

# EXHIBIT "C"

## CITY OF BOCA RATON UTILITY SERVICES WASTEWATER COLLECTION SYSTEM REHABILITATION

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## SECTION 01010

### SUMMARY OF WORK

#### PART 1 -- GENERAL

##### 1.01 GENERAL

- A. The Work to be performed under this Contract shall consist of furnishing all tools, equipment, materials, supplies, and manufactured articles and for furnishing all transportation and services, including fuel, power, water, and essential communications, and for the performance of all labor, work, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The Work shall be complete, and all work, materials, and services not expressly shown or called for in the Contract Documents which may be necessary for the complete and proper construction of the Work in good faith shall be performed, furnished, and installed by the Contractor as though originally so specified or shown, at no increase in cost to the Owner.
- B. The term "Owner" as used throughout these contract documents shall mean the actual Owner or a third-party representative who may be designated by the Owner to take responsibility for various functions under this contract.

##### 1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project consists of furnishing all labor, materials and equipment for performing sanitary sewer repairs.
- B. In order to obtain representative unit prices for sewer system rehabilitation technologies and construction services, four groups have been developed. Interested contractors are requested to submit price proposals for one or more of those groups which they are qualified to perform. Interested contractors are not required to bid every group but must bid all items within any group they elect to bid. Each group will be awarded, as a separate contract, to the lowest responsible bidder for that specific group.
  - 1. Group "A" - Excavated Point Repairs: Point repairs, cleanout installation, bypass pumping, surface restoration, traffic control, and TV survey.
  - 2. Group "B" - Manhole Rehabilitation: Installing cementitious and epoxy manhole liners, replacing manhole frames and covers and performing other miscellaneous manhole repairs traffic control, and bypass pumping.
  - 3. Group "C" - Cured-in-Place (CIP) Lining: Cured-in-place pipe lining for gravity mains, and associated work such as cleaning and preparation, lateral reinstatement, cleanout installation, bypass pumping, traffic control, and TV survey. This Group also contains cleaning, inspection, and lining for storm sewer piping.
  - 4. Group "D" - Cured-in-Place (CIP) Pressure Pipe Lining: Cured-in-place pipe lining for force mains, and associated work such as cleaning and preparation, bypass pumping, traffic control, and TV survey.

5. Group "E" – Lateral Lining: Pipe lining for laterals, and associated work such as cleaning and preparation, lateral reinstatement, cleanout installation, bypass pumping, traffic control, and TV survey.
- C. Work Order Development - Awarded Contractor(s) are expected to perform the required services for each Work Order as stipulated during the contract period.
- D. Prior to construction, the Contractor shall identify existing utilities. The Contractor will be responsible for the coordination of his work with the associated utility owner and permitting agencies having jurisdiction over the specific locations to be verified.
- E. After site visit and/or discussion with the Owner regarding the requirements and perimeters of a job, Contractor shall develop a Work Order consistent with the categories and information referenced in "Exhibit A" attached hereto. After Work Order has been developed, Contractor shall provide Work Order to the Owner for review and approval. Once the Contractor obtains an approved Work Order from the Owner, commencement of work under the Work Order shall be within fifteen (15) calendar days from the date the Work Order is signed by the Owner, and Contractor shall execute the work until fully complete, or subject to a time frame designated on the work order. Work orders may be issued concurrently.
- F. Repairs shall be continuously generated under individual work orders during the contract period as the results of the ongoing sewer system evaluation survey become available. Groups of work orders of the Project may be issued to the Contractor in the order in which the Owner wishes the lines repaired. The Contractor shall view the available video inspection tapes to familiarize himself with pipe's condition. The work orders or groups shall be worked upon and completed in the order they are issued, and the work of a given group of work orders shall be completed, prior to beginning the work of a subsequent group of work orders, unless otherwise specifically permitted by the Owner. The Owner and Contractor shall agree on a schedule for the completion of each group of work orders prior to initiation of the work.
- G. Upon receipt of any work order, the Contractor shall evaluate the work site and determine whether any foreseeable item of expense is not covered by a pay item under this contract. If the Contractor determines that any foreseeable item of expense is not covered by a pay item under this contract, the Contractor shall notify the Owner of this fact prior to initiation of the associated work and shall await authorization to proceed. If an unforeseeable item of expense is encountered following the initiation of work, Contractor shall similarly notify the Owner of this fact prior to initiation of the associated work and shall await authorization to proceed. In the event that no such prior notifications are made and no such prior authorizations are received, the Contractor will not be paid for the expense(s) in question. No after-the-fact change orders will be considered or approved.
- H. The Work also includes providing temporary sanitary sewer service of service laterals, bypass pumping or plugging, if needed, and other appurtenant and miscellaneous items and work for a completed project.
- I. Work shall be performed to ensure a minimum of traffic disruption or sewer down time as necessary, and work must be coordinated with affected residents and utility personnel. Whenever the property owners' use of the sanitary sewer must be interrupted by the Work, the Contractor shall notify the residents well in advance of the interruption. This notification

shall be accomplished with door hanger notification cards to be placed at the addresses of affected customers. Property owners shall be informed when service interruption will take place and the approximate duration. This notice shall be provided a minimum of 24 hours in advance of commencement of service interruption, unless otherwise specified. The Contractor shall make every effort to minimize inconvenience to the public and property owners.

- J. The Contractor shall perform all work in strict accordance with all applicable OSHA Standards. Particular attention is drawn to those safety requirements involving man entry in confined spaces. Prior to entering manholes and other confined spaces, the atmosphere shall be evaluated by the Contractor to determine the presence of toxic, flammable or explosive vapors or lack of oxygen in accordance with local, state, or federal safety regulations. Contractor shall follow all procedures outlined by OSHA's Confined Space Entry requirements.
- K. The Contractor shall warrant to the Owner that the equipment used on this Contract, where covered by patents or license agreements is furnished in accordance with such agreements and that the prices included herein cover all applicable royalties and fees in accordance with such license agreements. The Contractor shall defend, indemnify and hold the Owner harmless from and against any and all costs, loss, damage or expense arising out of or in any way connected with any claim of infringement of patent, trademark or violation of license agreement.
- L. As the results of the ongoing sewer system evaluation survey become available, specific collection system rehabilitation work orders will be developed for the technologies and remedial construction services in this proposal. The Owner reserves the right to select the technology and scope of work for each work order. Contractor unit prices established under this selection process will determine the total cost of each work order.

#### 1.03 WORK BY OTHERS

- A. The Contractor's attention is directed to the fact that work may be conducted at the sites by other contractors during the performance of the Work under this Contract. The Contractor shall conduct its operations so as to cause a minimum of interference with the Work of such other contractors and shall cooperate fully with such contractors to provide continued safe access to their respective portions of the sites, as required to perform their respective contracts.
- B. When two or more contracts are being executed at one time on the same or adjacent land in such manner that Work on one contract may interfere with that on another, the Owner shall determine the sequence and order of the Work. When the territory of one contract is the necessary or convenient means of access for the execution of another contract, such privilege of access or any other reasonable privilege may be granted by the Owner to the Contractor so desiring, to the extent, amount, in the manner, and at the times permitted. No such decision as to the method or time of conducting the Work or the use of territory shall be made the basis of any claim for delay or damage.
- C. Interference with Work on Utilities: The Contractor shall cooperate fully with all utility forces of the Owner or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the Work, and

shall schedule the Work so as to minimize interference with said relocation, altering, or other rearranging of facilities.

#### 1.04 FIELD LAYOUT OF WORK

- A. All work under this Contract shall be constructed in accordance with the requirements of each work order or as directed by the Owner. Information provided concerning existing ground, structures and appurtenances is believed to be reasonably correct but not guaranteed to be absolute and therefore is presented only as an approximation. Any error or apparent discrepancy in the data shown or omissions of data required for accurately accomplishing the work shall be referred immediately to the Owner for interpretation or correction.
- B. All survey work for construction control purposes shall be made by the Contractor at his expense. The Contractor shall establish all base lines for the location of the principal component parts of the work together with benchmarks and batter boards adjacent to the work. Based upon the information provided, the Contractor shall develop and make all detail surveys necessary for construction. The Owner will furnish information and location of existing benchmarks if available.
- C. The Contractor shall have the responsibility to carefully preserve the benchmarks, reference points and stakes. In case of destruction thereof by the Contractor or resulting from his negligence, he shall be held liable for any expense and damage resulting there from and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such benchmarks, reference points and stakes.
- D. Existing or new control points, property markers, and monuments that will be established or are destroyed during the normal causes of construction shall be re-established by the Contractor; and all reference ties recorded therefore shall be furnished to the Owner. All computations necessary to establish the exact position of the work shall be made and preserved by the Contractor.
- E. The Owner may check all or any portion of the work, and the Contractor shall afford all necessary assistance to the Owner in carrying out such checks. Any necessary corrections to the work shall be performed immediately by the Contractor.

#### 1.05 CONTRACTOR USE OF PROJECT SITE

- A. The Contractor's use of the project site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities, and field offices as applicable. Off-site storage of materials, if required, shall be arranged for by the Contractor and a copy of an agreement for use of other property shall be furnished to the Owner.

#### 1.06 OWNER USE OF THE PROJECT SITE

- A. The Owner may utilize all or part of the existing facilities during the entire period of construction for the conduct of the Owner's normal operations. The Contractor shall cooperate with the Owner to minimize interference with the Contractor's operations and to facilitate the Owner's operations.

#### 1.07 PARTIAL UTILIZATION OF THE WORK BY OWNER

- A. The Contractor is hereby advised that the Owner may accept the responsibility for the maintenance and protection of a specific portion of the project if utilized prior to completion. However, the Contractor shall retain full responsibility for satisfactory operation of the total project.

#### 1.08 PROJECT MEETINGS

- A. Preconstruction Conference: Prior to the commencement of Work at the site, a preconstruction conference will be held at a mutually agreed time and place which shall be attended by the Contractor, its superintendent, and its subcontractors as appropriate. Other attendees will be:
  - 1. Representatives of Owner.
  - 2. Governmental representatives as appropriate.
  - 3. Others as requested by Contractor or Owner.
  - 4. Unless previously submitted to the Owner, the Contractor shall bring to the conference one copy each or provide an electronic copy of the following:
    - a. Preliminary schedule.
    - b. Preliminary procurement schedule of major equipment and materials and items requiring long lead time.
    - c. Preliminary Shop Drawing / Sample / Substitute or "Or Equal" submittal schedule.
    - d. Schedule of Payment Items (lump sum price breakdown) for progress payment purposes.
    - e. Traffic Maintenance Plan
  - 5. The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established.
  - 6. The agenda will include (as applicable):
    - a. Contractor's tentative schedules.
    - b. Transmittal, review, and distribution of Contractor's submittals.
    - c. Processing applications for payment.
    - d. Maintaining record documents.
    - e. Critical work sequencing.
    - f. Field decisions and Change Orders.
    - g. Use of project site, office and storage areas, security, housekeeping, the Owner's needs.



1.10 DIFFERING SITE CONDITIONS

- A. The Contractor shall promptly and before such conditions are disturbed, notify the Owner in writing of: (1) subsurface or latent physical conditions at the site differing materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for this contract. The Owner will promptly investigate the conditions, and if he finds that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the work under this contract, whether or not changed as a result of such conditions, an equitable adjustment shall be made, and the contract modified in writing accordingly.
- B. No claim of the Contractor under this clause shall be allowed unless the Contractor has given the notice required in Paragraph A.
- C. No claim by the Contractor for an equitable adjustment hereunder shall be allowed if asserted after final payment under this contract.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

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## SECTION 01025

### MEASUREMENT AND PAYMENT

#### PART 1 – GENERAL

##### 1.01 SCOPE OF WORK

- A. Payments to the Contractor shall be made on the basis of the Bid Form (Groups A - E) as full and complete payment for furnishing all materials, labor, tools and equipment, and for performing all operations necessary to complete the work included in the Contract Documents. Such compensation shall also include payments for any loss or damages arising directly or indirectly from the work, or from any discrepancies between the actual quantities of work and those shown in the Contract Documents.
- B. The prices stated in the Bid Form (Groups A - E) include all costs and expenses for taxes, labor, equipment, materials, commissions, transportation charges and expenses, patent fees and royalties, labor for handling materials during inspection, together with any and all other costs and expenses for performing and completing the work as shown on the details and specified herein. The Basis of Payment for an item at the price shown in the Bid Form (Groups A - E) shall be in accordance with its description of the item in this Section and as related to the work specified. Unit prices will be applied to the actual quantities furnished and installed in conformance with the Contract Documents. The items listed below, refer to and are the same pay items listed in the Bid Forms. They constitute all of the pay items for the completion of the work. No direct or separate payment will be made for providing miscellaneous temporary or accessory works, services, field offices, layout surveys, job signs, sanitary requirements, testing, safety devices, approval and record drawings, water supplies, power, underground utility locating, maintenance of traffic, site preparation, removal of waste, site cleanup, watchmen, bonds, insurance, mobilization, demobilization, and any other requirements of the General Conditions and Bidding and Contract Requirements. Compensation for all such services, equipment and materials shall be included in the prices stipulated for the unit pay items listed herein.
- C. The Contractor's attention is called to the fact that the quotations for the various items of work are intended to establish a total price for completing the work in its entirety. Should the Contractor feel that the cost for any item of work has not been established in the Bid Form or this Section, the cost for that Work shall be included in some other applicable Bid Item, so that the Total Bid reflects the total price for completing the work in its entirety. It is intended that all work required to complete this Contract will be included in the various items as described herein. No dollar minimum shall be required of the City for the issuance of a Work Order and with the exception of expedited start of work as referenced in Section 01025, there shall be no separate charges for mobilization cost for each Work Order and mobilization costs (if any) shall be incorporated in the unit prices.
- D. In the event of any conflict among sections of these contract documents, the order of precedence as noted in Section 300, 7.0 of the Contract Documents. The Contractor is referred to Appendix A for copies of applicable Owner water and sewer standard details. It is intended that the work described in this section (Section 01025) result in installations conforming to these standard details and that the associated pay items include full compensation for all associated labor, equipment, and materials.

