flexural creep of the CIPP pipe material installed by his/her Company. Such testing results are to be used to determine the long-term, time dependent flexural modulus to be utilized in the product design. This is a performance test of the materials (Tube and Resin) and general workmanship of the installation and curing as defined within the relevant ASTM standard. A percentage of the instantaneous flexural modulus value (as measured by ASTM D790 testing) shall be used in design calculations for external buckling. The percentage, or the long-term creep retention value utilized, shall be verified by this testing. Retention values exceeding 50% of the short-term test results shall not be applied unless substantiated by qualified third party test data to the Owner's satisfaction. The materials utilized for the project shall be of a quality equal to or better than the materials used in the long-term test with respect to the initial flexural modulus used in the CIPP design.

M. The cured pipe material (CIPP) shall conform to the structural properties, as listed below.

Required Cured-In-Place Lateral Lining Standards	Minimum
Flexural Strength (ASTM D-790)	4,500 PSI
Flexural Modulus (ASTM D-790)	250,000 PSI
Tensile Strength (ASTM D-638)	3,000 PSI
Compressive Strength (ASTM D-695)	5,400 PSI
Chemical Resistance (ASTM D-543)	< 20% loss
Leakage Test (NSF Standard 14)	0/gal/in/day

* Leakage test performed by ANSI/NSF International

The required structural CIPP wall thickness shall be based as a minimum, on the physical properties above or greater values if substantiated by independent lab testing and in accordance with the design equations in the ASTM F1216, Appendix X1, and the following design parameters:

- Design Safety Factor (typically used value) = 2.0
- Maximum long-term deflection shall be 5 percent.
- All material properties used in design calculations shall be long-term (time-corrected) values.
- The CIPP shall be designed for fully deteriorated conditions.

- Retention Factor for Long-Term Flexural Modulus to be used in Design = 50%
- Ovality = Based on greater of actual ovality found during CCTV inspection and 2% (i.e. 2% minimum)
- Enhancement Factor, K = 7 min.
- Groundwater Depth (above invert of existing pipe) = Greater of 8 ft. or depth shown on plan
- Soil Depth (above crown of existing pipe) = Greater of 8 ft. or depth shown on plan
- Soil Density = 120 pcf (moist)
- Live Load = H20 Highway minimum; increase as needed for railroad crossing loads
- Designed for 50-year service life.
- Additional design requirements may be required for the following: pipes with a diameter of 36-in or larger, pipes installed with 10-ft or more of cover, pipes installed outside of the Owner's right-of-way and pipes installed within a railroad right-of-way.
- The design for the CIPP shall recognize any non-uniform cross section and the liner bifurcation present at the spring line of the pipe. Accounting for this condition using an ovality reduction factor alone is unacceptable.
- Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the structural CIPP wall thickness computation.

N. Chemical Resistance:

1. The liner shall be fabricated from materials which, when complete, are chemically resistant to and will withstand internal exposure to domestic sewage having a pH range of 5 to 10.5 and temperatures up to 125-degrees Fahrenheit.
2. CIPP liners shall meet the minimum chemical resistance requirements in accordance with ASTM D 543 and meet the chemical resistance requirements of ASTM F1216, Appendix X2.1 CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical testing requirements.

O. Hydraulic Capacity - Overall, the hydraulic cross-section shall be maintained to the greatest extent practical. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.

2.2 END SEALS

A. End seals shall be utilized at manhole connections and at lateral connections if needed. The rubber end seal shall be an extended hydrophilic rubber compounded from chloroprene (Neoprene) rubber and hydrophilic resin that expands on contact with water.

B. The end seals must be in a tubular form which when installed will form 360-degree seal between the host pipe and the newly installed liner and must be a minimum 3-inches wide. The use of caulking, rope, or band type of an end seal will not be allowed unless approved by the Owner/Engineer.

C. On contact with water, the rubber shall swell and mold itself to completely fill any gaps and exert pressure evenly to ensure the seal.

2.3 LATERAL CONNECTIONS/SEALS

A. Lateral connections (and/or storm services if connected directly to storm pipe) should be reconnected and sealed after the main gravity line has been lined. If the laterals off a main line are also being lined, the connection between the lateral and main line should be sealed with brim seal connection style, or full-wrap style lining as part of the lateral lining work in accordance with Section 02770 - Cured-In-Place-Pipe (CIPP)

Lining for Laterals. If not, in addition to the brim seal and full-wrap connection, the connection can also be sealed via chemical grouting in accordance with ASTM F2454.

B. For brim seal (top hat)/full-wrap connections, the reconnection should be performed by installation and curing of a resin-impregnated, flexible insert with sealing epoxy element in the form of a tube or top hat that will be installed into the existing service lateral utilizing a pressure apparatus and curing devise positioned in the mainline pipe in accordance with applicable ASTM standards as determined by the Owner. The resin shall be rapidly cured to transform the flexible insert into a hard, impermeable brim seal or full-wrap seal around and in the lateral connection.

C. The seal insert shall be fabricated to a size that when installed will key into the internal surface irregularities of the lateral joint and neatly fit tight to the internal

circumference of the lateral. The insert shall be of a material that allows for circumferential stretching and angular alignment with the lateral pipe connection geometry during insertion.

1. The finished brim seal/full-wrap product shall be a material and resin which when cured is chemically resistant to domestic sewage over the expected lifetime of the rehabilitated pipe.
2. The installed product shall be compatible with the lining system utilized for the main and/or lateral sewer lines.
3. Should have structural properties in accordance with ASTM F1216 and should meet the 50-year design life of the CIPP main (and lateral) liner.
4. Unless otherwise specified, the installer shall furnish a specially formulated polyester resin and catalyst system compatible that provides cured physical strength at least to the same level as required for the main and lateral liner.
5. A secondary epoxy-sealing component shall be used to form a sealing bond between the seal insert product and the host lateral and main pipe walls.

2.4 MATERIAL TESTING

Testing shall be carried out prior to the commencement of the Work to confirm that the materials used comply with the specification. Tests shall be carried out by an independent body approved by the Engineer.

A. The following tests shall be carried out and corresponding progress reports and results provided to the Engineer, on samples of cured resin/felt composite conforming to this specification:

1. Tensile Strength
2. Tensile modulus of elasticity
3. Flexural strength
4. Flexural modulus of elasticity
5. Compressive strength
6. Long term flexural creep test

B. In addition to the tests identified in 2.04 (A), the following tests shall also be required for the following: pipes with a diameter of 36-in or larger, pipes installed with 10-ft or more of cover, pipes installed outside of the Owner's right-of-way and pipes installed within a railroad right-of-way.

1. Density
2. Hardness (Barcol)
3. Impact resistance
4. Shear strength
5. Abrasion resistance

6. 100-day acid test

C. Details of standard test procedures shall conform to the relevant ASTM standard.

D. Additional requirements are detailed below:

1. Tensile Strength Testing: Samples shall be without end pieces. The rate of grip separation shall be 1 mm/minute. The tensile modulus of elasticity shall be measured over the linear portion of the load extension curve. If the load extension curve contains no straight portion, the modulus shall be taken as the slope of the tangent to the curve over the first 0.2% strain ignoring the initial strain required to straighten the sample. Samples of single layer felt/resin composite and multi-layer (2 or 3 layers of felt) composite shall be tested. The test report shall contain full particulars concerning the test and shall also include load extension curves for each sample.

2. Flexural Testing: Samples of single layer felt/resin composite and multi-layer (2 or 3 layers of felt) composite shall be tested. The modulus of elasticity shall be measured in accordance with Tensile Strength Testing above. The test report shall be measured in accordance with Tensile Strength Testing above. The test report shall contain all particulars in accordance with the relevant standard.

3. Density: Determine the hardness of single layer and multi-layer samples of cured resin/felt composite in accordance with the relevant standard.

4. Hardness: Determine the hardness of single layer and multi-layer samples of cured resin/felt composite in accordance with the relevant standard.

5. Impact Resistance: The impact resistance of samples of multi-layer resin/felt composite shall be determined. A minimum of ten specimens shall be tested. The test report shall include all relevant particulars required by the relevant standard.

6. Shear Strength: Determine the shear strength of a cured single layer sample of resin/felt composite. The samples shall be tested with the axis of the punch perpendicular to the sheet from which the samples were machined. The test report shall contain all relevant particulars the relevant standard.

7. Abrasion Resistance: The abrasion resistance of the resin/felt composite shall be measured in accordance with ASTM D-1044 using a Tabor abrader with H-18 Calibrade wheels and 1-kilogram weights. The material shall be tested with the surface dry, and again with the surface wet. After 2000 cycles the depth of wear shall be measured and recorded.

8. Coefficient of Thermal Expansion: The coefficient of the thermal expansion of the resin/felt composite shall be measured in accordance with ASTM D-696 or VDE 0304. The method adopted shall be maintained for all tests performed throughout the Contract.

9. Compression Testing: Samples shall be Type 1, and the speed of testing shall be 1 mm/minute. The test report shall contain all particulars required by the relevant standard.

10. 100 Day Acid Test: Samples of single layer and multi-layer or resin/felt composite shall also be subjected to a 100-day acid test. Samples shall be prepared to tensile and flexural testing as heretofore specified and shall be immersed in 10% V/V sulfuric acid at 40 ° C for 100 days. After removal from the acid samples shall be washed, dried, and tested for tensile and flexural properties. The values of the tensile and flexural strengths obtained from such tests shall not be less than 75.1% of the minimum values specified by the tests.

11. All the above tests shall be carried out at 35°C ± 2°C (In addition, Tests (1) to (4), above, i.e. tensile and short-term creep tests, shall be carried out in parallel from the same samples at 25°C ± 2°C (ambient laboratory temperature) for correlation purposes. A report on the form of correlation shall be submitted to the Engineer's along with other test progress reports and results.

PART 3 - EXECUTION

3.1 GENERAL

A. The contractor shall provide appropriate maintenance of traffic to complete the work including securing appropriate right of way and MOT permits from the City of West Palm Beach and other governing agencies as applicable. If water is needed to facilitate the installation, the contractor shall secure a hydrant meter from the City of West Palm Beach and pay for the meter deposit, set up and usage fees.

B. Public Notification - The Contractor shall make every effort to maintain sewer service usage throughout the duration of the project. In the event that a connection will be out of service, the longest period of no service shall be 8 hours. A public notification program shall be implemented, and shall as a minimum, require the Contractor to be responsible for contacting each home or business connected to the sanitary sewer and informing them of the work to be conducted, and when the sewer will be off-line. The Contractor shall also provide the following:

1. Written notice to be delivered to each home or business a minimum of 5 business days prior to the beginning of work being conducted on the section, and a local telephone number of the Contractor they can call to discuss the project or any potential problems.

2. Personal contact with any home or business, which cannot be reconnected within the time stated in the written notice.

3.2 BYPASSING

A. The Contractor shall notify the Engineer and Owner a minimum of 72 hours

prior to commencing any previously approved bypass operations for the sanitary or storm systems. The Contractor shall be solely responsible for clean-up, repair, property damage costs and claims resulting from failure of the diversion system.

1. Sanitary System: The Contractor shall provide for the continuous flow of sewage around the section or sections of pipe designated for repair in accordance with Section 02750 – Flow Bypass Pumping System (Sanitary Sewer). Plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system shall make the bypass.

2. Storm System: The Contractor shall provide a plan to divert stormwater flow during the liner insertion and manhole rehabilitation work in accordance with 02734 – Flow Bypass Pumping System (Drainage). The plan should include the liner insertion and stormwater flow diversion pumping locations and methods with sufficient detail to assure that the work can be performed without incident. The stormwater flow diversion plant shall include an emergency response plan in the event of a failure of the pumping system.

3.3 PRE-INSTALLATION INSPECTION AND CLEANING

A. The CONTRACTOR shall carry out his/her operations in a safe manner and in accordance with all applicable state and federal requirements and regulations in accordance with Section 02751 – Preparatory Cleaning and Root Removal and 02752 – Television Survey for Cured In-Place Pipe Lining. Contractor shall notify the City if any specialty work is required to clean the pipe and shall have written approval from the City before commencing this work.

B. The Contractor shall take field measurements to verify the existing pipe diameter, ovality and length prior to manufacturing liners. If the pipe is more than 3 percent out of round, immediately notify the ENGINEER. The manufacturer shall incorporate these measurements into the manufacturing process of the liner.

C. Initial Cleaning of Gravity Lines - The Contractor shall remove all internal debris out of the main that will interfere with the installation of the CIPP liner. The Contractor shall legally dispose of all debris removed from the pipes during the cleaning operation.

D. Inspection of Pipelines - Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections using close circuit television (CCTV) inspection techniques. The pipeline interior shall be carefully inspected to determine the location of any conditions that may prevent proper installation of CIPP. These shall be noted and corrected.

1. The Contractor shall be responsible for confirming the locations of all laterals, branch service connections and potential obstructions prior to installing the CIPP.

2. A video recording and suitable written log for each line section and the complete list of service laterals shall be produced for later reference by the

Owner.

E. Line Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP.

1. If the invert of a gravity main is eroded more than 2 inches, it shall be filled with grout to match the surrounding pipe surface. Location and distance from the upstream and downstream manholes of all internal and external point repairs shall be determined before rehabilitation commences. All point repairs must be completed prior to CIPP lining. If pre-installation inspection reveals an obstruction such as a protruding service connection, dropped joint, or a collapse that will prevent the installation process, that was not evident on the pre-bid video and it cannot be removed by conventional cleaning equipment, then the Contractor shall make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the Owner's representative prior to the commencement of the work.

2. The Contractor shall trim intruding laterals so when completed, the service connection is flush to within ¼ inch of the internal pipe wall. Lateral cutting shall be documented by internal inspection methods.

3. The Contractor shall ensure that the host pipe is not damaged during lateral trimming operations and document each location subjected to lateral trimming in the (CCTV) inspection.

3.4 INSTALLATION PROCEDURES

A. Installation shall be accomplished by inversion or pulled-in-place methods and cured in place by circulating hot water or steam to produce a hard, jointless, impermeable pipe repair. UV cured CIPP will not be permitted without prior written approval from the Owner.

B. Installation procedures shall be in accordance with the manufacturer's recommendations.

C. If a field "wet out" procedure is used for resin impregnation, the Contractor shall designate a location where the liner tube will be vacuum impregnated prior to installation subject to approval of the Owner. The Contractor shall allow the Engineer to inspect the materials and "wet out" procedure. Sufficient excess resin shall be used in accordance with the latest version ASTM F1216. A roller system shall be used to uniformly distribute the resin throughout the tube.

D. Before installation begins, the tube manufacturer shall provide the minimum pressure required to hold the tube tight against the existing conduit, and the maximum allowable pressure so as not to damage the tube. Once the installation has started, the pressure shall be maintained between the minimum and maximum pressures until the installation has been completed.

E. Insert the hydrophilic sealant material at each manhole connection to seal the liner to

the manhole wall once the liner is installed.

F. The curing of the CIPP must take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of soil). The post-cure temperature should be held for a period as recommended by the resin manufacturer, during which time the recirculation of the water and cycling of the head source to maintain the temperature continues.

G. The bond between all CIPP layers shall be uniform. All layers, after cure, shall be completely saturated with resin.

H. The CIPP shall be cooled to a temperature below 100-degrees F before relieving the hydrostatic head. Care should be taken in release of the static head so that a vacuum will not be developed that could damage the newly installed liner. Provide piping, valves, and other equipment to discharge curing water. Where practicable, liners can be installed in continuous runs through manholes where there are two or more continuous gravity main segments requiring lining, especially to connect several short segments with continuous lining. The temperature of water discharged to the sewer system from processing liners shall not exceed 125–degrees F maximum, or the level allowed by State or local standards if less than 125–degrees F. Temperature gauges shall be placed as needed to monitor the temperatures during the cure cycle.

I. Cut and trim the new lining at each manhole wall. Seal the lining to the manhole wall with hydrophilic sealant material.

J. The CONTRACTOR shall furnish on-site on a continuous basis at least one (1) additional operational robotic cutter assembly train and key spare components as a “stand-by” unit in the event of primary equipment breakdowns.

3.5 FINISHED CIPP LINER PRODUCT

A. The finished CIPP shall be continuous over the entire length of a manhole-to-manhole section of pipe and be free from visual defects such as foreign inclusions, dry spots, pinholes, delamination, fins and wrinkles larger than 2 percent of the pipe diameter.

B. The liner shall conform to the shape of the pipe existing prior to liner insertion and not be out of round by more than 3 percent.

C. Defects beyond the specification allowances, determined by the Engineer as affecting the integrity or strength of the CIPP, or as adversely affecting the hydraulic capacity of the pipe, shall be repaired, or replaced at the Contractor’s expense. Method of repair shall be proposed by the Contractor and submitted to the Engineer for review and approval. The repairs shall be smooth and sealed with an epoxy resin compatible with the CIPP liner system.

D. Fins and wrinkles in the finished CIPP beyond the specification allowances are unacceptable and shall be ground, removed or otherwise repaired and sealed by the Contractor at no additional cost to the Owner.

1. Methods of repair shall be proposed by the Contractor and submitted to the Engineer for review and approval.

E. Separations of liner seams in the finished liner pipe are unacceptable and shall be removed or repaired by the Contractor at no additional cost to the Owner.

1. If a separation of a liner seam exists, the Contractor shall repair or replace that section of the pipe at no additional cost to the Owner.

2. Methods of repair shall be proposed by the Contractor and submitted to the Engineer for approval.

F. There shall be no visible infiltration through the liner at the service connection, or around the liner at manhole connections. The Contractor shall repair all visible leaks in a manner approved by the Engineer.

3.6 POST INSTALLATION

A. After installation of the liner in a full segment pipe, a minimum of one (1) inch of the liner material shall be left to protrude from the wall of the entrance and the exit manholes.

B. The upstream and downstream manholes shall be inspected and any holes or voids in the manhole wall immediately surrounding the new liner shall be sealed with a hydrophilic rubber joint seal and chemical grout. The CIPP shall make a tight seal at the manhole opening with no annular gaps and no infiltration. The Engineer shall approve the seal. The liner shall be cut and trim the liner at each manhole connection upon approval.

C. The lining's field acceptance shall be based on the Owner's evaluation of the installation including post-lined digital CCTV inspection and reviewing certified test data for the installed pipe samples. A post-liner inspection of the rehabilitated line shall be completed in accordance with Section 02752 – Television Survey for Cured in-Place Pipe Lining.

D. Where liners of any type are installed in two or more continuous manhole segments, the liner invert through the trough of intermediate manholes shall be left intact. Final finishing of the installation in those intermediate manholes shall require removal of the top of the exposed liner and neat trimming of the liner edge where it touches the lip of the manhole bench.

E. Portions of any piece of liner material removed during installation shall be available for inspection and retention by the Engineer.

F. The Contractor shall take photographs of Hydrophilic Rubber End Seals at each manhole connection.

G. The liner shall be cut and trim the liner at each manhole connection upon approval.

H. The Contractor shall complete connections to manholes. This work shall be coordinated with manhole rehabilitation work if that work is also being performed in

accordance with Section 02775 – Manhole Rehabilitation.

1. Reinstate openings for all drop assemblies after relining the mainline sewer.

2. Use Class 5 concrete according to FDOT to form a smooth transition with a reshaped invert and a raised manhole bench to eliminate sharp edges of CIPP, concrete bench, and channel invert.

3. Build up and smooth invert of manhole to match flow line of new CIPP.

I. Service connections shall be reinstated without excavation as specified herein.

3.7 REINSTATEMENT OF EXISTING SERVICE LATERALS

A. After curing is complete, existing service connections shall be reinstated.

B. Reinstate service laterals using only remote internal methods (prior to CIPP liner acceptance).

C. Where the CIPP liner does not create dimples at the service connections or in other ways indicate the locations, the exact location shall be determined from the internal inspection data. It is the Contractor's responsibility to accurately locate and reinstate all service connections after the CIPP installation and curing has been completed. All service connections shall be reinstated to a minimum of 95% of the original opening, matching invert of the lateral.

D. The Contractor shall seal all laterals after reinstatements are 100% cut and brushed. Service lateral connections may be a combination of tees, wyes or break-in taps of varying sized and angle from 30 to 90 degrees and may include over-cut lateral openings, pilot holes or defects in relined main gravity pipe. Service Lateral Connections shall be sealed as specified and installed in accordance with the manufacturer's recommended installation instructions.

1. For sealing with chemical grout, the sealing is to be in compliance with ASTM F2454. The lateral sealing area is to include the first joint or 18" into the lateral pipe whichever is more. A test is necessary after the annular space is sealed in keeping with the ASTM Standard. If the test fails any resealing will be done at the expense of the contractor. All grout sealing required (lateral connections and manholes penetrations) are to be 100% complete before the final video is done to document that the completed section is ready to be submitted for payment.

2. For brim seal full-wrap connections/seals, the insert laminate shall seal to the inside wall of the gravity main 3 inches around the lateral opening and to the lateral wall 6 inches up into the lateral pipe from the main (or entire length if lateral is being lined). The brim seal/full-wrap connection should be in compliance with applicable ASTM standards as determined by the Owner. The installed product shall extend from the mainline into the lateral connection in a continuous tight fitting, watertight pipe within-a-pipe to

eliminate any visible ground water leakage and future root growth at the lateral to mainline connection. If, within the warranty period, the product installed in the gravity system is not acceptable due to leakage or any other defects, although originally accepted, the Contractor shall repair or replace the affected portion at no cost to the City. It is understood that if the Contractor fails to do such work as required, the Contractor shall be responsible for said costs of repair or replacement.

3. In addition, during the sealing and testing of the lateral connections the Contractor is to have an inspector present to document the procedure. The contractor is also directed to video record the seal and complete testing as follows: To be paid for lateral reinstatement the video must show 1) a 5 second video prior to sealing, 2) a 15 second video of the test pressure showing the lateral passed the pressure test. The screen must have the lift station number, manhole to manhole numbers and the station footage of the lateral on the main. The video must not run the entire time, just as described above. The Contractor shall submit a list of reinstated service connections to Engineer for approval.

4. The Engineer will compare list of reinstated service connections with approved submittal of lateral locations made prior to installation of CIPP. Any omitted service reinstatements must be thoroughly investigated by the Contractor and if needed, additional reinstatements shall be made at no additional cost to OWNER. No additional payment will be made for excavations for the purpose of reopening connections and the Contractor will be responsible for all costs and liability associated with such excavation and restoration work.

3.8 FIELD SAMPLING AND TESTING

A. The Contractor shall prepare a sample of the installed CIPP liner for subsequent testing of its physical properties.

B. Sampling shall be performed for each separate installation of CIPP on one (1) test per batch-order of liner. As an example – one sample from each pipeline reach where the liner is installed shall be provided.