- E. In the event that repairs to roadways, sidewalks, driveways, landscaping, piping, valves laterals, mains, manholes, force mains, utilities, or any other public or private property are required due to damage caused by the Contractor's operations, the Contractor shall provide and employ all necessary labor, equipment, and materials, at no additional cost, to complete such repairs in accordance with applicable provisions of these specifications. This shall include but not be limited to materials for repair, if required, including pipe, fittings and specials, pipe bedding, and materials for surface restoration; transportation and handling costs delivered to the work site; any bypass pumping; providing provisional sewers to maintain service; complying with the State of Florida Trench Safety Act, including shoring; removal, transportation and disposal of existing sewer excavation; supporting and protecting existing utilities as required; dewatering; sheeting and shoring, if necessary; furnishing and installing replacement pipe, fittings and repair couplings; unloading material and placing it in the trench; cutting pipe; furnishing and installing joint materials including lubricant; making all connections within the lines to existing sewers, laterals and structures; placing and compacting bedding and backfill; furnishing and installing additional suitable backfill material, if required; furnishing all materials and equipment required to clean and test the sewer; cleaning and testing the sewer; temporary paving installation and removal; permanent paving replacement; replacement of pavement markings as existed before repair; replacing utilities, catch basins, manholes, trees, grass, shrubs, mail boxes, sprinkler systems, concrete or rock bed driveways, sidewalk and all other similar items, to original locations and to equal or better than original conditions; obtaining and paying for any necessary permits; satisfying all requirements of the permits, and all other appurtenant and miscellaneous items and work including final cleanup.
- F. The Owner will not provide any space or place to store materials for this project. No payment will be made for stored materials.
- G. The Owner will not provide for disposal of any solids resulting from sewer cleaning. The Contractor shall obtain permits and make arrangements as required to properly dispose of solids. 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. Where applicable, the Owner will waive permit fees for Contractor. Water usage by the Contractor shall be metered using a meter to be obtained from the Owner, but the Owner will waive charges for the cost of such usage.
- H. Whenever "Limits of Construction" is referred to, the limit of construction shall be within an area 7.5 feet each side of the centerline of the pipe and no more than five feet beyond the end of the new pipe installed.

#### 1.02 CONTRACT DURATION

- A. As specified in section 300 "Contract"

#### 1.03 PUBLIC CONSTRUCTION BONDS

- A. As specified in the Instructions to Bidders.

#### 1.04 MEASUREMENT

- A. The quantities for payment under this Contract shall be determined by actual measurement of the completed items, in place, ready for service and accepted by the Owner unless otherwise specified. The Owner will witness all field measurements.

- B. When depth of cuts are indicated in the bid items, they shall be measured vertically from the existing grade at excavation point, paved or unpaved, to the pipe invert.
- C. The quantities stated in the Bid Form (Groups A - E) are approximate only and are intended to serve as a basis for the comparison of bids and to fix the approximate amount of the cost of the Project. The Owner does not expressly or impliedly agree that the actual amount of the work to be done in the performance of the contract will correspond with the quantities in the Bid Form (Groups A - E); the amount of work to be done may be more or less than the said quantities and may be increased or decreased by the Owner as circumstances may require. The increase or decrease of any quantity shall not be regarded as grounds for an increase in the unit price or in the time allowed for the completion of the work, except as provided in the Contract Documents.
- D. Payment items for cleaning and televising of mains and laterals will apply when sewer is cleaned and televised for inspection only, or when a sewer repair is not performed due to changed field conditions revealed by the pre-repair video inspection. Cleaning and television inspection performed to prepare for a repair or to document a completed repair are not considered separate pay items. Costs for such cleaning and TV inspection shall be included in the contract unit cost for each particular repair. Lateral inspection shall be performed using a camera launched from the main unless conditions within the sewer require lateral inspection from the cleanout. Reference Table 01025-1 for the television inspection requirements pertaining to each type of repair.
- E. The television inspection requirements in Table 01025-1, as well as other testing, documentation, or procedural requirements throughout these specifications, may be made less stringent on a case-by-case basis at the Owner's sole discretion.
- F. The Owner may request inspection for the purpose of locating or confirming defects in sewer mains and laterals for subsequent repair under this Contract. Where such mains and laterals are subsequently assigned to the Contractor for repair during this Contract, the initial inspection cost shall be deducted from the repair cost.

1.05 GROUP "A" (EXCAVATED POINT REPAIRS) PAYMENT ITEMS

- A. Items A1 to A11 – Point repairs of gravity mains and laterals
  - 1. This work, of whatever nature, will be measured and paid for at the unit price per each as delineated by pipe size and depth brackets as named in the Bid Form (Groups A - E). Payment of the unit price per each shall provide full compensation for all necessary and required work including, but not limited to pre- and post-construction television inspection and sonde locate if required; traffic control; excavation; removal, transportation, and disposal of existing pipe regardless of type; removal, transportation and disposal of material generated by cleaning and preparation; transportation and handling costs; furnishing and installing all materials including pipe (a maximum of 15 feet), pipe joint material including lubricant, pipe bedding, repair sleeves, flexible banded couplings and adapters, rigid sleeves with compression joints, embedment materials, wyes or tees and the reconnection of service laterals; flow isolation; backfill; compaction; complying with the State of Florida Trench Safety Act; supporting and protecting existing utilities as required; dewatering; sheeting and shoring, if necessary; cutting pipe; making all connections within the lines to existing sewers and structures; testing; cleanup; final cleanup; all labor, materials and equipment required to provide a complete and acceptable pipe installation, including all appurtenances, in accordance

with the Contract Documents, the manufacturer's specifications and compliance with all applicable regulatory requirements; and all incidentals related to point repairs to achieve a repaired segment of sewer gravity main or lateral complete in place, tested, and ready for use. Multiple payments can be made under this item if the repair exceeds 15 feet.

2. Payment for bypass pumping, if required (other than because of damage caused by the Contractor), will be paid for under a separate item.
3. Asphalt and concrete repair, if required, will be paid for as a separate item.

**B. Item A12 – Install lateral connection to lined main (open trench)**

1. This item of work will be measured and paid at the unit price per each lateral reinstated and shall include, but not be limited to, furnishing all labor, equipment, and material necessary to install lateral connections to lined mains (Fernco flexible tap saddle, LMT Saddle from LMK Technologies, or approved equal) in accordance with the manufacturer's recommendations, complete and in place.
2. The starting point for this item of work will be the performance of a point repair (one of Items A1 to A11) to expose the main, to provide an open trench with the sewer main located and exposed, as well as subsequent backfill and compaction.

**C. Items A13 to A48 – Items in common**

1. Reference Part 1.10 of this section.

**1.06 GROUP "B" (MANHOLE REHABILITATION) PAYMENT ITEMS**

**A. Note - All items include the installation of a CITY provided manhole insert for each manhole where work is done.**

**A. Items B1 to B2 – Realign, grout and seal manhole casting**

1. This item of work will be measured and paid for at the unit price per each manhole, regardless of size of frame and type of surface features which must be restored. Realignment may be horizontal, vertical, or both. Payment of the unit price per each will provide complete compensation for lifting, removing, cleaning and recoating the cast iron frame; removing and replacing the mortar bedding on the top of the manhole wall; reseating the frame in its correct position; patching as required; surface restoration; cleanup; labor, tools and equipment; and all incidentals as necessary to attain a water-tight junction between manhole wall and cast-iron frame.

**B. Item B3 – Install manhole chimney seal**

1. This item of work will be measured and paid for at the unit price per each seal installed. Payment of the unit price per each will provide complete compensation for furnishing and installing manhole chimney seals, labor, tools, equipment and incidentals necessary for a complete in place, acceptable installation, with no leakage through or around the seal.

**C. Items B4 to B5 – Seal visible infiltration through manhole walls, bench and invert**

1. This item of work will be measured and paid for at the unit price per each manhole,

regardless of depth or size (or number and flow rate of visible leaks encountered). Payment shall be made per unit price per each for sealing or patching all visible leaks by injecting chemical grout; including dewatering (or other means acceptable to the Owner) to relieve hydrostatic pressure outside the manhole.

**D. Item B6 – Repair manhole bench and invert**

1. This item of work will be measured and paid at the unit price of manhole invert repaired. Payment of the unit price will provide compensation for cleaning and patching the manhole bench and flow channels; isolation of the manhole by plugging entering lines; testing labor, tools and equipment; and all incidentals and materials needed to restore the manhole bench and invert.

**E. Item B7 – Replace manhole bench and invert**

1. This item of work will be measured and paid at the unit price per each of manhole invert replaced. Payment of the unit price will provide compensation for cleaning; injecting chemical grout to stop active infiltration, if necessary; furnishing labor, equipment, and all materials or combination of materials and applying them; isolation of the manhole by plugging entering lines; removal and re-installing flow channel and benches; testing labor, tools and equipment; and all incidentals necessary to obtain a watertight, sealed manhole bench and invert.

**F. Item B8 – Replace manhole frame and cover**

1. This item of work will be measured and paid for at the unit price per each, regardless of size. Payment of the unit price per each will provide compensation for furnishing and installing the new frame and cover; salvaging and transporting to the location designated by the Owner of all replaced cast iron materials; cutting, removal and replacement of surface materials as necessary; cleanup; labor, tools and equipment; and all incidentals necessary to obtain a new watertight cast iron cover, complete in place.

**G. Items B9 to B12 – Cementitious manhole liner or cementitious manhole liner with epoxy overlay**

1. This item of work will be measured and paid at the unit price per vertical foot of manhole wall. Measurement will be made from the bench, at its highest point, to the bottom of the frame. Payment of the unit price per vertical foot will provide compensation for cleaning of the wall; furnishing and supplying of all materials or combination of materials making up the cementitious lining or cementitious lining and epoxy overlay and applying them; manufacturer's representative's presence or assistance if required; isolation of the manhole by plugging entering lines; testing labor, tools and equipment; and all incidentals necessary to obtain a watertight, sealed manhole wall and bench complete.
2. Payment for bypass pumping, if required (other than because of damage caused by the Contractor), will be paid for under a separate item.

**H. Item B13 – Install urethane seal**

1. This item of work will be measured and paid for at the unit price per each urethane seal installed. Payment of the unit price per each will provide complete compensation for cleaning of the wall and surface preparation, furnishing and installing all materials, and providing all labor, tools, equipment and incidentals necessary for a complete in place, acceptable installation.

I. Items B14 to B21 – Items in common

1. Reference Part 1.10 of this section.

1.07 GROUP "C" CURED-IN-PLACE (CIP) LINING PAYMENT ITEMS

A. Items C1 to C19 – Install mainline liner

1. This work will be measured and paid at the unit price per linear foot of liner as delineated by the pipe size and depth brackets named in the Bid Forms. Measurement shall be made based on the horizontal projection of the centerline of the permanently installed liner between manholes, measured to the nearest foot from the inside wall of manhole to inside wall of manhole for each section lined. Each unit price bid shall include, but not be limited to, all necessary or required resident notification, sewer pipe cleaning and preparation of the existing sewer, including blocking or plugging incoming lines; removal, transportation and disposal of material generated by cleaning and preparation; pre- and post-lining television surveys; chemical joint sealing if necessary; pipe lining; the cost of obtaining a water meter from the Owner; cleaning; sample collection; grouting to prevent infiltration at service connections and liner ends; cleanup; documentation and reporting; and all labor, materials and equipment required to provide a complete and acceptable liner installation.

2. Where post-installation thickness measurements and/or physical property testing is performed, payment for installed liner will be made as itemized below:

- a. Full payment – If thickness, flexural strength, and flexural modulus of elasticity of installed liner are all 95 percent or more of specified values, full payment will be made accordingly.
- b. Adjusted payment for 90 to 95 percent of specified values – If thickness, flexural strength, or flexural modulus of elasticity of installed liner are between 90 and 95 percent of specified values, payment will be made based on an Adjusted Unit Price, which shall equal the Unit Price bid, multiplied by a Value Factor calculated as follows:

Value Factor =  $\frac{*}{100}$  thickness x  $\frac{*}{100}$  flexural strength x  $\frac{*}{100}$  flexural modulus of elasticity

*\* Insert actual measured or test result expressed as a fraction of the specified value. Maximum allowable is 1.*

- c. Adjusted payment for 85 to 90 percent of specified values – If thickness, flexural strength, or flexural modulus of elasticity of installed liner are between 85 and 90 percent of specified values, payment will be made at one half the Unit Price. Values below 85 percent may result in rejection of the liner.

3. Reinstatement of service lateral connections will be paid for separately.

B. Items C20 to C21 – Install liner end seals

1. This work will be measured and paid at the unit price per each pair of end seals as delineated by the pipe size brackets named in the Bid Forms.

2. Each unit price bid shall include, but not be limited to, all necessary or required labor and expense to procure and install end seals in conjunction with a mainline liner installation. End seals must form a 360-degree seal between the host pipe and the newly installed liner. Acceptable end seals are Insignia End Seals by LMK Enterprises or approved equal.
- C. Items C22 to C23 – CIP liner cure temperature monitoring and reporting
1. This work will be measured and paid at the unit price per linear foot of liner as delineated by the pipe size brackets named in the Bid Forms. Measurement shall be made based on the horizontal projection of the centerline of the permanently installed liner between manholes, measured to the nearest foot from the inside wall of manhole to inside wall of manhole for each section lined.
  2. Each unit price bid shall include, but not be limited to, all necessary or required labor and expense to procure temperature sensors along with necessary computer software and hardware; install temperature sensors between the host pipe and liner in the bottom of the host pipe at intervals no greater than 20-feet for pipe sizes up to 15-inches in diameter and no greater than 10-feet for pipe sizes 18-inches and larger; test the temperature monitoring system's proper functioning prior to installing the liner in the host pipe; monitor the temperatures inside the tube wall of the installed liner to verify proper curing using a computer and associated software with a tamper-proof database which can record the temperatures at this interface throughout the processing of the liner; and deliver to the Owner (via certified report or secure website access) an output report that identifies each sensor by its station in the reach and shows the maximum temperature achieved during the processing of the CIPP and the time sustained at or above the Manufacturer's required curing temperature at each sensor.
- D. Items C24 to C43 – Install CIPP liner in storm sewer mains
1. This work will be measured and paid at the unit price per linear foot of liner as delineated by the pipe size and liner thickness brackets named in the Bid Form. Measurement shall be made based on the horizontal projection of the centerline of the permanently installed liner between manholes or other access points, including the laying length of fittings along the run, measured to the nearest foot from the inside wall of manhole or other access point to inside wall of manhole or other access point for each section lined. Each unit price bid shall include, but not be limited to, all necessary or required traffic control; blocking or plugging incoming lines; dewatering of the pipe to be lined; chemical joint sealing if necessary; pipe lining; the cost of obtaining a water meter from the Owner; cleaning; sample collection; grouting to eliminate infiltration at service connections and liner ends; cleanup; post-lining television survey; documentation and reporting; and all labor, materials and equipment required to provide a complete and acceptable liner installation.
  2. Contractor shall propose a liner thickness for each installation based on physical and structural properties and design equations described in Section 02765 and on site-specific conditions, and the Owner shall approve the proposed thickness prior to installation.