C. The Owner reserves the right to take five (5) random core samples of the installed CIPP liner at no additional cost in accordance with the procedures in ASTM D5813, as is applicable. The method of repair will be as recommended by the Manufacturer.

D. The cured liner thickness shall be accurately measured as described in ASTM F1743 and shall not be less than 95 percent of the thickness specified.

E. The liner shall be visually inspected in accordance with ASTM F1743 to ensure the number of layers of felt conforms to the specified number of layers and thickness. The Contractor shall calculate the resin-to-felt ratio by weight and the ratio shall fall in the range of 1.10:1 to 1.15:1.

F. The sample shall be prepared using the flat plate sampling method in accordance with the procedures in ASTM F1216.

G. The flat plate sample shall be large enough to provide five sample specimens each for short term flexural (bending) properties, as per ASTM D790. The sample will be clamped in a mold and placed in the downtube during the curing of the CIPP tube.

H. The sample shall be removed after all the water is removed from the cured pipe tube. The samples shall be identified by: Date, Project Name, Size, Thickness, Location, Resin and Catalyst. The cured sample shall be tested by an independent testing laboratory as recommended by the CIPP liner manufacturer and approved by the Engineer for the short term flexural (bending) properties and tensile properties, per ASTM D790 and ASTM D638, respectively. The sample shall be double bagged and sealed.

I. The Contractor shall provide liner test results for long-term properties in accordance with ASTM D2990.

J. The Contractor shall be responsible for any deviation from the specified physical properties and those evaluated through testing. Failure to meet the specified physical properties shall result in the CIPP liner being considered defective work and shall be rejected.

K. The Contractor shall be responsible for all costs associated with the testing of the liner physical properties.

3.9 POST-INSTALLATION AND FINAL ACCEPTANCE

A. In addition to any specific acceptance criteria specified in the contract, the following standards shall be satisfied before final acceptance of the liner installation:

1. Finish - The finished pipe shall be continuous over the length of a run and be free from defects.

2. Defects - Any defects which will affect the integrity of the installed pipe, will be repaired as directed by the owner.

3. Leakage - No visible leakage through the liner will be allowed.

B. The Contractor shall refrain from removing the sewer and stormwater bypass pumping system until both the Engineer and Owner have formally notified the Contractor that the work and finished product is accepted.

C. Correction of failed CIPP or CIPP deemed defective from post-installation inspection or test reports for structural values, thickness, etc., shall be repaired at no extra cost to the Owner. Method of repair, which may require field or workshop demonstration, shall be approved by the Owner.

3.10 CLEANUP

A. After the liner installation has been completed and accepted, the Contractor shall cleanup the entire project area. The Contractor shall dispose of all excess material and debris not incorporated into the permanent installation.

END OF SECTION

SECTION 02770

CURED-IN-PLACE-PIPE (CIPP) LINING FOR LATERALS

PART 1 – GENERAL

2.1 WORK INCLUDED

A. The work specified in this section includes all labor, materials, accessories, equipment and tools necessary to install and test cured-in- place pipe lining in existing service laterals. Service laterals shall be lined from the connection with the main sewer to the property line or easement edge, unless otherwise noted or approved by the Owner. The finished pipe liner shall be fabricated from materials which when cured will, be chemically resistant to withstand internal exposure to the sewage and designed to handle all internal and external pressures.

B. A brim seal connection style, or full-wrap style lining shall be used to address the connection between the main sewer and the service lateral.

C. Furnish all labor, materials, equipment, and incidentals required to conduct testing, pre and post-rehabilitation CCTV inspections, and other requirements described herein for final service lateral lining acceptance.

D. This specification shall also apply to installing CIPP lining for laterals discharging directly into manholes, if the pipe diameter is 6-inch or less.

E. Service laterals may be a combination of tees, wyes, or break-in taps of varying sizes (4-inch to 8-inch) with angles generally ranging up to 90 degrees. The Contractor shall install a cleanout at the property line or easement edge in accordance with details provided if required for a successful installation of the lateral liner.

F. If any active service laterals are identified as defective and the Contractor is unable to line the lateral from the main sewer to the property line or easement edge, the Contractor shall inform the Owner about the lateral's condition and shall propose a rehabilitation method that maximizes the lateral's rehabilitated length while minimizing the extent of surface disruption. The Owner will direct the Contractor as to the acceptable approach for rehabilitating or replacing the service lateral in question.

G. CIPP installation of the primary main will take place prior to adjacent lateral/service lining work.

2.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including the General Conditions and Terms and Division 1 Specification sections, apply to this section.

B. The following sections are referenced in this specification:

1. 01340 – Submittals

2. 01610 - Delivery, Storage and Handling

3. 02750 – Flow Bypass Pumping System (Sanitary Sewer)

4. 02751 – Preparatory Cleaning and Root Removal

5. 02752 – Television Survey for Cured In-Place Pipe Lining

6. 02759 – Replacement of Sanitary Service Lateral and Cleanout

7. 02760 – Service Lateral Television Survey

8. 02765 - Cured-In-Place-Pipe (CIPP) Lining for Gravity Mains

9. 02775 – Manhole Rehabilitation

2.3 REFERENCED DOCUMENTS

This specification references standards from the American Society for Testing and Materials.

A. ASTM D543 (Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents)

B. ASTM D638 (Standard Test Method for Tensile Properties of Plastics)

C. ASTM D695 (Standard Test Method for Compressive Properties of Rigid Plastics)

D. ASTM D696 (Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C with a Vitreous Silica Dilatometer)

E. ASTM D790 (Test Methods for Flexural Properties of Un-Reinforced and Reinforced Plastics and Electrical Insulating Materials)

F. ASTM D1044 (Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion)

G. ASTM D2990 (Tensile, Compressive, and Flexural Creep and Creep- Rupture of Plastics)

H. ASTM D5813 (Cured In Place Thermosetting Resin Sewer Pipe) ASTM F1216 (Rehabilitation of Existing Pipeline and Conduits by the Inversion and Curing of a Resin Impregnated Tube)

I. ASTM F1216 (Standard Practice for Rehabilitation of Existing Pipeline and Conduits by the Inversion and Curing of a Resin – Impregnated Tube)

J. ASTM F1743 (Rehabilitation of Existing Pipelines and Conduits by Pulled- in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP))

K. ASTM F2454 (Sealing Lateral Connections and lines from the mainline Sewer Systems by the Lateral Packer Method, Using Chemical Grouting)

L. City of West Palm Beach Approved Materials List

All of the above are made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.

2.4 CONTRACTOR SUBMITTALS

Furnish Submittals in accordance with Section 01300 – Submittals and the following supplemental requirements:

This specification references standards from the American Society for Testing and Materials.

A. Certification showing the Contractor or lining Subcontractor is currently licensed by the appropriate licensor to perform CIPP installation. All certifications shall be submitted to the Engineer before any materials are ordered.

B. Shop drawings, plans, equipment catalog data, and written descriptions detailing short and long-term properties (providing all supporting test data) of all components, materials and composite materials, and recommendations for material storage and temperature control, CIPP

handling, insertion, curing, trimming, and finishing, and QA/QC procedures. The Contractor shall submit design calculations to the Engineer for review after field verification of sizes and prior to ordering any material from the manufacturer for the required minimum thickness for the CIPP to be installed in each pipe reach based on the internal inspection data and the CIPP manufacturer's specifications:

1. CIPP lining supplier's name and a list of material manufacturers.
2. CIPP lining schedules including field-verified lengths and diameters for all CIPP linings and appurtenances required. Plans should include map(s) showing insertion points, equipment and storage locations, and field wet-out locations for all CIPP installations.
3. Detailed installation procedures including CIPP lining production schedule, acceptable inversion heads and pressures, inversion procedures, curing and cool-down procedures and temperatures, and times for each process stage.
4. If a field wet-out procedure will be used for liner impregnation, submit a complete description of the proposed wet-out procedure with detailed information on equipment and material storage locations, resin volumes and/or weights, liner length, start times, finish times, resin injection locations, and any other pertinent data documenting the wet-out procedure.
5. Design data and specification data sheets listing all parameters used in the CIPP liner design and thickness calculations based on ASTM F1216.
6. Certification stating CIPP tube has been manufactured in accordance with ASTM F 1216 and resin is suitable for its intended use and this specification.
7. Procedure and materials to seal the connections between laterals and gravity main and/or manholes.
8. Detailed method for addressing CIPP sampling requirements including location and size of each sample, method of removal, and method of liner repair and procedure for testing CIPP Liner.
9. Pre-installation and post-installation CCTV Inspection reports.
10. A complete list of service laterals, including relevant footage and diameter shall be submitted to the Owner and Engineer prior to initiating CIPP lining.

11. Sewage bypass plans in accordance with this specification and with Section 02750 – Flow Bypass Pumping System (Sanitary Sewer).
12. Test Results. Prior to using any materials, furnish the proposed material's test results from an independent laboratory in conformance with these specifications. All submitted test data shall have been performed on field installed samples within the last 12 months. Testing by an independent laboratory shall verify the products to be used meet all minimum strength standards as set forth in ASTM F1216, Table 1. Testing shall also verify any product to be used on the project meets the minimum chemical resistance requirements as established in ASTM F1216, where the testing is in accordance with ASTM D543.
13. Pipe Cleaning Narrative. Submit a narrative describing in sufficient detail the proposed methods for root cutting and cleaning the existing laterals. Prepare such narrative to include the degree of cleaning as recommended by the lining manufacturer. Such narrative shall indicate the lining manufacturer's technical representative's approval for the proposed cleaning methods.
14. Manufacturers' shipping, storage, and handling recommendations for all CIPP system components.
15. A safety plan and MSDS sheets (Safety Data Sheets) for all hazardous chemicals used or expected to be on-site including resin, catalyst, cleaners and repair agents.
16. Technical procedure or information regarding the control and mitigation of shrinkage and wrinkling during installation and cure of CIPP liner. Copies of previous physical properties tests as well as chemical resistance tests.
17. An odor control plan describing how odors will be minimized at the project site upon request from the City.
18. All pipelines and structures shall be listed by the City's asset name in all submittal documentation.
19. CIPP manufacturer's statement accepting five (5) years warranty responsibility.

C. All lateral lining design calculations shall be sealed and signed by a Florida registered professional engineer.

D. Submit a copy of the initial customer notification as described in Section 3.01.

E. Post-lining inspection data. Submit the final television inspection that shows the rehabilitated pipe per Section 02760.

2.5 QUALITY ASSURANCE

A. The Contractor shall have a minimum of three (3) years of continuous experience installing the CIPP laterals liners in pipe of a similar size, length and configuration as contained in this contract. The lead personnel including the superintendent, the foreman and the lead crew personnel for the CCTV inspection, resin wet-out, the CIPP liner installation, liner curing and the robotic service reconnections must have a minimum of three (3) years of total experience with the CIPP technology proposed for this contract

and must have documented the following minimum criteria to be deemed commercially acceptable:

Product	Unit	Florida Minimum Requirement	U.S. Minimum Requirement
Lateral Liner	LF	15,000	50,000
Main/Lateral Connections	EA	200	1,000
Stack Single or Double Wye	EA	25	25
Lateral Transitions	EA	50	100

B. All CIPP linings (including lining for laterals) shall be from a single manufacturer. The Engineer and/or Owner may inspect the CIPP lining after delivery and reject any or all of the lining products if they fail to meet the requirements specified herein. Lining rejected after delivery shall be marked for identification and removed from the job site at once.

C. Final Installed Lining Thickness. The final installed lining thickness shall not be less than or more than 10 percent greater than the required thickness. The final installed lining thickness measurement shall be determined from lining sample coupons retrieved from the sewer, plate samples or as deemed necessary by the Engineer. It shall be the Contractor's responsibility to consider site conditions and their installation process to determine the proper lining thickness to install.

D. Non-Compliance. If the flat plate samples do not meet the required 4,500 psi flexural strength and 250,000 psi flexural elasticity modulus as outlined, actual installed samples must be taken. The installed samples shall be taken as directed by the Owner and in accordance with applicable ASTM standards as determined by the Owner. From these samples, the installed thickness shall be determined by taking an average of at least 10 thickness measurements. Installed samples shall then be prepared for re- testing in accordance with these specifications.

2.6 WARRANTY

A. The liner shall be certified by the manufacturer for specified material properties for a particular job. The manufacturer shall warrant the liner to be free from defects in raw materials for free (5) years-from the date of acceptance. The Owner may conduct TV inspections within the warranty period. During the warranty period, any defects that affect the integrity or strength of the pipe shall be repaired at the Contractor's expense in a manner mutually agreed by the Owner and the Contractor. Any defects replaced at

that time shall be fully warrantied by the Contractor and manufacturer for one year from the date the defect was repaired. During the non-prorated warranty period, any defects which affect the integrity, strength or water tightness of the installed pipe shall be repaired at the Contractor's expense.

B. Wrinkles, blisters, dry spots in resin, or other defects in the finished laterals, which in the Owner's opinion, negatively affect the lateral's integrity or strength or the pipe's flow capacity or performance of solids passage are unacceptable. Contractor will be responsible to remove and repair, at Contractor's expense, all such defects in a manner satisfactory to the Owner. Defects also include but are not limited to the following:

1. Leakage through the lining or between lining and pipe
2. More than 10 percent reduction in the lining thickness
3. Lining separating from the pipe
4. Excessive wrinkles inhibiting flow (greater than 3% outside of lower 120 degrees of pipe and greater than 2% within lower 120 degrees of pipe or at Owner's discretion).
5. Foreign Inclusions
6. Dry spot (area devoid of resin)
7. Improperly cut lateral/reinstatement connection

C. The lining shall be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. The lining shall have a smooth surface free from leaks, cracks, and crazing. Some minor waviness that, in the Owner's opinion, will not appreciably decrease the flow cross-section or affect the flow characteristics shall be permissible.

2.7 DELIVERY, STORAGE AND HANDLING

A. If the flexible tube is impregnated with resin at the factory, it shall be transported, installed, and cured before expiration of the shelf life.

B. The certified CIPP Contractor or Subcontractor shall be responsible for the delivery, storage and handling of all materials for CIPP lining in accordance with the written requirements of the manufacturer.

C. The Contractor shall exercise adequate care during transportation, handling and installation to ensure the CIPP material is not torn, cut, or otherwise damaged. If any part or parts of the CIPP material becomes torn, cut or otherwise damaged before or during insertion, it shall be repaired or replaced in accordance with the manufacturer's recommendations and approval by the Engineer before proceeding.

D. The CIPP lining shall be maintained at a proper temperature in refrigerated facilities and protected from ultraviolet light at all times prior to installation to prevent premature curing. Any CIPP lining showing evidence of premature curing shall be rejected for use and immediately removed from the site.

E. Storage and handling shall be in accordance with Section 01610 Delivery, Storage and Handling.

PART 2 - PRODUCTS

3.1 CIPP LINER

A. The CIPP liner for laterals is to be provided per the City of West Palm Beach's Approved Materials List or approved equivalent.

B. The outside reach of CIPP liner tube shall be labeled by the liner manufacturer with the location of the liner manufacturer, the liner thickness and the liner diameter. The outside of the flexible tube shall be marked along its full length at regular intervals not to exceed five (5) feet.

C. The service lateral lining shall be a seamless, corrosion-resistant, cured-in- place pipe lining product that seals the service lateral pipe and the junction between the service lateral pipe and main sewer. The portion of the lateral lining system that connects to the main/lateral interface shall be either a full- wrap or brim-seal connection type and should meet the following requirements:

1. The connection between the service lateral and the main sewer shall be lined so a continuous overlap between the service lateral lining and the main sewer extends 3-inches minimum from the lateral along the entire circumference.
2. The seal insert shall be fabricated to a size that when installed will key into the internal surface irregularities of the lateral joint and neatly fit tight to the internal circumference of the main and lateral. The insert shall be of a material that allow for circumferential stretching and angular alignment with the lateral pipe connection geometry during insertion.
3. A secondary epoxy-sealing component shall be used to form a sealing bond between the seal insert product and the host lateral and main pipe walls.

D. The flexible tube shall be one or more layers of needled felt or equivalent non-woven material manufactured under quality control conditions set by the manufacturer and be capable of holding resin and withstanding installation pressures and curing temperatures. The tube shall be

compatible with the resin system used and shall contain no intermediate layers that delaminate after resin curing. The liner tube will be lined on one side with a translucent impermeable chemically resistant waterproof coating that is compatible with the tube/resin material. This coating will be on the inside of the lined pipe after curing is completed. The coating will provide a smooth and seamless inner wall.

E. Tube material shall be able to stretch to fit irregular pipe sections and negotiate bends. The tube shall be fabricated to a size so that, when installed, it will fit snugly inside the circumference and length of the existing laterals and produce the required thickness after the resin is cured. Allowance should be made for circumferential stretching during installation and shrinkage of resin during curing and aging so that the final cured product is snug against the wall of the host pipe and free of fins and buckles.

F. The minimum length of the flexible tube shall be as necessary to effectively and fully span

the distance between manholes, with allowance for proper stretching or shrinkage due to pressure or expansion.

G. The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly, or the probe or knife blade moves freely between the layers. If the layers separate during field sample testing, new samples will be required to be obtained from the installed pipe. Any reoccurrence may cause rejection of the work.

H. 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.

I. The felt tubing shall be vacuum impregnated with a thermosetting resin system. The resin used shall be compatible with CIPP system used and designated for use with sewage.

J. The resin will be a corrosion resistant thermo-set polyester, vinyl ester or epoxy resin designed for use in sewer applications including all required catalysts, initiators that when cured within the tube create a composite that satisfies the requirements of ASTM F1216, ASTM D5813 and ASTM F1743, the physical properties herein, and those which are to be utilized in the submitted and approved design of the CIPP for this project. The resin shall not contain fillers, except those required for viscosity control or fire retarding. The resin shall be formulated to have a gel (pot) life appropriate for the scope of the work. The resin shall be heat cured by an internal exothermic chemical reaction initiated by steam. The resin shall produce a CIPP that will comply with the structural and chemical resistance requirements of this specification. The resin shall be resistant to abrasion from solids, grit, and sand in wastewater and stormwater. The resin shall have proven resistance to the municipal wastewater environment.

K. The reinforced / seam stitched / heat welded seam tape / felt liner tube and resin will meet and or exceed prior to and upon installation minimum testing standards as required by ASTM (ASTM F1216 and ASTM D5813) and ANSI/NSF International. All materials must have 3rd party testing provided by an independent laboratory. The materials must be ANSI/NSF Standard- 14 approved.

L. The wet-out tube shall have a relatively uniform thickness that when compressed at installation pressures will equal or exceed the calculated minimum design CIPP wall thickness.

M. The CIPP shall be designed as per ASTM F1216, Appendix X.1. The CIPP design shall assume no bonding to the original pipe wall. Contractor shall submit to the Engineer the design calculations for approval prior to procuring materials for the project.

N. The Contractor must have performed long-term testing for flexural creep of the CIPP pipe material installed by his/her Company. Such testing results are to be used to determine the long-term, time dependent flexural modulus to be utilized in the product design. This is a performance test of the materials (Tube and Resin) and general workmanship of the installation and curing as defined within the relevant ASTM standard. A percentage of the

instantaneous flexural modulus value (as measured by ASTM D790 testing) shall be used in design calculations for external buckling. The percentage, or the long-term creep retention value utilized, shall be verified by this testing. Retention values exceeding 50% of the short-term test results shall not be applied unless substantiated by qualified third-party test data to the Owner's satisfaction. The materials utilized for the project shall be of a quality equal to or better than the materials used in the long-term test with respect to the initial flexural modulus used in the CIPP design.

O. The cured pipe material (CIPP) shall conform to the structural properties, as listed below.

Required Cured-In-Place Lateral Lining Standards	Minimum Flexural
Strength (ASTM D-790)	4,500 PSI
Flexural Modulus (ASTM D-790)	250,000 PSI Tensile
Strength (ASTM D-638)	3,000 PSI
Compressive Strength (ASTM D-695)	5,400 PSI
Chemical Resistance (ASTM D-543)	< 20% loss
Leakage Test* (NSF Standard 14)	0/gal/in/day

* Leakage test performed by ANSI/NSF International

The required structural CIPP wall thickness shall be based as a minimum, on the physical properties above or greater values if substantiated by independent lab testing and in accordance with the design equations in the ASTM F1216, Appendix X1, and the following design parameters:

- Design Safety Factor (typically used value) = 2.0
- Maximum long-term deflection shall be 5 percent
- All material properties used in design calculations shall be long-term (time-corrected) values.
- The CIPP shall be designed for fully deteriorated conditions.
- Retention Factor for Long-Term Flexural Modulus to be used in Design = 50%
- Ovality = Based on greater of actual ovality found during CCTV inspection and 2% (i.e. 2% minimum)
- Enhancement Factor, K = 7 min.
- Groundwater Depth = Greater of 8 ft. or depth shown on plan
- Soil Depth (above crown of existing pipe) = Greater of 8 ft. or depth shown on plan

- Soil Density = 120 pcf (moist)
- Live Load = H20 Highway
- Designed for 50-year service life
- The design for the CIPP shall recognize any non-uniform cross section and the liner bifurcation present at the spring line of the pipe. Accounting for this condition by the use of an ovality reduction factor alone is unacceptable.
- Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the structural CIPP wall thickness computation.

P. Chemical Resistance:

1. The liner shall be fabricated from materials which, when complete, are chemically resistant to and will withstand internal exposure to domestic sewage having a pH range of 5 to 10.5 and temperatures up to 125-degrees Fahrenheit.

2. CIPP liners shall meet the minimum chemical resistance requirements in accordance with ASTM D 543 and meet the chemical resistance requirements of ASTM F1216, Appendix X2.1 CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical- testing requirements.

Q. Hydraulic Capacity - Overall, the hydraulic cross-section shall be maintained to the greatest extent practical. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.

R. The installed product shall be compatible with the lining system utilized for the main lines.

3.2 END SEALS

A. End seals shall be utilized at manhole connections and at lateral connections if needed. The rubber end seal shall be an extended hydrophilic rubber compounded from chloroprene (Neoprene) rubber and hydrophilic resin that expands on contact with water.

B. The end seals must be in a tubular form which when installed will form 360-degree seal between the host pipe and the newly installed liner and must be a minimum 3-inches wide. The use of caulking, rope, or band type of an end seal will not be allowed unless approved by the Owner/Engineer.

C. On contact with water, the rubber shall swell and mold itself to completely fill any gaps and exert pressure evenly to ensure the seal.

PART 3 - EXECUTION

1.1 GENERAL

A. The contractor shall provide appropriate maintenance of traffic to complete the work including securing appropriate right of way and MOT permits from the City of West Palm Beach and other governing agencies as applicable. If water is needed to facilitate the installation, the contractor shall secure a hydrant meter from the City of West Palm Beach and pay for the meter deposit, set up and usage fees.