3. Where post-installation thickness measurements and/or physical property testing is performed, payment for installed liner will be made as itemized above for Items C1 to C19.

E. Items C44 to C47– Install cured-in-place sectional pipe liners

1. Items with Bid form units of "EA" will be measured and paid at the unit price per each cured-in-place sectional pipe liner installed up to 6 feet, as delineated by the pipe size brackets named in the Bid Form. Each unit price bid shall provide full compensation for all work including, but not limited to, furnishing and installing section of epoxy impregnated fiberglass liner; pipe cleaning; television inspections; all labor, materials and equipment specified or not which will provide a complete and acceptable liner installation.
2. Items with Bid Form units of "L.F." will be paid for in addition to the price paid under corresponding Items with Bid Form units of "EA" as applicable, at the unit price bid per linear foot of liner installed beyond 6 feet and up to 9 feet. This item will be full compensation for all additional costs associated with work of installing sectional liner beyond 6 feet. Any sectional liner extending beyond 9 feet and up to 12 feet shall be paid for as the less costly of two single liners with Bid Form units of "EA" or one single liner with units of "EA" plus the appropriate cost in units of "L.F." for the additional footage.

F. Items C48 to C56 – Clean and inspect storm sewer mains

1. This item will be paid for at the unit price bid per foot of sewer cleaned and televised with the exception of post-lining inspection which is included in the cost of lining; moreover, this item will be paid no more than once prior to lining provided that no more than the lightest specified cleaning level (less than 20 percent sediment) is required between the initial cleaning and inspection and the Owner's direction to the Contractor to install a liner. The unit price shall provide full compensation for all work required to perform television inspection of storm sewer including, but not limited to, furnishing all labor, equipment and material for cleaning, dewatering, flow isolation, TV inspection, and all incidentals related to storm sewer inspection. The products shall be acceptable to the Owner or otherwise the Contractor shall re-televiser the storm sewer line to the satisfaction of the Owner.
2. Contractor shall demonstrate to the satisfaction of the Owner, through pre-cleaning video or other means agreed to by the Owner, the extent of cleaning required for any given storm sewer main, pursuant to the cleaning levels specified in the Bid Form.

G. Items C57 to C76 – Items in common.

1. Reference Part 1.10 of this section.

1.08 GROUP "D" CURED-IN-PLACE (CIP) PRESSURE PIPE LINING PAYMENT ITEMS

A. Items D1 to D16 – Install cured-in-place liner in force mains (up to 8-foot depth and 40 psi)

1. Items with Bid Form units of "EA" will be measured and paid at the unit price per each as delineated by the pipe size named in the Bid Form and shall include up to 50 feet of force main liner. Each unit price bid shall include, but not be limited to, all necessary or required traffic control; excavation to access the piping; complying with the State of

Florida Trench Safety Act; supporting and protecting existing utilities as required; dewatering; sheeting and shoring, if necessary; cutting of the force main; cleaning and preparation of the existing piping, including flow isolation; removal, transportation and disposal of material generated by cleaning and preparation; pre- and post-television surveys; pipe liner; installation of liner end seals; installation of closure pieces to permanently rejoin and restore the force main to full function upon conclusion of the repair work; testing; backfill; compaction; cleanup; final cleanup; documentation and reporting; and all labor, materials and equipment required to provide a complete and acceptable liner installation.

2. Items with Bid Form units of "L.F." will be measured and paid for at the unit price per foot lined beyond 50 feet of force main, in addition to the corresponding item with Bid Form units of "EA". This item will be full compensation for all additional costs associated with work of installing liner beyond 50 feet.
  3. Payment for bypass pumping, if required (other than because of damage caused by the Contractor) will be paid for under a separate item.
  4. Surge pressure shall be considered 40 percent greater than working pressure (12 psi for 30 psi working pressure, and 16 psi for 40 psi working pressure).
- B. Items D17 to D19 – Force main cleaning using poly pigs
1. Force main cleaning using poly pigs will be considered special cleaning and will be measured and paid per linear foot additionally to cleaning, depending on the pipeline diameter and the type of cleaning, as shown on the Schedule of Prices.
  2. Special cleaning not authorized in writing by the Owner shall be considered part of the cleaning operation and shall not be considered a separate pay item.
- C. Items D20 to D27 – Force main bypass, piped
1. This item shall provide full compensation for bypass operations required for force main lining work, including all labor, materials, accessories, equipment, and tools for performing all operations required to bypass sewage around a section of force main being lined, if surface conditions permit temporary bypass piping.
  2. This item shall include, but not be limited to, traffic control; additional excavation on both sides of the repair if required to access the force main for bypass operations; complying with the State of Florida Trench Safety Act; supporting and protecting existing utilities as required; dewatering; sheeting and shoring, if necessary; additional cutting of the force main on both sides of the repair, if necessary; provision and installation of all piping, fittings, and valves; making all connections to the existing force main on both sides of the repair; maintenance; transportation and storage; temporary bypass and service piping to bypass force main flow around the repair; installation of closure pieces to permanently rejoin and restore the force main to full function upon conclusion of the repair work; testing; backfill; compaction; cleanup; final cleanup; labor; materials and/or any other costs associated with force main flow bypass.
  3. The pay item is a charge per each for all flow bypass operations during all preparatory, cleaning, lining, testing, and reinstatement operations associated with a specific repair.

4. Items with Bid Form units of "EA" will be measured and paid at the unit price per each as delineated by the pipe size named in the Bid Form and shall include up to 50 feet of bypass piping.
5. Items with Bid Form units of "L.F." will be measured and paid for at the unit price per bypass beyond 50 feet, in addition to the corresponding item with Bid Form units of "EA". This item will be full compensation for all additional costs associated with work of providing bypass beyond 50 feet.

D. Items D28 to D34 – Items in common

1. Reference Part 1.10 of this section.

1.09 GROUP "E" CURED-IN-PLACE (CIP) LATERAL LINING PAYMENT ITEMS

A. Items E1 to E4– Install cured-in-place sectional pipe liners

1. Items with Bid form units of "EA" will be measured and paid at the unit price per each cured-in-place sectional pipe liner installed up to 6 feet, as delineated by the pipe size brackets named in the Bid Form. Each unit price bid shall provide full compensation for all work including, but not limited to, furnishing and installing section of epoxy impregnated fiberglass liner; pipe cleaning; television inspections; all labor, materials and equipment specified or not which will provide a complete and acceptable liner installation.
2. Items with Bid Form units of "L.F." will be paid for in addition to the price paid under corresponding Items with Bid Form units of "EA" as applicable, at the unit price bid per linear foot of liner installed beyond 6 feet and up to 9 feet. This item will be full compensation for all additional costs associated with work of installing sectional liner beyond 6 feet. Any sectional liner extending beyond 9 feet and up to 12 feet shall be paid for as the less costly of two single liners with Bid Form units of "EA" or one single liner with units of "EA" plus the appropriate cost in units of "L.F." for the additional footage.

B. Items E5 to E8 – Install T-liner in various-sized mains with 4-inch to 6-inch laterals

1. Items with Bid form units of "EA" will be measured and paid at the unit price per each as delineated by the pipe size and depth brackets named in the Bid Form and shall include up to 25 feet of lateral. Each unit price bid shall include, but not be limited to, all necessary or required labor, equipment, tools, and materials for sewer pipe cleaning and preparation of the existing sewer, including blocking or plugging incoming lines; removal, transportation and disposal of material generated by cleaning and preparation; television surveys; pipe liner; cleaning; testing; cleanup; documentation and reporting; and all labor, materials and equipment required to provide a complete and acceptable liner installation.
2. Items with Bid Form units of "L.F." will be measured and paid for at the unit price per foot of sewer laterals lined beyond 25 feet of lateral, in addition to the corresponding item with Bid Form units of "EA". This item will be full compensation for all additional costs associated with work of installing liner beyond 25 feet.

C. Items E9 to E12 – Install mainline/lateral connection repair system in various-sized mains with 4-inch to 6-inch laterals

1. Items with Bid form units of "EA" will be measured and paid at the unit price per each as delineated by the pipe size and depth brackets named in the Bid Form and shall include up to 25 feet of lateral. Each unit price bid shall include, but not be limited to, all necessary or required labor, equipment, tools, and materials for sewer pipe cleaning and preparation of the existing sewer, including blocking or plugging incoming lines; removal, transportation and disposal of material generated by cleaning and preparation; television surveys; pipe liner; cleaning; testing; cleanup; documentation and reporting; and all labor, materials and equipment required to provide a complete and acceptable liner installation.
  2. Items with Bid Form units of "L.F." will be measured and paid for at the unit price per foot of sewer laterals lined beyond 25 feet of lateral, in addition to the corresponding item with Bid Form units of "EA". This item will be full compensation for all additional costs associated with work of installing liner beyond 25 feet.
  3. The intent of these Items is to allow the Owner to evaluate mainline/lateral connection repair systems that may reasonably be considered as "Substitutes" or "Or-Equals", as defined in the *Standard General Conditions of the Construction Contract* (Engineers Joint Contract Documents Committee, 2002), to the "T-Liner" as manufactured by LMK Technologies, Incorporated (reference Items C48 to C51).
  4. While the Owner reserves the right to decide on the use of T-Liner versus an alternate mainline/lateral connection repair system for any particular installation, in general the intent is to use T-Liner for installations deeper than six feet, and alternate mainline/lateral connection repair systems for more shallow applications.
- D. Item E13 – Transitional liner (6-inch to 4-inch)
1. This item of work will be measured and paid for at the unit price per each, as defined in the Bid Form. Payment of the unit price per each will provide complete compensation for furnishing materials and all labor, tools, equipment and incidentals, to provide as directed by the Owner, a transitional liner (6-inch to 4-inch), as part of a T-liner or mainline/lateral connection repair system, complete in place. Payment for this item, when authorized by the Owner, shall be in addition to a T-liner or mainline/lateral connection repair system.
- E. Item E14 – Lateral grouting (if required in preparation for a T-liner or mainline/lateral connection repair system installation)
1. This item of work will be measured and paid at the unit price per each lateral grouting performed, with the advance concurrence of the Owner, in association with the performance of a T-liner or mainline/lateral connection repair system installation. Payment of the unit price per each will provide complete compensation for furnishing materials and all labor, tools and equipment and incidentals, to chemically grout leaking laterals prior to the installation of a T-liner or mainline/lateral connection repair system, complete in place. Payment for this item, when authorized by the Owner, shall be in addition to a T-liner or mainline/lateral connection repair system.
- F. Items E15 to E38 – Items in common
1. Reference Part 1.10 of this section.

## 1.10 ITEMS IN COMMON

### A. Lateral reinstatement:

1. This item of work will be measured and paid at the unit price per each lateral reinstated and shall include, but not be limited to, blocking or plugging incoming line(s); removal, transportation and disposal of material generated by cleaning and preparation; television surveys, furnishing the equipment necessary to internally cut out the liner to at least 95 percent of the circumference of the lateral, cutting out the coupon; wire-brushing the cut to remove jagged edges; recovering all waste material from the sewer; service pipe cleaning; sealing the lateral connection to the liner including the first joint of the lateral connection; grouting the annular space; performing all repairs required due to damage caused by the Contractor, and all appurtenant and miscellaneous items and work.
2. If the Contractor damages the host pipe during lateral reinstatement, the Contractor shall repair the host pipe to the satisfaction of the Owner at no additional cost.
3. If grouting of the annular space at the reinstated lateral results in residual grout in greater than 50 percent the circumference of the lateral, or if in the judgment of the Owner excessive grout presents a risk of blockage, such grout shall be removed at no additional cost.

### B. Recut lateral insufficiently reinstated by others:

1. This item of work will be measured and paid at the unit price per each lateral recut and shall include, but not be limited to, blocking or plugging incoming line; removal, transportation and disposal of material generated by cleaning and preparation; pre- and post-television surveys, furnishing the equipment necessary to internally cut out the liner to at least 95 percent of the area of the lateral, cutting out the coupon; wire-brushing the cut to remove jagged edges; recovering all waste material from the sewer; service pipe cleaning; performing all repairs required due to damage caused by the Contractor, and all appurtenant and miscellaneous items and work.
2. If the Contractor damages the host pipe during lateral reinstatement, the Contractor shall repair the host pipe to the satisfaction of the Owner at no additional cost.

### C. Grout annular space following recut of lateral insufficiently reinstated by others

1. This item of work will be measured and paid at the unit price per each recut lateral grouted and shall include, but not be limited to, blocking or plugging incoming line; removal, transportation and disposal of material generated by cleaning and preparation; pre- and post-television surveys, furnishing the equipment necessary; recovering all waste material from the sewer; service pipe cleaning; sealing the lateral connection to the liner including the first joint of the lateral connection; grouting the annular space; performing all repairs required due to damage caused by the Contractor, and all appurtenant and miscellaneous items and work.
2. If grouting of the annular space at the reinstated lateral results in residual grout in greater than 50 percent the area of the lateral, or if in the judgment of the Owner excessive grout presents a risk of blockage, such grout shall be removed at no additional cost.

**D. Protruding service connection removal by internal means**

1. The Owner may request that the Contractor remove protruding service connections where needed, typically to allow completion of inspection or as a prelude to lining. The Contractor shall use robotic techniques. The use of equipment that may damage the existing service connection will not be allowed. The Contractor shall not perform this work prior to receiving written authorization from the Owner.
2. Measurement shall be per protruding service connection removed.
3. Payment shall be at the unit price bid, per each protruding service connection removed, provided in the Bid Forms and shall include full compensation for accessing the site, wastewater flow control, performing the protruding service connection removal, and all else incidental thereto for which separate payment is not provided under other items in the Bid Forms.

**E. Sewer main cleaning and TV inspection**

1. This item will be paid for at the unit price bid per foot of sewer cleaned and televised for inspection only, when a sewer repair is not performed due to change of field conditions revealed by the pre-repair video inspection, or as directed by the Owner. The unit price shall provide full compensation for all work required to perform television inspection of sanitary sewer including, but not limited to, furnishing all labor, equipment and material for cleaning, flow isolation, TV inspection, and all incidentals related to sewer inspection. The products shall be acceptable to the Owner or otherwise the Contractor shall re-televiser the sewer line to the satisfaction of the Owner. Sewer main cleaning shall include drop connections.
2. Cleaning and TV inspection performed to prepare for a repair or to document a completed repair are not considered separate pay items. Costs for such cleaning and TV inspection shall be included in the contract unit cost for each particular repair. Reference Table 01025-1 for the television inspection requirements pertaining to each type of repair.

**F. Sewer lateral cleaning and TV inspection**

1. Items with Bid form units of "EA" will be measured and paid at the unit price per each named in the Bid Form and shall include up to 30 feet of lateral.
2. Items with Bid form units of "L.F." will be measured and paid for at the unit price per foot of sewer lateral cleaned and inspected beyond 30 feet of lateral, in addition to the corresponding item with Bid Form units of "EA".
3. Payment for sewer lateral cleaning and inspection will be made when a sewer lateral is cleaned and televised for inspection only, when a sewer repair is not performed due to a change of field conditions revealed by the pre-repair video inspection, or as directed by the Owner. The unit price shall provide full compensation for all work required to perform television inspection of sanitary sewer service laterals including, but not limited to, furnishing all labor, equipment, tools and material for cleaning, flow isolation, TV inspection, and all incidentals related to sewer inspection. The products shall be acceptable to the Owner or otherwise the Contractor shall re-televiser the sewer line to the satisfaction of the Owner.

4. Lateral inspection shall be performed using a camera launched from the main unless conditions within the sewer require lateral inspection from the cleanout.
5. Cleaning and TV inspection performed to prepare for a repair or to document a completed repair are not considered separate pay items. Costs for such cleaning and TV inspection shall be included in the contract unit cost for each particular repair. Reference Table 01025-1 for the television inspection requirements pertaining to each type of repair.

**G. Mechanical root or grease removal**

1. Removal of grease or roots involving the use of special equipment will be considered special cleaning and will be measured and paid per linear foot additionally to cleaning, depending on the pipeline diameter and the type of cleaning, as shown on the Schedule of Prices. The unit price shall provide full compensation for all work required to perform such cleaning including, but not limited to, furnishing all labor, equipment and material for cleaning, flow isolation, pre- and post-cleaning TV inspection, traffic control, and all incidentals. The products shall be acceptable to the Owner or otherwise the Contractor shall re-clean and re-televiser the sewer line to the satisfaction of the Owner.
2. Special cleaning not authorized in writing by the Owner shall be considered part of the cleaning operation and shall not be considered a separate pay item.
3. Sewer line or manhole cleaning is not a separate bid item. The prices for all cleaning of sewers and manholes; verification of adequate cleaning by pulling double squeegees; hoses; nozzles; water; labor; materials and/or any other work required to clean the sewers to a degree acceptable for television inspection and subsequent repairs shall be included in the bid item in which the rehabilitation occurs.

**H. Mechanical tuberculation/concrete removal**

1. Removal of tuberculation in cast iron pipe, or concrete in pipe, involving the use of special equipment will be considered special cleaning and will be measured and paid per linear foot additionally to cleaning, depending on the pipeline diameter and the type of cleaning, as shown on the Schedule of Prices. The unit price shall provide full compensation for all work required to perform such cleaning including, but not limited to, furnishing all labor, equipment and material for cleaning, flow isolation, pre- and post-cleaning TV inspection, traffic control, and all incidentals. The products shall be acceptable to the Owner or otherwise the Contractor shall re-clean and re-televiser the sewer line to the satisfaction of the Owner.
2. Special cleaning not authorized in writing by the Owner shall be considered part of the cleaning operation and shall not be considered a separate pay item.
3. Sewer line or manhole cleaning is not a separate bid item. The prices for all cleaning of sewers and manholes; verification of adequate cleaning by pulling double squeegees; hoses; nozzles; water; labor; materials and/or any other work required to clean the sewers to a degree acceptable for television inspection and subsequent repairs shall be included in the bid item in which the rehabilitation occurs.

**I. Exploratory excavation**

1. This item shall include vacuum excavation services for locating utilities 0 to 5 feet in depth below ground or pavement surface, including excavation, backfill, asphalt/concrete removal and disposal, compaction, surface restoration, primary locating services and appurtenances.
2. Payment will be made at the contract unit cost for each pothole including survey.
3. For exploratory excavations greater than 5 feet in depth, payment will be made at the contract unit cost for each vertical foot below 5 feet excavated. This item shall be paid in addition to the contract unit cost for the first 5 feet of depth.

**J. Bypass pumping**

1. These items shall provide full compensation for bypass pumping operations required for sewer and manhole repair work. The Contractor shall attempt to perform the sewer work without bypass pumping. However, if, in the opinion of the Owner bypass pumping is necessary, it will be identified as a payment item. The pay item is a charge per day for all bypass pumping operations during a specific sewer repair, including services, regardless of the number of pumps required. Bypass Pumping shall be bid on the basis of sewer size which is bypassed.
2. These items shall include, but not be limited to, all necessary and required traffic control; pumps; piping; gasoline/diesel fuel; maintenance; transportation and storage; temporary bypass and service piping; labor; materials and/or any other costs associated with bypass pumping.
3. Plugging or blocking a sewer line shall be included in the appropriate bid item for which the flow must be stopped and shall be considered incidental work and no additional payment shall be considered.
4. This item is not intended to address bypassing of force main flows where such flows discharge directly into a manhole being repaired or through a force main being repaired.

**K. Cleanout installation**

1. This item of work will be measured and paid for at the unit price per each. Payment of the unit price per each will provide complete compensation for furnishing materials and all labor, tools, equipment and incidentals, to locate utilities; locate lateral; excavate; install a cleanout riser with cover and plug at the property line; backfill; compact; and restore surface in grass, asphalt, or concrete as applicable, complete in place.
2. For cleanout installations greater than 5 feet in depth, payment will be made at the contract unit cost for each vertical foot below 5 feet excavated. This item shall be paid in addition to the contract unit cost for the first 5 feet of depth.

**L. Cleanout installation (open trench)**

1. This item of work will be measured and paid for at the unit price per each. Payment of the unit price per each will provide complete compensation for furnishing materials and all labor, tools, equipment and incidentals, to install a cleanout riser with cover

and plug at the property line, complete in place, beginning and ending with an open trench.

M. Asphalt roadway replacement

1. The unit price bid for Asphalt Roadway Replacement shall provide full compensation for all work including, but not limited to furnishing all labor, equipment and material required for cutting, removing, protecting and replacing all existing asphalt paving and subgrade removed or damaged under this Contract; limerock base, prime coat, tack coat, asphalt, compaction, traffic markings, and maintenance of traffic. Contractor shall refer to Appendices A & B for additional details regarding work involved.
2. Payment will only be made if asphalt paving is encountered within the "Limits of Construction". All other replacement due to removal or damage as a result of the Contractor's operation shall be at the Contractor's expense.
3. Payment for Asphalt Roadway Replacement will be made once and shall include both temporary and permanent Asphalt Roadway Replacement and will be made per square yard, based on base and asphalt thickness dimensions as required, installed and accepted.
4. Payment for asphalt roadway replacement will be made per ton installed and accepted.

N. Pavement overlay

1. Item for construction pavement repairs (1-inch thick asphaltic concrete wearing surface overlay) will be paid for at the unit price bid times the number of square yards of overlay installed where directed by the Owner, and the price bid shall provide full compensation for all work including, but not limited to, furnishing all materials, labor and equipment for a complete installation. Pavement overlay will be in addition to the asphalt concrete pavement restoration. Contractor shall refer to Appendices A & B for additional details regarding work involved
2. Payment for pavement overlay will be made per ton installed and accepted.

O. Concrete sidewalk replacement

1. The unit price bid for Concrete Sidewalk Replacement shall provide full compensation for all work including, but not limited to, furnishing of all labor, equipment and material required for cutting, removing, protecting and replacing all existing concrete sidewalks removed or damaged under this Contract, concrete, formwork, reinforcing, placing, finishing and curing. Payment will only be made if sidewalks are encountered within the "Limits of Construction" as described herein. All other replacement due to removal or damage as a result of the Contractor's operation shall be at the Contractor's expense. Contractor shall refer to Appendices A & B for additional details regarding work involved
2. Payment for concrete sidewalk will be made per square yard installed and accepted.

P. Concrete curb and gutter replacement

1. The unit price bid for Concrete Curb and Gutter Replacement shall provide full compensation for all work including, but not limited to furnishing all labor, equipment and material required for cutting, removing, replacing all existing concrete curbs and gutters removed or damaged under this Contract. Payment will only be made if curbs and gutters are encountered within the "Limits of Construction" as described herein. All other replacement due to removal or damage as a result of the Contractor's operation shall be at the Contractor's expense. Contractor shall refer to Appendices A & B for additional details regarding work involved.
2. Payment for Concrete Curb and Gutter Replacement will be made per linear foot installed and accepted.

**Q. Asphalt driveway replacement**

1. The unit price for Asphalt Driveway Replacement shall provide full compensation for all work including, but not limited to, furnishing of all labor, equipment and material required for cutting, removing, protecting and replacing all existing asphalt driveways removed or damaged under this Contract; limerock base, prime coat, tack coat, asphalt and compaction. Payment will only be made if asphalt driveways are encountered within the "Limits of Construction" as described herein. All other replacement due to removal or damage as a result of the Contractor's operation shall be at the Contractor's expense. Contractor shall refer to Appendices A & B for additional details regarding work involved.
2. Payment for asphalt driveway replacement will be made per square yard installed and accepted.

**R. Concrete driveway replacement**

1. The unit price for Concrete Driveway Replacement shall provide full compensation for all work including, but not limited to, furnishing of all labor, equipment and material required for cutting, removing, protecting and replacing all existing concrete driveways removed or damaged under this Contract, concrete, formwork, reinforcing, placing, finishing and curing. Payment will only be made if sidewalks are encountered within the "Limits of Construction" as described herein. All other replacement due to removal or damage as a result of the Contractor's operation shall be at the Contractor's expense. Contractor shall refer to Appendices A & B for additional details regarding work involved.
2. Payment for concrete driveway replacement, will be made per square yard installed and accepted.

**S. Replace concrete slabs and/or aprons**

1. The unit price for Concrete Slab and/or Apron Replacement shall provide full compensation for all work including, but not limited to, furnishing of all labor, equipment and material required for cutting, removing, protecting and replacing all existing concrete removed or damaged under this Contract, concrete formwork, reinforcing, placing, finishing and curing. Payment will only be made if slabs and/or aprons are encountered within the "Limits of Construction" as previously described. All other replacement due to removal or damage as a result of the Contractor's operation

shall be at the Contractor's expense. Contractor shall refer to Appendices A & B for additional details regarding work involved.

2. Payment for concrete slab and/or aprons replacement will be made per square yard installed and accepted.

T. Sod replacement

1. Sod replacement will be paid for at the unit price bid and shall provide full compensation for all work including, but not limited to, furnishing all labor, equipment and material required for replacing sod removed or damaged under this Contract. Payment will only be made if sodded areas are encountered within the "Limits of Construction" as described herein. Measurement of payment shall be the number of square feet actually removed and replaced within the Limits of Construction. All other replacement due to removal or damage as a result of the Contractor's operation shall be at the Contractor's expense.
2. Payment for Sod Replacement will be made per square foot installed and accepted.

U. Work in rear-yard easement

1. Payment shall be at the unit price bid, per easement work authorization performed, provided in the Bid Forms and shall include full compensation for all additional labor, materials, equipment and incidentals required to perform work away from vehicular traveled ways, if so requested by the Owner, in association with any other work under this contract. This item will be paid in addition to the price paid under the corresponding work item and will only be paid when the area where work must necessarily be performed is in the easement area and presents restrictions to vehicular access from roads, alleys, driveways, or other features suitable for access by the installation vehicles. This item shall be full compensation for all additional costs associated with working in an easement area.
2. When the Contractor judges that this item is applicable, the Contractor shall obtain the Owner's concurrence on such judgment in advance of performing the work.
3. Where multiple repairs are performed in a single mainline, as in the case of joint testing/sealing and lateral or sectional lining, a single easement access charge shall apply.

V. Traffic control

1. The pay item is a charge per setup for all traffic control operations necessary before, during, and upon completion of work. A setup is defined as the placement of cones, barricades, arrow boards, flagmen, and ancillary items to ensure traffic safety. Multiple payments can be made under this item if the traffic control operations exceeds one day in duration.
2. .

W. Expedited mobilization

1. Payment shall be at the unit price bid, per mobilization performed, provided in the Bid Form (Groups A - E) and shall include full compensation for all additional labor,

materials, equipment and incidentals required to complete an expedited mobilization, if so requested by the Owner, in association with any other work under this contract. Payment shall be per mobilization performed, where Contractor shall mobilize and actively initiate the repair work within 24 hours of the Owner's request.

2. The Contractor is not required to accomplish an expedited mobilization but cannot otherwise earn the associated payment.
- X. Time-and-materials items for work not covered by other pay items
1. When field conditions require work for which there are no pay items in the contract, the Owner may request the Contractor to provide a Not-to-Exceed estimate for such work using the unit prices bid for labor, equipment, materials, and services (reference A48-1 through A48-28) and estimated amounts for items not listed on the bid form that must be rented or purchased.
  2. Foreman
    - a. Payment for this item will be made on an Hourly (HR) basis. A qualified foreman shall only be used. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be measured in increments of 15 minutes.
  3. Pipe Layer
    - a. Payment for this item will be made on an Hourly (HR) basis. A qualified pipe layer shall only be used. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be measured in increments of 15 minutes.
  4. Laborer
    - a. Payment for this item will be made on an Hourly (HR) basis. A qualified laborer shall only be used. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be measured in increments of 15 minutes.
  5. Backhoe – 3/4-yard combination backhoe front end loader, with operator
    - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.
  6. Backhoe – 3/8-yard combination backhoe front end loader, with operator
    - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.
  7. Backhoe – Caterpillar Model 225 or equal, with operator
    - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's

Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.

8. Bulldozer – Caterpillar Model D4 or equal, with operator
  - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.
9. Gradeall, Caterpillar, Model 215 or equal, with operator
  - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.
10. Compactor – 10-ton asphalt roller with operator
  - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.