B. Public Notification - The Contractor shall make every effort to maintain sewer service usage throughout the duration of the project. In the event that a connection will be out of service, the longest period of no service shall be 8 hours. A public notification program shall be implemented, and shall as a minimum, require the Contractor to be responsible for contacting each home or business connected to the sanitary sewer and informing them of the work to be conducted, and when the sewer will be off-line. The Contractor shall also provide the following:

1. Written notice to be delivered to each home or business a minimum of five (5) business days prior to the beginning of work being conducted on the section, and a local telephone number of the Contractor they can call to discuss the project or any potential problems.
2. Personal contact with any home or business, which cannot be reconnected within the time stated in the written notice.

1.2 BYPASSING

A. The Contractor shall notify the Engineer and Owner a minimum of 72 hours prior to commencing any previously approved bypass operations for the sanitary or storm systems. The Contractor shall be solely responsible for clean-up, repair, property damage costs and claims resulting from failure of the diversion system.

1. Sanitary System: The Contractor shall provide for the continuous flow of sewage around the section or sections of pipe designated for repair in accordance with Section 02750 – Flow Bypass Pumping System (Sanitary Sewer). Plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system shall make the bypass.

1.3 PRE-INSTALLATION INSPECTION AND CLEANING

A. The CONTRACTOR shall carry out his/her operations in a safe manner and in accordance with all applicable state and federal requirements and regulations in accordance with Section 02751 – Preparatory Cleaning and Root Removal and 02752 – Television Survey for Cured In-Place Pipe Lining.

B. The Contractor shall take field measurements to verify the existing pipe diameter, ovality and length prior to manufacturing liners. If the pipe is more than 3 percent out of round, immediately notify the ENGINEER. The manufacturer shall incorporate these measurements into the manufacturing process of the liner.

C. Initial Cleaning of Lateral Lines - The Contractor shall remove all internal debris out of the laterals that will interfere with the installation of the CIPP liner. The Contractor shall legally dispose of all debris removed from the pipes during the cleaning operation.

D. Inspection of Pipelines - Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections using close circuit television (CCTV) inspection techniques. The pipeline interior shall be carefully inspected to determine the location of any conditions that may prevent proper installation of CIPP in the laterals. The CCTV video inspection must be done on the mainline pipe and laterals, in accordance with Section 02760 – Service Lateral Television Survey to confirm the proposed repair falls within the limitation parameters set by the manufacturer on the following aspects:

1. The location and clock reference of the lateral junctions to be lined
2. Any offsets, any intrusions from the lateral into the main
3. Angle at which the connection comes in
4. Any changes in the lateral's approach angle for the repair length
5. Potential flows coming throughout the lateral pipe
6. Potential flows going through the main pipe
7. Diametric connection size for the lining length
8. Main pipe's size at the service lateral point
9. Service lateral's condition including the presence of debris, turns, bends, changes in diameter, or other observations
10. Active infiltration present within the work area vicinity
11. Any defects noted in the mainline pipe or lateral should be documented using NASSCO PACP/LACP Standards.

E. Inform the Owner about service laterals in which a service lateral lining cannot be installed from the main sewer to the cleanout established at the property line or easement line. The Contractor shall identify these service laterals and provide the Owner with documentation about the conditions encountered including the CCTV inspection. If a full-length lateral lining cannot be installed or a point repair on the service cannot be performed, the Owner may direct the Contractor to install a short lateral lining with no cleanout required extending up the lateral from the main. The length is to be field determined to the maximum length possible but should extend 3 feet minimum up the lateral from the main.

F. Inform the Owner about service laterals in which a short length service lateral product cannot be installed. The Contractor shall identify, document, and video record these services and inform the Owner about the conditions encountered. If a short length lateral lining cannot be installed, the service connection will be "cut and buffed" to restore a 95% minimum service opening.

G. Line Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP.

1. All point repairs and clean out replacements/additions must be completed prior to CIPP lining.

   a. If pre-installation inspection reveals an obstruction such as a dropped joint, or a collapse that will prevent the installation process, that was not evident on the pre-bid video and it cannot be removed by conventional cleaning equipment, then the Contractor shall make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the Owner's representative prior to the commencement of the work.

   b. If the contractor needs to add a new or replace an existing clean out to perform the CIPP lining and this was not evident from the plans, then the Contractor shall perform this work upon written approval from the Owner's representative prior to the commencement of the work.

2. Prior to installing the service lateral product, the area around the lateral sealing surface in the main and lateral shall be inspected.

   a. All protruding taps should be cut even/flush or replaced with factory fitting.
   b. Waste product build-up, hard scale, roots, lateral cutting debris, or resin slugs must be removed using high-pressure water jetting or in-line cutters. All laterals to be lined shall be cleaned as required prior to lining. The term "cleaned" shall mean removing all sand, dirt, roots, grease, and other solids or semisolid materials from the interior face of the sewer mainlines and the service laterals. Built-up deposits on the main and lateral pipe walls shall be removed. The removal shall reach at least 1 foot beyond the scheduled service lateral installation length to allow the bladder to inflate tightly against the pipe walls ensuring a smooth transition from service lateral product to the existing pipe wall.

3. Have a copy of the pre-lining inspections in the field. Immediately prior to lining insertion, the camera shall traverse the lateral to inspect for debris which may have entered the line after the existing condition inspection.

4. Where active infiltration is present and when it is recommended by the service lateral lining manufacturer, the infiltration must be stopped in advance by chemical grouting in accordance with ASTM F2454. Additional precautions need to be taken when applying the sleeve to a main pipe lined with a CIPP lining with a polyolefin coating. The coating is to be lightly scarified, scraping off the coating in the main CIPP in the service lateral lining's vicinity, and verified by the

Owner. This scuffing is mandated for service lateral linings required to adhere to the pipe wall.

5. The Contractor shall be responsible, if needed, for bypassing sewage while installing the service lateral lining product. In cases where the temporary sewage backup is accepted as a replacement for bypassing, the Contractor shall be responsible for all damage caused by sewage backing up into properties or sanitary sewer overflows.

1.4 INSTALLATION PROCEDURES

A. The service lateral lining shall be vacuum-impregnated with resin (wet-out) under controlled conditions. The resin volume used shall be sufficient to fill all voids in the textile lining material at nominal thickness and diameter. The volume shall be adjusted by adding 5% to 10% excess resin for the change in resin volume due to polymerization and to allow for any resin migration into the cracks and joints in the original pipe. All resin shall be contained within the translucent bladder during vacuum impregnations. No dry or unsaturated area in the lateral tube shall be acceptable upon visual inspection.

B. The pressure apparatus shall include a bladder with sufficient length in the main and lateral lines so the inflated bladder extends beyond the ends of the service lateral product's lateral tube and main line tube, pressing the end edges flat against the internal pipe wall, thus forming a smooth transition from service lateral product to pipe diameters without a step, ridge, or gap between the service lateral product and the lateral and mainline pipes' inner diameters.

C. For service lateral linings with hydrophilic materials, the main bladder shall be inflated causing the main sheet to unwrap and expand, embedding the hydrophilic material between the main lining and the main pipe as the main lining is pressed tight against the main pipe.

D. After insertion is completed, recommended pressure must be maintained on the impregnated service lateral product pressing the lining firmly against the inner pipe wall during the entire curing process.

E. The lining shall be cured at ambient temperatures or by a suitable heat source. In no instance will sewage be used to invert or cure linings or calibration tubes. The finished service lateral lining shall be free from dry spots, lifts, and delamination. The installed service lateral lining should not inhibit the CCTV post installation video inspection for the mainline and service lateral pipes or future pipe cleaning operations. For service lateral linings with compression gaskets, the CIPP shall taper at each end providing a smooth transition to accommodate video equipment and maintain proper flow in the mainline. In all cases, the finished product must provide an airtight/watertight verifiable non-leaking connection between the main sewer and sewer service lateral. During the warranty period, any defects with the service lateral that affect the lateral connection's performance, cleaning, or water tightness shall be repaired at the Contractor's expense in a manner acceptable to Owner.

F. Following the lining installation, provide the Owner with an electronic picture and recorded data identifying the location and showing the completed work and restored condition for all the rehabilitated service laterals from the sewer main to the service reconnection point. The Contractor shall televise the rehabilitated lateral to provide a detailed record of finished conditions using NASCCO PACP/LACP guidelines. When complete, the Contractor shall submit the rehabilitated lateral inspections

G. Installation procedures shall be in accordance with the manufacturer's recommendations.

H. The curing of the CIPP must take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of soil). The post-cure temperature should be held for

a period as recommended by the resin manufacturer, during which time the recirculation of the water and cycling of the head source to maintain the temperature continues.

I. The bond between all CIPP layers shall be uniform. All layers, after cure, shall be completely saturated with resin.

J. The CIPP shall be cooled to a temperature below 100-degrees F before relieving the hydrostatic head. Care should be taken in release of the static head so that a vacuum will not be developed that could damage the newly installed liner. Provide piping, valves and other equipment to discharge curing water. The temperature of water discharged to the sewer system from processing liners shall not exceed 125–degrees F maximum, or the level allowed by State or local standards if less than 125–degrees F. Temperature gauges shall be placed as needed to monitor the temperatures during the cure cycle.

K. The Contractor shall furnish on-site on a continuous basis at least one (1) additional operational robotic cutter assembly train and key spare components as a "stand-by" unit in the event of primary equipment breakdowns.

1.5 FINISHED CIPP LINER PRODUCT

A. The finished CIPP shall be continuous over the entire length of service pipe and be free from visual defects such as foreign inclusions, dry spots, pinholes, delamination, fins and wrinkles larger than 2 percent of the pipe diameter.

B. The liner shall conform to the shape of the pipe existing prior to liner insertion and not be out of round by more than 3 percent.

C. Defects beyond the specification allowances, determined by the Engineer as affecting the integrity or strength of the CIPP, or as adversely affecting the hydraulic capacity of the pipe, shall be repaired or replaced at the Contractor's expense. Method of repair shall be proposed by the Contractor and submitted to the Engineer for review and approval. The repairs shall be smooth and sealed with an epoxy resin compatible with the CIPP liner system.

D. Fins and wrinkles in the finished CIPP beyond the specification allowances are unacceptable and shall be ground, removed or otherwise repaired and sealed by the Contractor at no additional cost to the Owner.

1. Methods of repair shall be proposed by the Contractor and submitted to the Engineer for review and approval.

E. Separations of liner seams in the finished liner pipe are unacceptable and shall be removed or repaired by the Contractor at no additional cost to the Owner.

1. If a separation of a liner seam exists, the Contractor shall repair or replace that section of the pipe at no additional cost to the Owner.

2. Methods of repair shall be proposed by the Contractor and submitted to the Engineer for approval.

F. There shall be no visible infiltration through the liner at the service connection, or around the liner at manhole connections. The Contractor shall repair all visible leaks in a manner approved by the Engineer.

1.6 POST INSTALLATION

A. The lining's field acceptance shall be based on the Owner's evaluation of the installation including post-lined digital CCTV inspection and reviewing certified test data for the installed pipe samples. A post-liner inspection of the rehabilitated line shall be completed in accordance with Section 02760
– Service Lateral Television Survey.

B. Portions of any piece of liner material removed during installation shall be available for inspection and retention by the Engineer.

C. The Contractor shall take photographs of Hydrophilic Rubber End Seals when used at manhole connections.

1.7 FIELD SAMPLING AND TESTING

A. The lining's field acceptance shall be based on the Owner's evaluation of the installation including post-lined digital CCTV inspection and reviewing certified test data for the installed pipe samples. The CCTV inspection for each lateral shall extend 10 feet minimum past the end of the rehabilitation work on the service lateral. For laterals where a cleanout was installed, the
CCTV inspection shall include the cleanout and the connection to the existing, undisturbed service lateral.