11. Compactor – 4-ton drum, with operator
  - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.
12. Compactor – vibratory plate, with operator
  - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.
13. Generator, mass lighting
  - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.
14. 100 CFM air compressor, hose, and hammer with operator
  - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.
15. Truck – crew truck
  - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.
16. Truck – dump, double axle, with operator
  - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.
17. Truck – dump, single axle, with operator
  - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.
18. Truck – flatbed, under 25,000 pounds (GVW) with operator
  - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not

be measured for payment. The time intervals shall be in increments of 15 minutes.

19. Truck – vacuum tank
  - a. Payment for this item will be made on an Hourly (HR) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall be in increments of 15 minutes.
20. 4-inch pump with discharge hose
  - a. Payment for this item will be made on a Daily (DAY) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall include full compensation for all labor, equipment and materials.
21. 6-inch pump with discharge hose
  - a. Payment for this item will be made on a Daily (DAY) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall include full compensation for all labor, equipment and materials.
22. 8- inch pump with discharge hose
  - a. Payment for this item will be made on a Daily (DAY) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall include full compensation for all labor, equipment and materials.
23. Wellpoint equipment, 0 - 50 points, complete
  - a. Payment for this item will be made on a Daily (DAY) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall include full compensation for all labor, equipment, and materials. Equipment shall include all wellpoints, piping, pumps, discharge hosing, etc. to provide a complete system for dewatering.
24. Wellpoint equipment, each additional 25 points, complete
  - a. Payment for this item will be made on a Daily (DAY) basis. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment. The time intervals shall include full compensation for all labor, equipment and materials to install 25 additional wellpoints in addition to the complete system established in item 22. The additional wellpoints shall only be installed as approved by the Owner or the Owner's Representative.
25. 3/4-inch washed rock
  - a. Payment for this item will be made on the basis of cubic yards (CY) used. The Owner's Representative shall be notified in advance of the work. Standby time

shall not be measured for payment.

26. Mason sand

- a. Payment for this item will be made on the basis of cubic yards (CY) used. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment.

27. Flowable Fill

- a. Payment for this item will be made on the basis of cubic yards (CY) used. The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment.

28. Density Testing

- a. Payment for this item will be made for each test performed (EA). The Owner's Representative shall be notified in advance of the work. Standby time shall not be measured for payment.

Y. Allowances

1. The allowance shall be used to pay for unforeseen utility conflict resolution, utility repair work, or other material and work not within the other bid items, but necessary and related to the itemized line items only at the direction and within the authorization of the City. With the exception of FPL fees, City-approved items and materials shall be submitted and processed for payment in accordance with Article 38, Extra Work of the General Conditions.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -

Table 01025-1. Pre-Repair and Post-Repair Video Inspection Requirements

Required Action	Work Assignment											Notes
	A	B	C	D	E	F	G	H	I	J	K	
	Inspect Main	Inspect Lateral	Install Lateral Liner	Install Full Liner	Install Sectional Liner	Install T-Liner	Install Main/Lateral Connection Interface Seal	Perform Chemical Grouping (mains and main/lateral connections)	Perform Chemical Grouping (laterals)	Perform Excavated Point-Repair (mains and main/lateral connections)	Perform Excavated Point-Repair (laterals)	
1	•		•	•	•	•	•	•				
2		•	•			•		•	•			(i)
3			•	•	•	•	•	•	•			(ii), (iii)
4			•	•	•	•	•	•	•	•	•	(ii)
5				•								(iv)
6			•		•	•	•	•		•		
7			•			•			•		•	(i)
8	•											
9		•	•	•	•	•	•	•	•	•	•	(ii), (v)

**Notes**

- (i) Continuous video of the main from the upstream manhole must precede lateral launching and lateral video to allow verification that camera is in the correct lateral. Pan designated laterals from main before launching.
- (ii) Engineer may act as Owner's representative if so directed by Owner.
- (iii) If Owner cancels original repair following review of pre-repair video, contractor will be paid separately for the pre-repair video inspection. Otherwise, pre-repair video inspection is included in the repair price along with post-repair video inspection. Where a contractor performs video for purposes of inspection only, and Owner assigns a repair to that contractor within 90 days of receipt of such video, this initial video inspection will be considered to be pre-repair video inspection and the contractor will not be paid separately for the initial video inspection.
- (iv) Televisa liner ends following full liner installation.
- (v) If multiple repairs are being performed in the same line by one or more contractors, Owner may direct one contractor to provide pre-repair video and/or post-repair video a single time on behalf of all repairs and/or contractors. In this or any other case where the Owner allows any video inspection to not be performed, contractor(s) shall issue a credit to the Owner for video inspection not performed in the amount of the pay item used for video inspection only.
- (vi) Required Action No. 3, or others, may be omitted on a case by case basis at the Owner's discretion and with the Owner's advance approval.
- (vii) Lateral location is included in the repair price.

SECTION 01035

CHANGE ORDER PROCEDURES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This Section provides further specification of the requirements and procedures for implementing change to the Work
- B. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.
- C. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorize, by one or more of the following ways:
  - 1. A Field Order; or
  - 2. A Change Order; or
  - 3. Owner's written interpretation or clarification (e.g., Owner's response to a Request for Information)

1.02 DEFINITIONS

- A. Field Order: A written order to the Contractor signed by the Owner and the Contractor, which is issued to interpret/clarify the Contract Documents, and/or order minor changes in the work. The work described by a Field Order is to be accomplished without change to the Contract Price or Contract Time.
- B. Work Change Directive: A written order to the Contractor, signed by the Owner and Contractor, which is issued to identify a change in the Work which is anticipated to require a change to the Contract Price and/or Contract Time. A Work Change Directive generally will be issued to maintain progress of the Work and minimize delays. A Work Change Directive shall include an estimate of the potential change to the Contract Price and/or Contract Times and shall be incorporate into the Contract by subsequent execution of a Change Order.
- C. Refer to the General Conditions for definitions of other terms used in this Section.

1.03 CONTRACTOR'S RESPONSIBILITIES

- A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No work shall be delayed or postponed pending resolution of any disputes or disagreements, except as Owner and Contractor may otherwise agree in writing.

#### 1.04 OWNER'S RESPONSIBILITIES

- A. Owner is obligated to execute Change Orders as indicated in Paragraph 1.05A of this Section.

#### 1.05 CHANGE ORDERS

- A. Owner and Contractor shall execute appropriate Change Orders covering:
  - 1. Changes in the Work which are:
    - a. Ordered by Owner pursuant to Article 38 of the General Conditions
    - b. Required because of acceptance of defective Work under Article 23 of the General Conditions or Owner's correction of defective Work under Article 46 of the General Conditions; or
    - c. Agreed to by the parties.
  - 2. Changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive.
  - 3. Changes in the Contract Price and Contract Times which embody the substance of any written decision rendered by the Owner pursuant to Paragraph 36.B of the General Conditions; provided that, in lieu of executing any such Change Order, and appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 1.03A.
- B. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of such notice will be the Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

#### 1.06 WORK CHANGE DIRECTIVES

- A. Owner may issue a Work Change Directive authorizing Contractor to proceed with a change for subsequent inclusion in a Change Order.
- B. The Work Change Directive will describe changes in the work, both additions and deletions, with attachments of revised Contract Documents to define details of the change and will designate the method of determining any change in the Contract Price and any change in the Contract Times.
- C. A Work Change Directive will not change the Contract Price or the Contract Times but it evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

## 1.07 FIELD ORDERS

- A. A field order is issued by signature and date of the Owner to describe interpretations or clarifications of Contract Documents, order minor changes in the Work, and/or memorialize trade-offs, and receipt is acknowledged by signature and date of the Contractor.
- B. Field Order work will be accomplished without change in the Contract Price, Contract Times, and/or claims for other costs.

## 1.08 PROPOSALS AND CLAIMS

- A. Owner may initiate changes by submitting a Request for Proposal (RFP) to Contractor. Such request is for information only and is not an instruction to execute the changes, nor to stop work in progress. The RFP will typically include a detailed description of the change, supplementary or revised drawings and/or specifications, if required, a description of construction constraints, if any, and a time limit for submitting proposals in response to the RFP.
- B. Contractor may initiate changes by submitting a written notice to Owner, followed by a written claim providing a description of the proposed change, a statement of the reason for making the proposed change, a detailed description and supporting documentation of the effects on the Contract Price and/or the Contract Time, and a description of any effects on the work by other Contractors, as applicable.
  - 1. Contractor's written notices stating the general nature of each claim shall be delivered by the Contractor to the Owner promptly (but in no event later than 7 days) after the start of the event giving rise to the claim. The responsibility to substantiate a claim shall rest with the Contractor.
  - 2. Contractor's written claim, with supporting data, shall be delivered to the Owner within 7 days of the end of such event.
  - 3. Owner shall submit any response to the Contractor within 7 days after receipt of Contractor's last claim submittal.
- C. A Contractor's proposal or claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 38A of the General Conditions and Paragraph 1.09 of this Section.
- D. A Contractor's proposal or claim for an adjustment in Contract Times shall be prepared in accordance with provisions of Paragraph 14B of the General Conditions and Paragraph 1.10 of this Section.
- E. Each Contractor's proposal or claim shall be accompanied by Contractor's written statement that the adjustment proposed or claimed is the entire adjustment to which the Contractor believes it is entitled as a result of the RFP giving rise to the proposal, or as a result of the event giving rise to the claim.

## 1.09 CHANGE OF CONTRACT PRICE

- A. The Contract Price may only be changed by a Changed Order.

B. The value of a Change Order, or proposal, or claim for an adjustment in the Contract Price will be determined in accordance with Article 38 of the General conditions further clarified as follows:

1. Labor Costs (Paragraph 38A.3(a) of the General Conditions):

- a. Shall only include payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, forepersons and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include Social Security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays shall be included in the above to the extent authorized by Owner.
- b. Shall not include payroll costs and other compensation of the Contractor's offices, executives, principals (or partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred in Paragraph 1.09B.1 a, all of which are considered administrative costs covered by the Contractor's 15% labor overhead fee specified in Paragraph 38A.3(a) of the General Conditions.
- c. Shall only include Contractor's profit as indicated in Paragraph 38A.3 (e) of the General Conditions.

2. Material costs (Paragraph 38A.3(b) of the General Conditions):

- a. Shall only include cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts, rebates and refunds and returns from sale or surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
- b. Shall only include Contractor's profit as indicated in Paragraph 38A.3(e) of the General Conditions.

3. Special equipment and machinery costs (Paragraph 38A.3(c) of the General Conditions):

- a. Shall only include rentals of all construction equipment and machinery, except those listed as being covered by the 15% labor overhead in Paragraph

38A.3(e) of the General Conditions, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the items of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

- b. Shall only include Contractor's profit as indicated in Paragraph 38A.3(e) of the General Conditions.

4. Subcontractor costs:

- a. Shall only include payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain bids from Subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine which bids will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Costs of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in Paragraph 38A.3 of the General Conditions and further clarified in this Paragraph 1.09B, with no additional mark-up by Contractor.
- b. Shall only include Contractor's profit of five percent as indicated in Paragraph 38A.3 (d) of the General Conditions.
- c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus fee, the intent is that the Subcontractor who actually performs the Work, at whatever tier, will be paid as provided in Paragraph 38A.3 of the General Conditions and further as clarified in this Paragraph 1.09B, and that any higher tier Subcontractor and Contractor will each be paid a profit of five percent of the amount paid to the next lower tier Subcontractor.

5. Supplemental costs:

- a. Shall include costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountant (s) employed for services specifically related to the Work.
- b. Shall include costs, including transportation and maintenance, of all materials, supplied, equipment, machinery, appliances, office, utilities and temporary facilities at the site, if and only if the Work requires an extension of the Contract Times, as determined by Paragraph 1.011 below, and only to the extent that the materials, supplies, equipment, machinery, appliances, office, utilities and temporary facilities are specifically necessary for the Work and the extended Contract Times.
- c. Shall include costs for sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
- d. Shall include the costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

- e. Shall not include expenses of Contractor's principal and branch offices other than Contractor's office at the site.
- f. Shall not include any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
- g. Shall not include costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good damage to property.
- h. Shall not include other overhead or general expense costs of any kind of the costs of any item not specifically and expressly included in Paragraphs 1.09B.
- i. Shall not include any mark-up for Contractor's overhead or profit.

#### 1.10 CHANGE OF CONTRACT TIMES

- A. The Contract Times may only be changed by a Change Order.
- B. Any adjustment of the Contract Times covered by a Change Order, or proposal, or claim for an adjustment in the Contract Times will be determined in accordance with Articles 14, 18, 19 of the General Conditions further clarified as follows:
  - 1. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of the Contractor, or due to extra Work added by written request from the Owner, the Contract Times will be extended only in the amount necessary to maintain the completion of the Work, including the time lost due to such delay, or including the time to complete such extra Work, within the Contract Times. Delays beyond the control of the Contractor shall include but not be limited to, acts or neglect by Owner, acts or neglect by utility Owners or other Contractors performing other work as contemplated by Article 43 of the General Conditions, and force majeure as defined by Article 19 of the General Conditions.
  - 2. If Contractor is delayed in the performance or progress of the Work by force majeure as defined by Article 19 of the General Conditions, or failures to act of utility Owners not under the control of Owner, or other causes not the fault of and beyond the control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 1.10B.2

#### 1.11 DOCUMENTATION OF PROPOSALS AND CLAIMS

- A. Support each quotation for a proposal with sufficient substantiating data to allow Owner to evaluate the quotation.
- B. On request provide additional data to support time and cost computations:
  - 1. Labor required.

2. Equipment required.
  3. Products required.
    - a. Recommended sources of purchase and unit cost.
    - b. Quantities required.
  4. Taxes, insurance and bonds.
  5. Credit for work deleted from Contract, similarly documented.
  6. Overhead and profit.
  7. Justification for any change in Contract Time.
- C. Support each claim for additional costs, and for work done on a time-and-material/force account basis, with documentation as required for a lump-sum proposal, plus additional information:
1. Name of Owner's authorized agent who ordered the work, and date of the order.
  2. Dates and times work was performed, and by whom.
  3. Time record, summary of hours worked, and hourly rates paid.
  4. Receipts and invoices for:
    - a. Equipment used, listing dates and times of use.
    - b. Products used, listing of quantities.
    - c. Subcontractors.
- D. Document requests for substitutions for Products as specified elsewhere in these specifications.
- 1.12 PREPARATION OF CHANGE ORDERS
- A. Owner will prepare each Change Order.
- B. Change Order will describe changes in the Work, both additions and deletions, with attachments, as required:
1. Revised Contract Documents to define details of the change;
  2. Supporting documents pertaining to Requests for Proposals including as applicable;
    - a. The RFP;
    - b. Contractor's response proposal;
    - c. Negotiated adjustments to Contract Price and Contract Times.
  3. Supporting documents pertaining to claims including as applicable:

- a. Contractor's initial notice of claim;
  - b. Contractor's claim and supporting documentation;
  - c. Negotiated adjustments to Contract Price and Contract Times.
- C. Change Order will provide an accounting of the adjustment in the Contract Price and in the Contact Time.