B. All service connections shall be open, clear, and watertight.

C. A flat plate sample shall be collected for every 50 lateral installations, and the sample shall be submitted to a third-party testing laboratory to confirm and thickness measured as described in ASTM F1743 and strength properties (flexural strength and flexural modulus) in accordance with ASTM F1216. The test results must meet or exceed the strengths in the design, or the Contractor shall provide acceptable remediation measures to repair defects.

D. The lining shall have no evidence of defects including splits, cracks, breaks, lifts, kinks,

delamination's, or crazing.

E. If any defective lining is discovered after it has been installed, it shall be removed and replaced by the Contractor with a new lining, a new pipe, or other measures with the Owner's approval at no additional cost to Owner. Any lining installation not meeting specified strengths or thickness shall provide other acceptable remediation measures as approved by the Owner. Credit will only be accepted if remediation measures cannot be agreed upon. The re-inspection requirements as listed above shall apply to this re-installed section of line.

F. The Owner reserves the right to take five (5) random core samples of the installed CIPP liner at no additional cost in accordance with the procedures in ASTM D5813, as is applicable. The method of repair will be as recommended by the Manufacturer.

G. The Contractor shall be responsible for all costs associated with the testing of the liner physical properties.

H. The Contractor shall refrain from removing the sewer bypass pumping system until both the Engineer and Owner have formally notified the Contractor that the work and finished product is accepted.

1.8 CLEANUP

A. After the liner installation has been completed and accepted, the Contractor shall cleanup the entire project area. The Contractor shall dispose of all excess material and debris not incorporated into the permanent installation.

END OF SECTION

SECTION 02775

MANHOLE REHABILITATION

PART 1 - GENERAL

2.1 WORK INCLUDED

A. The work specified in this section includes all labor, materials, accessories, equipment, and tools for performing operations required to rehabilitate sanitary sewer and stormwater manholes to reduce infiltration and inflow (I&I), provide corrosion protection, repair cracks and voids, and restore/increase structural integrity as a result of application of lining materials to the structure walls, bench, and all other surfaces of concrete, brick or any other masonry construction material. The materials shall be chemically resistant to withstand internal exposure to the typical fluid within the host structure (domestic sewage or stormwater) and designed to handle all design pressures.

B. Where indicated on the plans, recommended by liner manufacturer or as needed to perform the manhole rehabilitation, work may require, patching manhole interior; stopping infiltration with chemical grout; rebuilding invert and benching; resetting or replacing manhole ring and cover assemblies; installing chimney seals, adjusting elevation of manhole frame and cover.

C. Eliminate active infiltration observed in the frame seal, chimney (corbel for brick manholes), cone, wall, bench, invert, holes, or pipe connections prior to applying the manhole lining system.

D. Reinstall existing manhole rings and covers removed to allow the completion of the rehabilitation work and restore the site to its pre-maintenance condition.

E. The Contractor shall provide a written report including photographs for each completed manhole. This report should include the general masonry condition before and after preparation, the amount of infiltration, how infiltration was rectified, and what type and how much product was used.

F. CIPP installation of the primary main will take place prior to all manhole coating work. Lined-through manholes shall be opened prior to manhole coating work.

2.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including the General Conditions and Terms and Division 1 Specification sections, apply to this section.

B. The following sections are referenced in this specification:

1. 01340 – Submittals

2. 01610 - Delivery, Storage and Handling

3. 02734 – Flow Bypass Pumping System (Drainage)

4. 02750 – Flow Bypass Pumping System (Sanitary Sewer)

2.3 QUALITY ASSURANCE

A. Furnish materials of quality required by the American Society for Testing and Materials (ASTM) standards or other approved standards and specifications.

B. Provide guarantee against defective materials and workmanship in accordance with the requirements of these specifications.

C. All workers must be confined space certified prior to starting all work. All workers shall abide by OSHA 1910.146.

D. Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE and SSPC standards and the protective coating manufacturer's recommendations.

E. The contractor installing the finished protective liner shall meet the following requirements and provide the following documentation as part of their qualifications:

1. Be a certified trained applicator of the specified process. Provide documentation supporting applicator's qualifications including applicator's certificate from the manufacturer.
2. Have a minimum of five (5) years of work experience with successfully performing reconstruction of sanitary sewer and stormwater manholes on projects of similar size and scope within the State of Florida and have successfully installed the proposed lining system in a minimum of 500 manholes. Provide a list of all municipal installations performed by the manufacturer and Contractor over the past five (5) years along with the client reference contact name, telephone number, and brief description of work performed.
3. Be fully qualified, experienced, and equipped to complete the work in a timely and satisfactory manner and capable of providing crews as needed to complete this work without undue delay.

F. The City reserves the right to disapprove the use of the Contractor based on the submitted qualifications.

2.4 REFERENCES

A. ASTM – Applicable published standards of the American Society for Testing and Materials, West Conshohocken, PA.

B. SSPWC 210-2.3.3 - Chemical resistance testing published in the Standard Specifications for Public Works Construction, 1997 edition (otherwise known as “The Greenbook”).

C. NACE - The published standards of National Association of Corrosion Engineers (NACE International), Houston, TX.

D. ICRI Technical Guideline No. 03730 - Surface Preparation Guidelines for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion

E. City of West Palm Beach Approved Materials List

2.5 SUBMITTALS

A. Furnish detailed and complete data pertaining to the interior surface of the structure to be rehabilitated, the rehabilitation products, surface preparation and installation to the Engineer for approval in accordance with Section 01300 – Submittals and the following supplemental requirements. The submission should include manufacturer recommendations for each of the products and structures.

1. The submission of these data shall be made in a timely manner to prevent project delay. At the request of the Engineer, test for adverse chemical conditions that may hinder overall product performance. The wall thickness of the liner shall be structurally designed to withstand the hydraulic load generated by the groundwater table and restore structural integrity. Contractor shall submit calculations for approval and/or certifications by the liner manufacturer that demonstrate the required minimum thickness for the field conditions.

2. In additional to liner/coating materials, the submission shall include information on all patching and repair materials, epoxies, chemical grout and additives, cementitious compound, waterproofing, and corrosion control materials that will be used, the installation method, curing times and temperatures, recommended surface preparations, and description of sealing method for each manhole and equipment.

B. Reports: Submit manufacturer's test reports of physical/chemical properties of the product.

C. A certificate of "Compliance with Specifications" shall be furnished for all materials supplied.

D. Documentation showing compliance with OSHA VOC emissions regulations.

E. A work plan including by-pass pumping for stormwater and sewer.

F. A safety plan: Comply with OSHA standards and all regulations pertaining to the work including confined space entry.

G. Applicator Qualifications: Submit qualifications of applicator. Certification by the manufacturer stating that the applicator is trained and approved in the application of the specified products. Certification that the equipment to be used for applying the

products have been manufactured or approved by the protective coating manufacturer and Applicator personnel have been trained and certified for proper use of the equipment. Certification letter shall be dated within six months of bid date.

H. Material Safety Data Sheet (MSDS) for each product used (applies to coatings/linings and chemical grouts).

I. Final installation report on completed manholes including thickness measurements (applies to linings only) and testing reports.

2.6 DELIVERY, STORAGE, AND HANDLING

A. Care shall be taken in shipping, handling and placing to avoid damaging the chemical grouts, cementitious materials, and other manhole rehabilitation products. Extra care may be necessary during cold weather construction. Any lining product or material damaged in shipment shall be replaced as directed by the Engineer or Owner.

B. Any materials showing deterioration, or which has been exposed to any other adverse storage condition that may have caused damage, even though no such damage can be seen, shall be marked as rejected and removed at once from the work.

C. While stored, the materials shall be adequately packaged and protected. The materials shall be stored in a manner as recommended by the manufacturer.

D. Protective coating materials are to be handled according to their material safety data sheets.

E. Storage and handling shall be in accordance with Section 01610 Delivery, Storage and Handling.

2.7 SITE CONDITIONS

A. Applicator shall conform with all local, state and federal regulations including those set forth by OSHA and the EPA and any other applicable authorities.

B. Method statements and design procedures are to be provided by Contractor when confined space entry, flow diversion or bypass is necessary in order for Applicator to perform the specified work.

2.8 WARRANTY

A. Applicator shall warrant all work against defects in materials and workmanship for a period of five (5) years, unless otherwise noted, from the date of final acceptance of the project.

B. The warranty shall be for all labor and materials cost necessary to repair or replace the failed application, including related work (permits, bypass piping, pumps, flow monitoring, restoration, and record information)

Applicator shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship which may develop during said five (5) year period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the Owner.

PART 2 - PRODUCTS

3.1 GENERAL

A. The materials to be utilized in the lining of manholes shall be designed for to withstand internal exposure to the typical fluid within the host structure (domestic sewage or stormwater).

B. Sewer manholes shall be designed and manufactured to withstand the severe effects of hydrogen sulfide in a wastewater environment. Manufacturer of corrosion protection products shall have long proven experience in the production of the lining products utilized and shall have satisfactory installation record.

1. The finished sewer structure shall be corrosion resistant to: Hydrogen sulfide, 20% sulfuric acid, 17% nitric acid, 5% sodium hydroxide, as well as other common ingredients of the sanitary sewage environment.

C. Equipment for installation of repair and lining materials shall be high quality grade and be as recommended by the manufacturer.

3.2 REPAIR MATERIALS

A. Repair materials shall be used to; fill voids, bug holes, structurally reinforce and/or rebuild surfaces, etc. as determined necessary by the engineer, liner manufacturer and protective coating applicator. Repair materials must be compatible with the specified coating/liner and shall be applied in accordance with the manufacturer's recommendations. Shop drawings shall be submitted for all proposed repair materials and should include application, minimum thickness, cure time, compressive strength and surface preparation procedures which permit optimum bond strength with the approved coating.

B. The following products may be accepted and approved as compatible repair basecoat materials for approved top coating for use within the specifications.

1. 100% solids, solvent-free grout specifically formulated for approved top coating compatibility. The grout manufacturer shall provide instructions for trowel or spray application and for approved top coating procedures.

2. In the case of excessive infiltration, a rapid-setting hydraulic cement or plug may be used to stop the flow of the infiltration. Approved manufacturers include Strong or approved equal. The hydraulic cement shall not contain chlorides, gypsums, plasters, iron particles, aluminum powder or gas-forming agents, or promote the corrosion of steel it may come in contact; the plug shall also be compatible with the coating/lining products to be used and shall comply with the following minimum requirements:

Minimum Requirements		
Compressive Strength	ASTM C 109	>1000 psi, 1hr. >2500 psi, 24 hrs.
Tensile Strength	ASTM C 190	>290 psi, 1 day >575 psi, 28 days
Sulfate Resistance	ASTM C 267	No weight loss after 15 cycles @ 2000 ppm
Freeze/Thaw	ASTM C 666 "Method A"	100 cycles
Pull Out Strength	ASTM C 234	14,000 lbs.
Set Time		< 5.0 minutes

3. Factory blended, rapid setting, high early strength, non-shrink cementitious or epoxy repair mortar that can be troweled or pneumatically spray applied may be approved if specifically formulated to be suitable for approved top coating. Such repair mortars should not be used unless their manufacturer provides information as to its suitability for top coating with the approved top coating.
4. Restoration mortar - Low shrinkage, high strength, sprayable cementitious mortar when recommended by the liner manufacturer to restore surface profile.
5. The water used to mix product shall be clean and potable. No material (other than water) shall be used with or added to the patching product.