1.13 CORRELATION WITH CONTRACTOR'S SUBMITTALS

- A. Periodically revise Schedule of Values and Request for Payment forms to record each change as a separate item of Work, and to record the adjusted Contract Price.
- B. Periodically revise the Construction Schedule to reflect each change in Contract Time.
  - 1. Revise sub-schedules to show changes for other items of work affected by the changes.
- C. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01090

REFERENCE STANDARDS

PART 1 -- GENERAL

1.01 GENERAL

- A. Titles of Sections and Paragraphs: Captions accompanying specification sections and paragraphs are for convenience of reference only, and do not form a part of the Specifications.
- B. Applicable Publications: Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date of the opening of bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein shall be waived because of any provision of, or omission from, said standards or requirements.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of other requirements of the specifications, all work specified herein shall conform to or exceed the requirements of all applicable codes and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of these Specifications nor the applicable codes.
- B. References herein to "Building Code" or SFBC shall mean the locally applicable edition of the South Florida Building Code. The latest edition of the code as approved and used by the local agency as of the date of award, as adopted by the agency having jurisdiction, shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.
- C. In case of conflict between codes, reference standards, Drawings and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the Owner for clarification and directions prior to ordering or providing any materials or labor. The Contractor shall bid the most stringent requirements.
- D. Applicable Standard Specifications: The Contractor shall construct the Work specified herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and Specifications listed herein.
- E. References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.
- F. References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

### 1.03 ABBREVIATIONS AND ACRONYMS

- A. Wherever in these specifications references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these specifications, the following acronyms or abbreviations which may appear in these specifications shall have the meanings indicated herein.

AAMA	Architectural Aluminum Manufacturer's Association
AASHTO	American Association of the State Highway and Transportation Officials
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AFBMA	Anti-Friction Bearing Manufacturer's Association, Inc.
AGMA	American Gear Manufacturer's Association
AHGDA	American Hot Dip Galvanizers Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
APHA	American Public Health Association
APWA	American Public Works Association
ASA	Acoustical Society of America
ASAE	American Society of Agriculture Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASLE	American Society of Lubricating Engineers
ASME	American Society of Mechanical Engineers

ASMM	Architectural Sheet Metal Manual
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BCDNRP	Broward County Department of Natural Resources Protection
BCPHU	Broward County Public Health Unit
BCOES	Broward County Office of Environmental Services
BCWRMD	Broward County Water Resources Management Division
BHMA	Builders Hardware Manufacturer's Association
CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DIPRA	Ductile Iron Pipe Research Association
EIA	Electronic Industries Association
ETL	Electrical Test Laboratories
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FS	Federal Specifications
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
ISO	International Organization for Standardization
MBMA	Metal Building Manufacturer's Association
MTI	Marine Testing Institute
NAAM	National Association of Architectural Metal Manufacturer's
NACE	National Association of Corrosion Engineers

NASSCO	National Association of Sewer Service Companies
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NRCA	National Roofing Contractors Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
SFBC	South Florida Building Code
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Steel Structures Painting Council
SSPWC	Standard Specifications for Public Works Construction
SFWMD	South Florida Water Management District
UL	Underwriters Laboratories, Inc.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

## SECTION 01300

### SUBMITTALS

#### PART 1 – GENERAL

##### 1.01 THE REQUIREMENT

- A. This section specifies the means of all submittals. All submittals shall be submitted to the Owner. A general summary of the types of submittals and the number of copies required is as follows:
- a. Subcontractors' and suppliers' qualifications: within 30 days of NTP
  - b. Preliminary baseline construction schedule: within 14 days of NTP
  - c. Schedule of shop drawings, samples and other submittals: within 30 days of NTP
  - d. Schedule of values: within 14 days of NTP
  - e. Warranties, operation and maintenance manuals, and manufacturer's check-out forms: in accordance with schedule of shop drawings and other submittals

*\*Electronic PDF files are also acceptable*

- B. Qualification documentation specified throughout these contract documents shall be submitted prior to contract award. The Owner reserves the right to require the submittal of additional documentation to evaluate the technical suitability of proposed products as well as a bidder's qualifications and ability to satisfactorily perform the work outlined in these contract documents.

##### 1.02 SUBMITTAL PROCEDURES

- A. Transmit each submittal with a form acceptable to the Owner, clearly identifying the project and the Contractor, the enclosed material and other pertinent information specified in other parts of this section. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
- B. Revise and resubmit submittals as required, identify all changes made since previous submittals. Resubmittals shall be noted as such.
- C. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

##### 1.03 CONSTRUCTION SCHEDULE

- A. The construction schedule shall be prepared for each group of work orders in the form of a horizontal bar chart showing in detail the proposed sequence of the work and identifying construction activities for each major component, structure or facility. The schedule shall be time scaled, identifying the first day of each week, with the estimated date of starting and completion of each stage of the work in order to complete the project within the Contract

time. Three copies of the schedule shall be submitted within ten calendar days after the date of the Notice to Proceed.

- B. The construction schedule shall be revised to reflect comments by the Owner and updated monthly, depicting progress to the last day of the month. Three copies shall be submitted with each request for monthly progress payments.
- C. Changes to the schedule shall be accompanied by a letter of explanation with appropriate reference and revision date on the schedule.
- D. The following additional requirements shall apply to the schedule.
  - 1. The Contractor shall provide notification to the Owner by e-mail a minimum of 24 hours in advance of any schedule change.
  - 2. Toward the close of each working day, the Contractor shall deliver notification to the Owner as to the location at which the next day of work will be conducted.
  - 3. At the completion of each task order, the Contractor shall notify the Owner of such fact.

#### 1.04 SCHEDULE OF PAYMENT ITEMS

- A. The Contractor shall submit a Schedule of Payment Items for review within 14 calendar days after the date of the Notice to Proceed. The schedule shall contain the installed value of the component parts of Work for the purpose of making progress payments during the construction period.
- B. The schedule shall be given in sufficient detail for the proper identification of Work accomplished. Each item shall include its proportional share of all costs including the Contractor's overhead, contingencies and profit. The sum of all scheduled items shall equal the total value of the Contract.
- C. No payment will be made for materials stored on the project site.
- D. The Contractor shall expand or modify the above schedule as required by the Owner's initial or subsequent reviews.

#### 1.05 PROGRESS ESTIMATES

- A. Progress estimates shall be submitted in accordance with the General Conditions and shall be accompanied by the revised Construction Schedule.

#### 1.06 SHOP DRAWINGS

- A. General: The Contractor shall submit for review shop drawings for concrete reinforcement, structural details, materials fabricated especially for this Contract, and materials for which such Drawings are specified or specifically requested by the Owner.
- B. Shop drawings shall show the principal dimensions, weight, structural and operating features, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the Drawings.

- C. When so specified, or if considered by the Owner to be acceptable, the manufacturer's specifications, catalog data, descriptive matter, illustrations, etc., may be submitted for review in place of shop drawings. In such case, the requirements shall be as specified for shop drawings, insofar as applicable.
- D. The Contractor shall be responsible for the prompt submittal of all shop drawings so that there shall be no delay to the Work due to the absence of such Drawings. The Owner will review the shop drawings within 14 calendar days of receipt of such Drawings. Reviewed shop drawings will be returned to the Contractor by regular mail, posted no later than 14 days after receipt.
- E. Time delays caused by rejection of submittals are not cause for extra charges to the Owner or time extensions.
- F. Requirements: All shop drawings shall be submitted to the Owner through the Contractor. The Contractor is responsible for obtaining shop drawings from his subcontractors and returning reviewed Drawings to them. All Drawings shall be clearly marked with the name of the project, Owner, Contractor, Work Order number, and structure to which the drawing applies. Drawings shall be suitably numbered and stamped by the Contractor.
- G. Product Data: Where manufacturer's publications in the form of catalogs, brochures, illustrations, or other data sheets are submitted in lieu of prepared shop drawings, such submission shall specifically indicate the particular item offered. Identification of such items and relative pertinent information shall be made with indelible ink. Submissions showing only general information will not be accepted.
- H. Product data shall include materials of construction, dimensions, performance characteristics and capacities, and other relevant details.
- I. Sample Warranties: When warranties are called for, a sample of the warranty shall be submitted with the shop drawings. The sample warranty shall be the same form that will be used for the actual warranty.
- J. Work Prior to Review: No material or equipment shall be purchased, fabricated especially for this Contract, or delivered to the project site until the required shop drawings have been submitted, processed and marked either "FURNISH AS SUBMITTED" or "FURNISH AS CORRECTED". All materials and Work involved in the construction shall be as represented by said Drawings.
- K. The Contractor shall not proceed with any portion of the Work for which the design and details are dependent upon the design and details of equipment for which submittal review has not been completed.
- L. Contractor's Review: Only submittals which have been checked and corrected should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting shop drawings to the Owner, the Contractor shall check thoroughly all such Drawings to satisfy himself that the subject matter thereof conforms to the Drawings and Specifications in all respects. Drawings which are correct shall be marked with the date, checker's name and indications of the Contractor's approval, and then shall be submitted to the Owner; other Drawings submitted to the Owner will be returned to the Contractor unreviewed.

- M. Contractor's Responsibility: The review of shop drawings will be general and shall not relieve the Contractor of the responsibility for details of design, dimensions, etc., necessary for proper fitting and construction of the Work required by the Contract and for achieving the specified performance.
- N. Contractor's Modifications: For submissions containing departures from the Contract Documents, the Contractor shall include proper explanation in his letter of transmittal. Should the Contractor submit for review equipment that requires modifications to the structures, piping, layout, etc. detailed on the Drawings, he shall also submit for review details of the proposed modifications. If such equipment and modifications are accepted, the Contractor, at no additional cost to the Owner, shall do all Work necessary to make such modifications.
- O. Substitutions: Whenever a particular brand or make of material, equipment, or other item is specified, or is indicated on the Drawings, it is for the purpose of establishing a standard of quality, design, and type desired and to supplement the detailed specifications. Any other brand or make which, in the opinion of the Owner, is equivalent to that specified or indicated may be offered as a substitute subject to the following provisions:
1. Contractor shall submit for each proposed substitution sufficient details, complete descriptive literature, and performance data together with samples of the materials, where feasible, to enable the Owner to determine if the proposed substitution is equal.
  2. Contractor shall submit certified tests, where applicable, by an independent laboratory attesting that the proposed substitution is equal.
  3. Contractor shall submit a list of installations where the proposed substitution is equal.
  4. Where the acceptance of a substitution requires revision or redesign of any part of the Work, all such revision and redesign, and all new Drawings and details required therefore, shall be provided by the Contractor at his own cost and expense, and shall be subject to review of the Owner.
  5. In all cases the Owner shall be the sole judge as to whether a proposed substitution is to be accepted. The Contractor shall abide by the Owner's decision when proposed substitute items are judged to be unacceptable and shall in such instances furnish the item, or substitute, as specified. No substitute items shall be used in the Work without written acceptance of the Owner.
  6. Acceptance of any proposed substitution shall in no way release the Contractor from any of the provisions of the Contract Documents.
- P. Complete Submittals: Each submittal shall be complete in all aspects incorporating all information and data required to evaluate the products' compliance with the Contract Documents. Partial or incomplete submissions shall be returned to the Contractor without review.
- Q. Electronic Data Submittal Format
1. Files shall be electronically searchable based on Owner established standard file naming convention.

2. **Quality and Legibility:** Electronic submittal files shall be made from the original and shall be clear and legible. Do not provide scans of faxed copies. Electronic file shall be made at the full size of the original paper documents. All pages shall be properly oriented for reading on a computer screen without rotating.
  3. **Organization and Content:**
    - a. Each electronic submittal shall be one electronic file. Do not divide and submit individual submittals into multiple electronic files unless directed by Owner.
    - b. When submittal is large or contains multiple parts, provide PDF file with bookmark for each section of submittal.
    - c. Submittal content shall include Contractor's letter of transmittal and Contractor's review and stamp.
  4. **Electronic file format:** PDF (Portable Document Format): .pdf, Adobe PDF documents; created through electronic conversion rather than optically scanned whenever possible.
- R. All submissions shall be dated and properly referenced to the specification section and Contract Drawing number. The submittal number shall match the following submittal numbering system (or an equivalent system as approved by the Owner):
- 1.07 **PRODUCT SAMPLES**
- A. Contractor shall furnish for review all product samples as required by the Contract Documents or requested by the Owner to determine compliance with the specifications.
  - B. Samples shall be of sufficient size or quantity to clearly illustrate the quality, type, range of color, finish or texture and shall be properly labeled to show complete project identification, the nature of the material, trade name of manufacturer and location of the Work where the material represented by the sample will be used.
  - C. Samples shall be checked by the Contractor for conformance to the Contract Documents before being submitted to the Owner and shall bear the Contractor's stamp certifying that they have been so checked. Transportation charges on samples submitted to the Owner shall be prepaid by the Contractor.
  - D. Owner's review will be for compliance with the Contract Documents, and his comments will be transmitted to the Contractor with reasonable promptness.
  - E. Acceptable samples will establish the standards by which the completed Work will be judged.
- 1.08 **CERTIFICATES OF COMPLIANCE**
- A. Copies of certificates of compliance and test reports shall be submitted for requested items to the Owner prior to request for payment.