3.3 LINER MATERIALS

A. The liner material shall be used to form the sprayed on/structural enhanced monolithic liner covering all interior surfaces of the structure including benches and inverts of manholes. The coating/liner system shall be a structural liner from the City of West Palm Beach's Approved Materials List or approved equal and should be appropriate for the existing condition, material and use of the manhole structures to be rehabilitated.

B. Other Materials: All components of the lining system recommended by the product manufacturer for a complete and functional system shall be applied as part of the complete coating system for each manhole. This includes applying primers and additional topcoats as recommended by the liner manufacturer.

3.1 PROTECTIVE COATING APPLICATION EQUIPMENT

A. Manufacturer approved spray equipment shall be used in the application of all layers of the protective coating.

PART 3 - EXECUTION

3.1 INSTALLATION RESPONSIBILITIES

A. The contractor shall provide appropriate maintenance of traffic to complete the work including securing appropriate right of way and MOT permits from the City of West Palm Beach and other governing agencies as applicable. If water is needed to facilitate the installation, the contractor shall secure a hydrant meter from the City of West Palm Beach and pay for the meter deposit, set up and usage fees.

B. Cleaning of Manholes - The Contractor shall remove all internal debris out of the adjacent mains that will interfere with the installation of the liner/coating system. The Contractor shall legally dispose of all debris removed from the adjacent gravity mains during the cleaning operation.

1. Each manhole to be rehabilitated shall be thoroughly cleaned and then inspected for loose or missing bricks, loose mortar, or holes. Remove any protrusions or obstructions into the manhole. Observed leaks shall be eliminated prior to applying the manhole lining system.
2. Damage incurred to the manhole or pipe segments due to methods and equipment employed by the Contractor is the responsibility of the Contractor. Damage to public and private property from sewer surcharging/blocked drainage pipes that results from material or equipment left in the manhole or mains or from any flow blockage is the responsibility of the Contractor. The cost to repair the manhole or pipe segments and expenses incurred by the City as a result of the damage shall be the responsibility of the Contractor.

C. Bypassing Flows - The Contractor shall notify the Engineer and Owner a minimum of 72 hours prior to commencing any previously approved bypass operations for the sanitary or storm systems. The Contractor shall be solely responsible for clean-up, repair, property damage costs and claims resulting from failure of the diversion system.

1. Sanitary System: The Contractor shall provide for the flow of sewage around the manholes designated for repair in accordance with Section 02750 – Flow Bypass Pumping System (Sanitary Sewer). Plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system shall make the bypass. The pump(s) and bypass line(s) shall be of adequate capacity to accommodate the sewage flow.
2. Storm System: The Contractor shall provide a plan to divert stormwater flow during the manhole rehabilitation work in accordance with 02734 – Flow

Bypass Pumping System (Drainage). The plan should include the stormwater flow diversion pumping locations and methods with sufficient detail to assure that the work can be performed without incident. The stormwater flow diversion plan shall include an emergency response plan in the event of a failure of the pumping system.

3. The Contractor shall coordinate with City's Operations and Maintenance Staff a minimum of two (2) weeks prior to performing any work that would require any lift stations to be temporarily shut down.

D. Evaluation of Atmosphere: Prior to entering structures, an evaluation of the atmosphere will be conducted to determine the presence of toxic, flammable vapors or possible lack of oxygen. The evaluation shall be in accordance with local, state or federal safety regulations.

E. Before application of each material, surfaces to be sprayed or coated will be inspected by the Engineer and by the Owner. Correct defects or deficiencies before application of subsequent material.

F. Public Notification - The Contractor shall make every effort to maintain sewer service usage throughout the duration of the project. In the event that a connection will be out of service, the longest period of no service shall be 8 hours. A public notification program shall be implemented, and shall as a minimum, require the Contractor to be responsible for contacting each home or business connected to the sanitary sewer and informing them of the work to be conducted, and when the sewer will be off-line. The Contractor shall also provide the following:

1. Written notice to be delivered to each home or business a minimum of five (5) business days prior to the beginning of work being conducted on the section, and a local telephone number of the Contractor they can call to discuss the project or any potential problems.
2. Personal contact with any home or business, which cannot be reconnected within the time stated in the written notice.

3.2 PREPARATION

A. Place covers over all pipe openings to prevent extraneous material from entering the adjacent piping system. Place tape to protect equipment not intended for spraying/coating. All foreign material shall be removed from the structures' wall and bench/floor using a pressure water spray (minimum 3000 psi). Contractor is responsible for any damage caused during cleaning and is responsible for notifying Engineer if there is a concern that using high velocity water will cause damage to the structure. All contaminants including oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed. The use of acid for cleaning purposes, no matter how dilute, will not be allowed. Loose or protruding brick, mortar and concrete shall be removed by using a mason's hammer and chisel. The surface to be repaired must be clean and free of any loose materials.

B. Inspect cleaned surfaces to identify and mark corroded reinforcing steel, and to locate cracks, leaks, and joints. Remove all loose mortar and rubble of existing chimney (corbelling), cone, walls, benches, and inverts. Prepare manhole to receive lining as necessary by reshaping and repairing benches, inverts, cone, walls, and corbelling where required. All interior surfaces shall be prepared as recommended by the lining manufacturer. Minimum requirements are as listed below:

1. Replace or treat corroded reinforcing steel, repair cracks and leaks, and treat joints in accordance with manufacturer's instructions and as approved by the Engineer. Refer to ICRI Technical Guideline No. 03730 - Surface Preparation Guidelines for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion. Apply approved epoxy putty promptly after cleaning reinforcing steel to protect the steel from contamination and re-rusting.

2. Infiltration shall be stopped by using a material which is compatible with the specified repair mortar and is suitable for top coating with the specified protective coating. Repair cracks and other voids and fill with suitable non-shrinking cements, sealants, or grouts, including all voids between the existing connecting pipes and manhole walls. Patches shall be smooth and even with the manhole wall. All excess or spilled material shall be cleaned and removed prior to application of the liner/coating.

3. The area between the manhole and the manhole ring and any other area that might exhibit movement or cracking due to expansion and contraction, shall be grouted with a flexible grout or gel.

4. Surfaces to receive protective coating shall be cleaned and abraded to produce a sound surface with profile to meet as a minimum ICRI CSP4 – CSP6 profile and porosity to provide a strong bond between the protective coating and the substrate. Detergent water cleaning and hot water blasting may be necessary to remove oils, grease or other hydrocarbon residues from the concrete. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound clean neutralized surface that is not excessively damaged.

5. Prepare surfaces in accordance with manufacturer's recommendations. This includes adding a restoration mortar as needed to rebuild surface profile within the structure as Recommended by the liner manufacturer. When installing restoration mortar:
   a. Do not trap air in corners, behind exposed reinforcing steel, or between lifts.
   b. Mortar Thickness: Apply in layers of a minimum thickness of 1/2" and no more than 4" above peaks of existing profile after surface

preparation. If material sags or slumps, remove it and replace with new material.

c. Manhole chimneys constructed with bricks or precast concrete rings shall be completely lined with the mortar mix but not overlap the bottom inside edge of the manhole frame.

d. Finishing: Finish surface with wood float, sponge float, broom, or brush to produce a textured surface to apply corrosion barrier topcoat.

6. Install coating/liner in accordance with manufacturer's recommendations within 24-hours of surface preparation.

C. Drop Connections: Remove any interior drop connections anchored to manhole walls prior to installing the lining system. After installation and proper curing of the liner, reinstall interior drop connections to their original condition prior to removal. If the existing drop connection is already damaged and cannot be reused, Contractor shall request from the Engineer on the best course of action.

3.3 INSTALLATION/APPLICATION

A. Application Temperatures: Temperature of the surface to be coated should be maintained as recommended by the product manufacturer during application. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the structure being coated.

B. Surfaces to receive protective coating shall be dry to the touch and or with no visible dampness unless otherwise required by the product manufacturer. This is to insure maximum adhesion to the substrate. If required, drying may be accomplished by a minimum of 20 minutes of a heated, forced air blower. The drying shall be to the specification dictated by the resin manufacturer and its trained applicator.

C. Application of Protective Lining System:

1. The liner shall be manually sprayed on to all surfaces by a trained technician who is experienced and certified in the application of a spray applied resin and has been certified by the manufacturer. Appropriate personal protection equipment shall be utilized but in every case when applying the liner, the sprayer and personnel in direct contact with the spray atmosphere, will always be protected by supplied air.

2. Application procedures shall conform to the recommendations of the protective coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment. This includes apply all recommended layers of the lining system.

3. The spray equipment shall be specifically designed to accurately ratio and apply the specified protective coating materials and shall be regularly maintained and in proper working order.

4. If necessary, subsequent top coating or additional coats of the protective coating should occur within the time frame specified by the product manufacturer. Additional surface preparation procedures will be required if

this recoat window is exceeded.

5. The minimum thickness of the material applied is to be no less than recommended by the product manufacturer to provide structural integrity. No other products such as cement or grouts may be used as part of the structural reinstatement, however, said products may be used as part of the repair process prior to sprayed application of the structure as specified.
6. Application of the spray applied material must be completed in one (1) mobilization in order to minimize the disruption and cost of excessive bypassing, pipeline plugging, traffic control and all other support services.
7. The finished manhole must be returned to full service immediately after the spray application is complete.

D. Bench/Invert Repair: The manhole bench must be sprayed but depending on availability and future plans, some judgment consideration will have to be made regarding the invert. Important issue here is the necessity to insure a monolithic system is achieved. The spray shall be applied such that the entire structure receives a structurally enhanced monolithic liner.

E. The finished invert surfaces shall be smooth, free of ridges and will be sloped in the direction of flow. Special care shall be used to insure a smooth transition between the new manhole invert and intersecting pipeline inverts such that flow will not be impaired.

F. Curing: The structure should be allowed to cure per manufacturer recommendations and return to ambient temperature prior to any physical testing, including vacuum testing.

G. Reset or replace manhole ring and cover assemblies and adjust elevation of manhole frame and cover as needed for a complete and functional manhole. The following procedures should be followed for resetting and/or replacing the manhole:

1. Realign, Grout, and Seal Manhole Casting (Frame): Remove the frame by excavating as necessary, lifting off the frame, thoroughly cleaning its bottom bearing surface, coating it with asphalt paint similar to the original coating, removing the old mortar from the top of the wall and replacing it with a 2-inch (nominal) layer of new mortar consisting of one part of Portland cement to three parts of clean, washed sand, mixed with an adequate amount of water and carefully resealing the frame in its correct position. Realignment may be horizontal or vertical. Where vertical realignment is required, grade rings may be required in order to raise the manhole frame and cover to the existing grade elevation. A minimum of 7 days after the manhole casting has been realigned and grouted, where so indicated by the Owner, the Contractor shall install an aromatic urethane internal manhole sealing system through the frame-joint area.
2. Replace Manhole Ring and Cover and Install Seal: Where the manhole ring and cover is damaged is required to be replaced, the Contractor shall remove and replace the entire assembly with a new frame and cover. The frame shall be set on the manhole wall as described above entitled "Realign, Grout, and Seal Manhole Casting (Frame)" above. A minimum of 7 days after the manhole casting has been realigned and grouted, where so indicated

by the Owner, the Contractor shall install an aromatic urethane internal manhole sealing system through the frame-joint area.