1.09 WARRANTIES

- A. Original warranties, called for in the Contract Documents, shall be submitted to the Owner. When warranties are required for an item, warranty shall be submitted prior to request for payment of that item.
- B. When warranties are requested, a sample of the warranty to be provided shall be submitted with, and considered part of, the shop drawings.
- C. The Contractor shall warrant to the Owner that all material and labor used in the construction are covered by his warrantee for a minimum of a one-year period or as otherwise specified upon approval and acceptance by the Owner. The Contractor shall replace or repair defects at no cost to the Owner during the warrantee period. No visible or potential leakage shall be allowed during the warrantee period.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01400

QUALITY CONTROL

PART 1 – GENERAL

1.01 QUALITY ASSURANCE

- A. Quality: All materials shall be new and correctly designed, and shall conform to the requirements of Section 01090, "Reference Standards" and Section 01600, "Materials". They shall be standard first-grade quality produced by expert workmen and be intended for the use for which they are offered. Materials which, in the opinion of the Owner, are inferior or of a lower grade than indicated, specified or required will not be acceptable.
- B. Source Limitations: To the greatest extent possible for each unit of Work, the Contractor shall provide products, materials, or equipment of a singular generic kind from a single source.
- C. Compatibility of Options: Where more than one choice is available as options for Contractor's selection of a product, material, or equipment, the Contractor shall select an option which is compatible with other products and materials already selected. Compatibility is a basic general requirement of product/material selections.

1.02 PRODUCT EVALUATION

- A. The Owner will employ and pay for the services of an independent testing laboratory for specified testing as specified by the Owner.
- B. The work or actions of the testing laboratory shall in no way relieve the Contractor of his obligations under the Contract. The laboratory testing work will include such inspections and testing required by the Contract Documents, existing laws, codes, ordinances, etc. The testing laboratory will have no authority to change the requirements of the Contract Documents, nor perform, accept or approve any of the Contractor's Work.
- C. The Contractor shall allow the Owner ample time and opportunity for evaluation and testing materials to be used in the Work. The Contractor shall advise the Owner promptly upon placing orders for materials so that arrangements may be made, if desired, for evaluation before shipment from the place of manufacture. The Contractor shall at all times furnish the Owner and his representatives, facilities including labor, and allow proper time for evaluation and testing materials, and workmanship. The Contractor must anticipate that possible delays may occur in the execution of its work due to the necessity of materials being inspected and accepted for use. The Contractor shall furnish, at his own expense, all samples of materials required by the Owner for testing, and shall make his own arrangements for providing water, electric power, or fuel for the various evaluation and tests of structures and materials.
- D. The Owner will bear the cost of all tests, evaluation, or investigations undertaken by the order of the Owner for the purpose of determining conformance with the Contract Documents if such tests, evaluation, or investigations are not specifically required by the Contract Documents, and if conformance is ascertained thereby. Whenever

nonconformance is determined by the Owner as a result of such tests, evaluation, or investigations, the Contractor shall bear the full cost of any additional tests, evaluations and investigations, which are ordered by the Owner to ascertain subsequent conformance with the Contract Documents.

#### 1.03 EVALUATION AT PLACE OF MANUFACTURE

- A. Unless otherwise specified, all products and materials shall be subject to evaluation by the Owner at the place of manufacture.
- B. The presence of the Owner at the place of manufacture, however, shall not relieve the Contractor of the responsibility for furnishing products, materials, and equipment, which comply with all requirements of the Contract Documents. Compliance is a duty of the Contractor and said duty shall not be avoided by any act or omission on the part of the Owner.

#### 1.04 SAMPLING AND TESTING

- A. Unless otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered; however, the Owner reserves the right to use any generally-accepted system of sampling and testing which, in the opinion of the Owner will ensure the Owner that the quality of the workmanship is in full accord with the Contract Documents.
- B. Any waiver by the Owner of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial Work, shall not be construed as a waiver of any requirements of the Contract Documents.
- C. Notwithstanding the existence of such waiver, the Owner reserves the right to make independent investigations and tests and failure of any portion of the Work to meet any of the requirements of the Contract Documents, shall be reasonable cause for the Owner to require the removal or correction and reconstruction of any such work in accordance with the General Conditions.
- D. In addition to any other evaluation, observation or quality assurance provisions that may be specified, the Owner shall have the right to independently select, test, and analyze, at the expense of the Owner, additional test specimens or any or all of the materials to be used. Results of such tests and analyses shall be considered along with the tests or analyses made by the Contractor to determine compliance with the applicable specifications for the materials so tested or analyzed; provided, however, that where testing or investigation by the Owner reveals failure to meet the requirements of the Contract Documents, all costs of such independent inspection and investigation, and all costs of removal, correction, and reconstruction or repair of any such Work shall be borne by the Contractor.

#### 1.05 SITE INVESTIGATION AND CONTROL

- A. The Contractor shall verify all dimensions in the field and shall check field conditions

continuously during construction. The Contractor shall be solely responsible for any inaccuracies built into the Work due to its failure to comply with this requirement.

- B. The Contractor shall inspect related and appurtenant Work and shall report in writing to the Owner any conditions which will prevent proper completion of the Work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the Contractor at its sole cost and expense.

#### 1.06 RIGHT OF REJECTION

- A. The Owner shall have the right, at all times and places, to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the Work at the site. If the Owner, through an oversight or otherwise, has accepted materials or Work which is defective or which is contrary to the Contract Documents, such materials, no matter in what stage or condition of manufacture, delivery, or erection, may be subsequently rejected by the Owner.
- B. The Contractor shall promptly remove rejected articles or materials from the site of the Work after notification of rejection. All costs of removal and replacement of rejected articles or materials as specified herein shall be borne by the Contractor.

#### 1.07 WATERTIGHTNESS OF STRUCTURES

- A. It is the intent of these specifications that all concrete work, sealing work around built-in items and penetrations be performed as required to ensure that groundwater and/or rainwater will not leak into any repaired collection line, service lateral, or manhole.
- B. The required watertightness shall be achieved by quality construction and proper sealing of all pipes and manholes.
- C. The Contractor shall provide at its own expense all labor, material, temporary bulkheads, pumps, water, measuring devices, etc., necessary to perform the required tests.

#### 1.08 HYDRAULIC UPLIFT ON STRUCTURES

- A. The Contractor shall be completely responsible for any pipelines or manholes that may become buoyant during the construction operations due to the groundwater or floods and before the structure is put into operation. Should there be any possibility of buoyancy of a structure, the Contractor shall take the necessary steps to prevent its buoyancy. Damage to any structures due to floating or flooding shall be repaired, or the structures replaced at the Contractor's expense.

#### 1.09 CUTTING AND PATCHING

- A. The Contractor shall perform all cutting and patching of the Work that may be required to make its several parts come together properly and fit it to receive or be received by such other work. The Contractor shall not endanger any work of others by cutting, excavating or otherwise altering their work and shall only cut or alter work with the written consent of the Owner and of the other Contractors whose work will be affected.

#### 1.10 REMOVAL OF EXISTING PIPELINES

- A. General: The scope of work requires the Contractor to interface with existing piping which will be removed as part of the work. Prior to beginning any work associated with existing facilities to be removed, the Contractor shall inform the Owner of his intent so that all arrangements can be made with the Owner for disconnecting or isolating pipelines (where possible) from service to the extent possible. The Contractor shall not proceed without written authorization from the Owner.
- B. Pipelines: The Contractor shall remove existing pipelines or segments of existing pipelines shown to be replaced as part of the contract work. Piping indicated as being replaced with new piping, shall be excavated and removed using methods which will not disturb adjacent piping or other facilities. After piping has been removed and new piping installed, the Contractor shall backfill the evacuated area in accordance with requirements set forth in other sections of these specifications.
- C. Where new piping is to be connected to existing piping, the existing piping shall be cut square and the ends properly prepared for the connection. Any damage to the lining and coating of the existing piping shall be repaired by the Contractor.
- D. Disposal of Debris: All debris, materials, piping, and miscellaneous waste products from the work shall be removed from the project as soon as possible. They shall be disposed of in accordance with applicable federal, state, and local regulations. The Contractor is responsible for determining these regulations and shall bear all costs or retain any profit associated with disposal of these items.

#### 1.11 OBSERVATION OF THE WORK

- A. The Work shall be conducted under the general observation of the Owner and shall be subject to observation by representatives of the Owner acting on behalf of the Owner to ensure strict compliance with the requirements of the Contract Documents. Such observation may include mill, plant, shop or field observation, as required. The Owner shall be permitted access to all parts of the Work, including plants where materials are manufactured or fabricated.
- B. The presence of the Owner or any observer, however, shall not relieve the Contractor of the responsibility for the proper execution of the Work in accordance with all requirements of the Contract Documents. Compliance is a duty of the Contractor and said duty shall not be avoided by any act or omission on the part of the Owner or any observer.
- C. All materials and articles furnished by the Contractor shall be subject to rigid inspection, and no materials or articles shall be used in the Work until they have been inspected and accepted by the Owner or its representative. No Work shall be backfilled, buried, cast in concrete, hidden or otherwise covered until it has been inspected by the Owner or its authorized representative. Any Work so covered in the absence of inspection shall be subject to uncovering. Where un-inspected Work cannot be uncovered, such as in concrete cast over reinforcing steel, all such Work shall be subject to demolition, removal, and reconstruction under proper inspection, and no additional payment will be allowed therefore.

1.12 TIME OF OBSERVATION AND TESTS

- A. Samples and test specimens required under these Specifications shall be furnished and prepared for testing in ample time for the completion of the necessary tests and analyses before said articles or materials are to be used. The Contractor shall furnish and prepare all required test specimens within the scope of the Contract. Except as otherwise provided in the Contract Documents, performance of the required tests will be by the Owner, and all costs therefore will be borne by the Owner at no cost to the Contractor, except that the costs of any test which shows unsatisfactory results shall be borne by the Contractor. Whenever the Contractor is ready to backfill, bury, cast in concrete, hide, or otherwise cover any Work under the Contract, the Owner shall be notified not less than twenty-four hours in advance to request inspection before beginning any such Work of covering. Failure of the Contractor to notify the Owner at least twenty-four hours in advance of any such inspections shall be reasonable cause for the Owner to order a sufficient delay in the Contractor's schedule to allow time for such inspections and any remedial or corrective Work required, and all costs of such delays, including its effect upon other portions of the Work, shall be borne by the Contractor.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -

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SECTION 01510  
TEMPORARY UTILITIES

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. It shall be the Contractor's responsibility to provide equipment that is adequate for the performance of the Work under this Contract within the time specified. All equipment shall be kept in satisfactory operating condition, shall be capable of safely and efficiently performing the required Work, and shall be subject to inspection and review by the Owner's representative at any time within the duration of the Contract. All Work hereunder shall conform to the applicable requirements of the OSHA Standards for Construction.
- B. The Contractor shall provide for utilities and services for its own operations. The Contractor shall furnish, install and maintain all temporary utilities during the contract period including removal upon completion of the Work.

1.02 POWER AND LIGHTING

- A. Power: The Contractor shall provide all necessary power required for its operations under the Contract and shall provide and maintain all temporary power lines required to perform the Work in a safe and satisfactory manner.
- B. Construction Lighting: All Work conducted at night or under conditions of deficient daylight shall be suitably lighted to ensure proper Work and to afford adequate facilities for inspection and safe working conditions. Temporary lighting shall be maintained during nonworking periods if the area is subject to access by the public.
- C. Electrical Connections: All temporary connections for electricity shall be subject to review by the Owner and the power company representative and shall be removed in like manner at the Contractor's expense prior to final acceptance of the Work.
- D. Separation of Circuits: Unless otherwise permitted by the Owner circuits separate from lighting circuits shall be used for all power purposes.
- E. Construction Wiring: All wiring for temporary electric light and power shall be properly installed and maintained and shall be securely fastened in place. All electrical facilities shall conform to the requirements of Subpart K of the OSHA Safety and Health Standards for Construction.

1.03 WATER SUPPLY

- A. General: The Contractor shall supply and pay for all costs for all water used for construction, flushing and testing. The Contractor shall provide and maintain all meters, piping, fittings, adapters, and valving required.
- B. Potable Water: All drinking water on the site during construction shall be furnished by the Contractor and shall be bottled water or water furnished in suitable dispensers. Notices

shall be posted conspicuously throughout the site warning the Contractor's personnel that piped water may be contaminated.

- C. **Water Connections:** The Contractor shall not make connection to, or draw water from, any fire hydrant or pipeline without first obtaining permission of the authority having jurisdiction over the use of said fire hydrant or pipeline and from the agency owning the affected water system. For each such connection made, the Contractor shall first attach to the fire hydrant or pipeline a valve and a meter, if required by the said authority, of a size and type acceptable to said authority and agency.
- D. **Removal of Water Connections:** Before final acceptance of the Work on the project, all temporary connections and piping installed by the Contractor shall be entirely removed, and all affected improvements shall be restored to their original condition, or better, to the satisfaction of the Owner and to the agency owning the affected utility.
- E. **Fire Protection:** The construction, and all other parts of the Work shall be adequately protected against damage by fire. Hose connections and hose, water casks, chemical equipment, or other sufficient means shall be provided for fighting fires in the temporary structures and other portions of the Work, and responsible persons shall be designated and instructed in the operation of such fire apparatus so as to prevent or minimize the hazard of fire. The Contractor's fire protection program shall conform to the requirements of Subpart F of the OSHA Standards for Construction.

#### 1.04 SANITATION

- A. **Toilet Facilities:** Fixed or portable chemical toilets shall be provided wherever needed for the use of employees. Toilets at construction job sites shall conform to the requirements of Part 1926 of the OSHA Standards for Construction.
- B. Such facilities shall be made available when the first employees arrive on the Work, shall be properly secluded from public observation, and shall be constructed and maintained in suitable numbers and at such points and in such manner as may be required.
- C. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Owner, or an adjacent property.
- D. The Owner shall have the right to inspect any building or other facility erected, maintained, or used by the Contractor, to determine whether or not the sanitary regulations have been complied with.
- E. **Sanitary and Other Organic Wastes:** The Contractor shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor's operations shall be disposed of away from the site in a manner satisfactory to the Owner and in accordance with all laws and regulations pertaining thereto.

#### 1.05 TEMPORARY VENTILATION

- A. The Contractor shall provide and maintain adequate ventilation for a safe working environment. In addition, forced air ventilation shall be provided for the curing of installed

materials, humidity control and the prevention of hazardous accumulations of dust, gases or vapors.

**PART 2 – PRODUCTS**

(NOT USED)

**PART 3 – EXECUTION**

(NOT USED)

- END OF SECTION -

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SECTION 01530

PROTECTION OF EXISTING FACILITIES

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than they were prior to such damage or temporary relocation, all in accordance with requirements of the Contract Documents.
- B. The Contractor shall verify the exact locations and depths of all utilities shown and the Contractor shall make exploratory excavations of all utilities that may interfere with the Work. All such exploratory excavations shall be performed as soon as practicable after award of Contract and, in any event, a sufficient time in advance of construction to avoid possible delays to the Contractor's Work. When such exploratory excavations show the utility location as shown to be in error, the Contractor shall so notify the Owner.
- C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.