3. Where so indicated by the Owner, a flexible rubber chimney sleeve shall be installed in manhole frame and chimney joint area with stainless steel expansion band to compress the sleeve and seal the chimney area between casting ring and manhole wall, or HDPE manhole liner.

3.4 TESTING AND INSPECTION

A. The following test/inspection will be performed by the Owner's Representative.

1. Visually verify the absence of leaks from infiltration.
2. At no cost to the City, the Contractor shall hire an independent material-testing firm to perform appropriate testing and certify that the thickness of the liner is in accordance with these specifications and the submitted shop drawings. Minimum 1 (one) test shall be performed for each manhole. Each passing thickness test shall have a minimum of 90% of the design thickness for each product. The average of all tests performed for each structure shall be the minimum thickness specified. The testing firm shall issue a written statement to the Department confirming the compliance of each manhole.
3. High Voltage Spark Test: After the protective coating has set hard to the touch it shall be inspected with high-voltage holiday detection equipment. Surface shall first be dried, an induced holiday shall then be made on to the coated concrete or metal surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays at that particular area. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of film thickness applied but may be adjusted as necessary to detect the induced holiday (refer to NACE RPO188-99). 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 protective coating material can be hand applied to the repair area. All touch-up/repair procedures shall follow the protective coating manufacturer's recommendations.

B. Coated Surfaces will be rejected by the Department if they fail:

1. To meet the minimum thickness requirements, or
2. To stop inflow, infiltration, exfiltration, or
3. To restore the structural integrity of the reconstructed structure (if applicable), or
4. To pass the Department's inspections and testing, or
5. To provide uniform and solid mechanical bonding between the structure's

original surface/rehabilitated surface and the cementitious sub-coat and/or the epoxy top coat

C. Rejected Coated Surfaces: Coated and rejected areas must be identified and marked.

1. If any defective lining is discovered after it has been installed, it shall be repaired or replaced in. a satisfactory manner within a 72- hour period and at no additional cost to the Owner. This requirement shall apply for the entire guarantee period.
2. To repair and recoat: sand or grind down to substrate, clean, spray with approved primer sealer, and recoat with specified corrosion barrier topcoat. Re-inspection will be required.
3. The Department may require that additional testing of the liner be performed at the manufacturer's expense any time during the five- year warranty period. Any deficiencies in performance shall be corrected without delay by the manufacturer's contractor at no cost to the Department.

D. A final visual inspection shall be made by the Inspector and manufacturer's representative. Any deficiencies in the finished coating shall be marked and repaired according to the procedures set forth herein by Applicator.

E. The municipal sewer or storm system may be put back into non-severe operational service as soon as the final inspection has taken place. However, for severe corrosion duty such as high concentrations of acids, bases or solvents, 4 to 8 hours may be necessary prior to returning to service. Consult coating manufacturer for further details.

END OF SECTION

SECTION 09972

COATINGS - MORTAR/EPOXY LINER FOR CONCRETE MANHOLES

PART 1 - GENERAL

1.1 SCOPE

A. Furnish all labor, surface preparation and coating material, tools, rigging, harness, lighting, ventilation, gas monitor and other related items of equipment and materials necessary to clean, prepare, cure, coat and cleanup a complete coating system on all structures and/or equipment as specified or shown on the drawings.

B. The work includes coating (application of corrosion barrier system) the interior surface of new sanitary manholes. These areas are located within confined space areas. All workers must be confined space certified prior to starting all work. All workers shall abide by OSHA 1910.146.

C. Clean, prepare, and coat all surfaces in strict accordance with the manufacturer's published recommendations and specifications.

D. Perform all work by the use of skilled work persons in a safe and productive manner using equipment and procedures consistent with good coating practices.

1.2 RELATED SECTIONS

A. Section 01340: Submittals

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Prior to preconstruction meeting submit a certification stating the applicator is:

1. Currently approved by the Manufacturer of the specified products.

2. Licensed and qualified in the application of the specified products.

2.2 QUALITY ASSURANCE

A. Preconstruction meeting: A preconstruction meeting shall be held prior to start of any application of restoration and corrosion barrier system. The Engineer is responsible for scheduling the meeting. The attendance of the Engineer, Applicator, Underground Contractor and City Construction Coordinator is required. During the meeting, the process of preparation, application, curing, field inspection and coordination with other work shall be reviewed.

B. The approved specified products shall be applied in accordance with the Manufacturer's recommendations unless noted otherwise in this specification.

C. Material delivered to the site shall be in Manufacturer's original, unopened containers and packaging, with label clearly identifying product name and Manufacturer, batch and lot number, and expiration date as applicable. The material shall be protected during storage, handling and application to prevent damage.

D. The coating manufacturer shall warrant the corrosion barrier system for five (5) years from the time of:

1. First permanent service activation discharging wastewater into the new structure.

E. The coating manufacturer shall warrant the corrosion barrier system for all labor and materials cost necessary to repair or replace the failed application, including related work (permits, bypass piping, pumps, flow monitoring, restoration, and record information).

2.3 ENVIRONMENTAL CONDITIONS

A. Do not apply materials under the following conditions:

1. Temperature exceeding the Manufacturer's recommended maximum or minimum allowable.

2. Overflowing water condition

2.4 PRODUCTS

A. Restoration and Corrosion Barrier System

1. General:

a. Materials from single Manufacturer

B. Penetrating Epoxy Primer/Sealer

1. Compatible with Corrosion Barrier Topcoat

2. Composition: 100% solids epoxy

3. Number of components: 2

C. Corrosion Barrier Topcoat

1. Composition: 100 percent solids, modified epoxy sprayable coating

2. Thickness: min. of 100 mils in 1 or 2 coats (dry film thickness)

3. Number of components: 2

4. Finish: Gloss

5. Color: White or Gray

D. Water: Water shall be potable and clean.

2.5 APPROVED PRODUCTS

A. Approved products for corrosion barrier systems are Mainstay or equal. Mainstay is manufactured by Madewell Products Corporation, Inc.

Madewell Products Corporation
P.O. Box 902
Roswell, Georgia 30077
(770)-475-8199
(770)-475-8167 Fax

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect surfaces to receive restoration and corrosion barrier system for leaks, deteriorated concrete, cracks and voids. Notify the Engineer and the City Construction Coordinator in writing if surfaces do not meet the minimum conditions as set by the coating Manufacturer. Do not begin surface preparation or application until unacceptable conditions have been corrected. New structures to be inspected and visibly marked by the City Construction Coordinator prior to system application.

B. Give the City Construction Coordinator a minimum of two days advance notice of completion of surface preparation and start of application.

C. Before application of each material, surfaces to be sprayed or coated will be inspected by the City Construction Coordinator. Correct defects or deficiencies before application of subsequent material.

D. Inspection or the waiver of inspection by the City Construction Coordinator and /or the Engineer of any portion of the work shall not relieve the Contractor of responsibility to perform the work as specified.

3.2 SURFACE PREPARATION

A. Place covers over inverts to isolate the structure receiving the surface restoration.

B. Place masking tape to protect equipment not intended for spraying/coating.

C. Prepare surfaces in accordance with manufacturer's instructions.

D. Cleaning: Clean surfaces by water (minimum 3500 psi) or abrasive blasting, or hand or power tools as required to remove all previously applied coatings, unsound concrete, contaminants, dirt, debris, and deteriorated reinforcing steel, laitance, efflorescence, form oils and spoiled concrete.

3.3 HYDROSTATIC LEAKS

A. Stop visible hydrostatic leaks by application of hydraulic cement mortar, after completion of surface preparation.

1. Mix only 1 to 2 pounds of mortar at a time.

2. Add water to form a viscous mass with consistency of modeling clay.

3. Apply by hand or trowel.

4. Press mixed material firmly into place, starting at top of leak and working downward.

5. Inject flowing leaks using a suitable polymer gel or foam. Be sure to remove any excess or spilled material and clean/saturate the concrete surface with water prior to application of the restoration mortar

6. Prepare surfaces to have a minimum profile of 1/16 inch, with aggregate exposed, then remove the water and any loose material.

7. Inspect surfaces for soundness.

8. Saturate all surfaces thoroughly with clean water.

9. Apply mortar as soon as water sheen is no longer visible (saturated surface dry).

3.4 APPLICATION OF CORROSION BARRIER TOPCOAT

A. Provide mixing and application equipment designed for mixing and spraying epoxy coating.

B. Apply penetrating Epoxy primer/sealer and corrosion barrier topcoat epoxy to all prepared surfaces in accordance with manufacturer's instructions.

C. Apply topcoat as soon as possible after application of penetrating Epoxy primer/sealer.

D. Do not allow surface contamination to the finished primer/sealer before application of topcoat.

E. Topcoat Thickness: Spray apply a minimum thickness of 100 mils DFT.

F. Curing of Corrosion Barrier Topcoat

1. Allow a minimum cure time of 24 hours at 70 degrees F.

2. Curing Conditions:

a. Shelter system from direct impingement of water until 1 to 3 hours after application of topcoat, depending on substrate temperatures, after which cure sufficiently to be undamaged by water impingement or immersion at ordinary velocities.

b. Sanitary Sewer Systems: It may be necessary to plug services or main lines temporarily in order to achieve these environmental conditions.

3. Immersion Service: Reach a tack-free condition before being immersed.

4. Remove any loose debris, plugs, covers and masking prior to inspection.

3.5 FIELD QUALITY CONTROL:

A. The Contractor shall hire an independent testing laboratory to perform and certify Check the application for minimum thickness of coatings (minimum ½" of restoration mortar, minimum 100 mils MDFT of epoxy topcoat). The test for the topcoat shall consist of five separate spot measurements (average of three readings each), spaced evenly over each 100 square feet of the area to be tested. The average of five spot measurements for each such 100 square foot area shall not be less than 100 mils MDFT. No single spot measurement in any 100 square foot area shall be less than 80 mils MDFT. Any one of three readings which are averaged to produce each spot measurement may underrun be a greater amount. The five spot measurement shall be made for each 100 square feet of area as follows:

1. Perform minimum 1 set of tests for every manhole, and minimum of three (3) 100 square foot areas shall be randomly selected and measured for every wet well.

2. If the dry film thickness for any 100 square foot area is not in compliance with the average of 100 mils MDFT, then each 100 square foot area shall be tested. Check the application for holidays using recognized testing procedures and equipment, such as "high voltage holiday detector test."

B. Coated Surfaces will be rejected by City if they fail:

1. To meet the MDFT requirements, or

2. To stop inflow, infiltration, exfiltration, or

C. Rejected Coated Surfaces: Coated and rejected areas must be identified and marked. To repair and recoat: sand or grind down to substrate, clean, spray with approved primer/sealer, and recoat with specified corrosion barrier topcoat. Re-inspection will be required.

1. The certified laboratory performing the testing shall issue a written statement to the Department confirming the compliance of each structure.

2. The Department may require that additional testing of the liner be performed at the manufacturer's expense any time during the five-year warranty period. Any deficiencies in performance shall be corrected without delay by the manufacturer's contractor at no cost to the Department.

PART 4 - SAFETY

4.1 GENERAL

A. Make all necessary provisions regarding materials, confined space entry, equipment, personnel, procedures, and practices, to assure that the work is done safely and that the working area is maintained free of all health and safety hazards.

B. Observe manufacturer's health and safety precautions when storing,

C. Direct personnel's attention to all product warnings and information given on the labels of all products.

D. Post warning signs outside of the work to appraise personnel of the hazards in the work area.

E. Remove waste coating materials and contaminated disposable items from the job site and dispose of them at the completion of work each a day.

END OF SECTION