1.02 RIGHTS-OF-WAY

- A. The Contractor shall not do any Work that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electric transmission line; any fence; or any other structure, nor shall the Contractor enter upon any rights-of-way involved until notified that the Owner has secured authority therefore from the proper party. After authority has been obtained, the Contractor shall give said party due notice of its intention to begin Work and shall give said party convenient access and every opportunity for removing, shoring, supporting, or otherwise protecting such pipeline, transmission line, ditch, fence, or structure, and for replacing same. When two or more contracts are being executed at one time on the same or adjacent land in such manner that Work on one contract may interfere with that on another, the Owner shall determine the sequence and order of the Work. When the territory of one contract is the necessary or convenient means of access for the execution of another contract, such privilege of access or any other reasonable privilege may be granted by the Owner to the Contractor so desiring, to the extent, amount, in the manner, and at the times permitted. No such decision as to the method or time of conducting the Work or the use of territory shall be made the basis of any claim for delay or damage.

1.03 PROTECTION OF STREET OR ROADWAY MARKERS

- A. The Contractor shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced for easy and accurate restoration. It shall be the Contractor's responsibility to notify the proper representatives of the Owner of the time and location that Work will be done. Such

notification shall be sufficiently in advance of construction so that there will be no delay due to waiting for survey points to be satisfactorily referenced for restoration. All survey markers or points disturbed by the Contractor without proper authorization by the Owner, will be accurately restored by the Owner at the Contractor's expense after all street or roadway resurfacing has been completed.

#### 1.04 RESTORATION OF FACILITIES

- A. General: All paved areas including asphaltic concrete berms cut or damaged during construction shall be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents or in the requirements of the agency issuing the permit. All temporary and permanent pavement shall conform to the requirements of the affected pavement owner. All pavements which are subject to partial removal shall be neatly saw cut in straight lines. Within five working days of the pipe installation, temporary restoration shall be completed. All paved areas including asphaltic concrete berms cut or damaged during construction shall be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas, except where specific restoration requirements have been called for in the Contract Documents or in the requirements of the agency issuing the permit.
- B. Temporary Restoration: Temporary restoration includes repair to all driveways, sidewalks and roadways. They shall be swept clean and be maintained free of dirt and dust. All areas disturbed by the construction activities shall be restored to proper grade, cleaned up, including the removal of debris, trash, and deleterious materials. All construction materials, supplies, or equipment, including piles of debris shall be removed from the area. All temporarily restored areas shall be maintained by the Contractor. These areas shall be kept clean and neat, free of dust and dirt, until final restoration operations are completed. The Contractor is responsible to utilize dust abatement operations in the temporarily restored areas as required, to the satisfaction of the Owner.
- C. Temporary Resurfacing: Wherever required by the public authorities having jurisdiction, the Contractor shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.
- D. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, the Contractor shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement, unless otherwise directed by the Owner.
- E. Temporary Restoration of Sidewalks or Private Driveways: Wherever sidewalks or private driveways have been removed for purposes of construction, the Contractor shall place suitable temporary sidewalks or driveways promptly after backfilling and shall maintain them in satisfactory condition for the period of time fixed by the authorities having jurisdiction over the affected portions before proceeding with the final restoration or, if no such period of times is so fixed, the Contractor shall maintain said temporary sidewalks or driveways until the final restoration thereof has been made.

- F. **Final Restoration:** Final restoration shall include the completion of all required pavement replacement of roadways, driveways, curbs, gutters, sidewalks and other existing improvements disturbed by the construction: final grading, placement of sod, installation or replacement of any trees or shrubs, repair of irrigation systems, pavement marking, etc., all complete and finished, acceptable to the Owner. All areas disturbed during the work shall be restored to pre-construction conditions or better.

#### 1.05 EXISTING UTILITIES AND IMPROVEMENTS

- A. **General:** The Contractor shall protect all underground utilities and other improvements which may be impaired during construction operations. It shall be the Contractor's responsibility to ascertain the actual location of all existing utilities and other improvements that will be encountered in its construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. The Contractor shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.
- B. **Utilities to be Moved:** In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon request of the Contractor, be notified by the Owner to move such property within a specified reasonable time. When utility lines that are to be removed are encountered within the area of operations, the Contractor shall notify the Owner a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.
- C. **Where the proper completion of the Work requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is shown, the Contractor shall remove and temporarily replace or relocate such utility or improvement in a manner satisfactory to the Owner and the Owner of the facility. In all cases of such temporary removal or relocation, restoration to former location shall be accomplished by the Contractor in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.**
- D. **Owner's Right of Access:** The right is reserved to the Owner and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the Work of this Contract.
- E. **Underground Utilities Shown or Indicated:** Existing utility lines that are shown or the locations of which are made known to the Contractor prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired by the Contractor.
- F. **Underground Utilities Not Shown or Indicated:** In the event that the Contractor damages any existing utility lines that are not shown or the locations of which are not made known to the Contractor prior to excavation, a written report thereof shall be made immediately to the Owner. If directed by the Owner, repairs shall be made by the Contractor under the provisions for changes and extra Work contained in the General Conditions.

- G. All costs of locating, repairing damage not due to failure of the Contractor to exercise reasonable care, and removing or relocating such utility facilities not shown in the Contract Documents with reasonable accuracy, and for equipment on the project which was actually working on that portion of the Work which was interrupted or idled by removal or relocation of such utility facilities, and which was necessarily idled during such Work will be paid for as extra Work in accordance with the provisions of the General Conditions. Compensation shall not include Contractor's costs for the coordination of his activities with the utility company affected. Contractor shall schedule his work in such a manner that he is not delayed by the utility's companies relocating or supporting their facilities. No compensation will be paid the Contractor for any loss of time or delay.
  - H. Approval of Repairs: All repairs to a damaged improvement are subject to inspection and approval by an authorized representative of the improvement owner before being concealed by backfill or other Work.
  - I. Maintaining in Service: All oil and gasoline pipelines, power, and telephone or other communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the Work shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the Owner are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, or wire or cable. The Contractor shall be responsible for and shall repair all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.
  - J. The Contractor shall be solely and directly responsible to the Owner and operators of such properties for any damage, injury, expense, loss, inconvenience, delay, suits, actions or claims of any character brought because of any injuries or damage which may result from the construction operations under this Contract.
  - K. Neither the Owner nor its officers or agents shall be responsible to the Contractor for damages as a result of the Contractor's failure to protect utilities encountered in the work.
  - L. In the event of interruption to domestic water, sewer, storm drain or other utility services as a result of accidental breakage due to construction operations, promptly notify the proper authority. Cooperate with said authority in restoration of service as promptly as possible and bear all costs of repair. In no case shall interruption of any water or utility service be allowed to exist outside working hours unless prior approval is granted.
- 1.06 TREES WITHIN STREET RIGHTS-OF-WAY AND PROJECT LIMITS
- A. General: The Contractor shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street rights-of-way and project limits, and shall not trim, relocate or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or Owner. All existing trees and shrubs which are damaged during construction shall be trimmed or replaced by the Contractor or a certified tree company under permit from the jurisdictional agency or Owner and to the satisfaction of said agency and/or the Owner. Tree trimming and replacement shall be accomplished in accordance with the following paragraphs.

- B. **Trimming:** Symmetry of the tree shall be preserved; no stubs or splits or torn branches left; clean cuts shall be made close to trunk or large branch. Spikes shall not be used for climbing live trees. All cuts over 1-1/2 inches in diameter shall be coated with an asphaltic emulsion material.
- C. **Replacement:** The Contractor shall immediately notify the jurisdictional agency and/or the Owner if any tree is damaged by the Contractor's operations. If, in the opinion of said agency or the Owner, the damage is such that replacement is necessary, the Contractor shall replace the tree at his own expense. The tree shall be of a like size and variety as the tree damaged, or, if of a smaller size, the Contractor shall pay to the Owner of said tree compensatory payment acceptable to the tree owner, subject to the approval of the jurisdictional agency or Owner.

**1.07 NOTIFICATION BY THE CONTRACTOR**

- A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way the Contractor shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than three days nor more than seven days prior to excavation, so that a representative of said owners or agencies can be present during such Work if they so desire. The Contractor shall also notify Sunshine 811 at least two days, but no more than fourteen days prior to such excavation.
- B. The Contractor shall prepare a written notice to property owners adjacent to the project work site notifying them of the schedule of work affecting them and anticipated inconveniences they may expect. The notice shall meet the approval of the Owner and be delivered to property owners at least 72 hours prior to construction adjacent to their property.

**PART 2 – PRODUCTS**

(NOT USED)

**PART 3 – EXECUTION**

(NOT USED)

- END OF SECTION -

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SECTION 01550

SITE ACCESS AND STORAGE

PART 1 -- GENERAL

1.01 SITE ACCESS

- A. The Contractor shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the Work. It shall be the Contractor's responsibility to construct and maintain any haul roads required for its construction operations.

1.02 TEMPORARY CROSSINGS

- A. Street Use: Nothing herein shall be construed to entitle the Contractor to the exclusive use of any public street, alleyway, or parking area during the performance of the Work hereunder, and he shall so conduct his operations as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleys, ways, or parking areas. No street shall be closed to the public without first obtaining permission of the Owner and proper governmental authority. Where excavation is being performed in primary streets or highways, one lane in each direction shall be kept open to traffic at all times unless otherwise provided or shown. Toe boards shall be provided to retain excavated material if required by the Owner or the agency having jurisdiction over the street or highway. Fire hydrants on or adjacent to the Work shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the Contractor to assure the use of sidewalks and the proper functioning of all gutters, sewer inlets, and other drainage facilities.
- B. Traffic Control: For the protection of traffic in public or private streets and ways, the Contractor shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of the "Manual of Uniform Traffic Control Devices, Part VI - Traffic Controls for Street and Highway Construction and Maintenance Operations," published by U.S. Department of transportation, Federal Highway Administration (ANSI D6.1).
- C. The Contractor shall take all necessary precautions for the protection of the Work and the safety of the public. All barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. The Contractor shall station such guards or flaggers and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. All signs, signals, and barricades shall conform to the requirements of Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction.
- D. The Contractor shall remove traffic control devices when no longer needed, repair all damage caused by installation of the devices, and shall remove post settings and backfill the resulting holes to match grade.

- E. **Temporary Street Closure:** If closure of any street is required during construction, a formal application for a street closure shall be made to the authority having jurisdiction at least 30 days prior to the required street closure in order to determine necessary sign and detour requirements.
- F. **Temporary Driveway Closure:** The Contractor shall notify the Owner or occupant (if not owner-occupied) of the closure of the driveways to be closed more than one eight-hour workday, at least three working days prior to the closure. The Contractor shall minimize the inconvenience and minimize the time period that the driveways will be closed. The Contractor shall fully explain to the owner/occupant how long the work will take and when closure is to start.
- G. **Temporary Bridges:** Wherever necessary or required for the convenience of the public or individual residents at street or highway crossings, private driveways, or elsewhere, the Contractor shall provide suitable temporary bridges or steel plates over unfilled excavations, except in such cases as the Contractor shall secure the written consent of the individuals and authorities concerned to omit such temporary bridges or steel plates, which written consent shall be delivered to the Owner prior to excavation. All such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation. Temporary bridges or steel plates for street and highway crossing shall conform to the requirements of the authority having jurisdiction in each case, and the Contractor shall adopt designs furnished by said authority for such bridges or steel plates, or shall submit designs to said authority for approval, as may be required.

### 1.03 STORAGE

- A. The Contractor shall store his equipment and materials at the Contractor's base of operations in accordance with the manufacturer's recommendations and as indicated by the Owner. No storage facility is provided by the Owner.
- B. Responsibility for protection and safekeeping of equipment and materials will be solely that of the Contractor, and no claim shall be made against the Owner by reason of any act of an employee or trespasser. Should an occasion arise necessitating access to an area occupied by stored equipment and/or materials, the Contractor shall immediately move them.
- C. Upon completion of the Contract, the Contractor shall remove from the storage areas all of their equipment, temporary fencing, surplus materials, rubbish, etc., and restore the area to its original or better conditions.
- D. The Contractor's storage shall be limited to on-site storage only. Off-site storage of materials, if required, shall be arranged for by the Contractor and a copy of an agreement for use of other property shall be furnished to the Owner.

### PART 2 – PRODUCTS (NOT USED)

### PART 3 – EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01560

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 – GENERAL

1.01 EXPLOSIVES AND BLASTING

- A. The use of explosives on the Work will not be permitted.

1.02 DUST ABATEMENT

- A. The Contractor shall furnish all labor, equipment, and means required and shall carry out effective measures wherever and as often as necessary to prevent its operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity. The Contractor shall be responsible for any damage resulting from any dust originating from its operations. The dust abatement measures shall be continued until the Contractor is relieved of further responsibility by the Owner. No separate payment will be allowed for dust abatement measures and all costs thereof shall be included in the Contractor's bid price.

1.03 RUBBISH CONTROL

- A. During the progress of the Work, the Contractor shall keep the site of the Work and other areas used in a neat and clean condition, and free from any accumulation of rubbish. The Contractor shall dispose of all rubbish and waste materials of any nature occurring at the Work site and shall establish regular intervals of collection and disposal of such materials and waste. The Contractor shall also keep its haul roads free from dirt, rubbish, and unnecessary obstructions resulting from its operations. Disposal of all rubbish and surplus materials shall be off the site of construction in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws, and to the particular requirements of Part 1926 of the OSHA Safety and Health Standards for Construction.

1.04 SANITATION

- A. Toilet Facilities: Fixed or portable chemical toilets shall be provided wherever needed for use of employees. Toilets at construction job sites shall conform to the requirements of Part 1926 of the OSHA Standards for Construction.
- B. Such facilities shall be made available when the first employees arrive on the Work, shall be properly secluded from public observation, and shall be constructed and maintained in suitable numbers and at such points and in such manner as may be required.
- C. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Owner, or an adjacent property.
- D. The Owner shall have the right to inspect any building or other facility erected, maintained, or used by the Contractor, to determine whether or not the sanitary regulations have been complied with.

- E. Sanitary and Other Organic Wastes: The Contractor shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor's operations shall be disposed of away from the site in a manner satisfactory to the Owner and in accordance with all laws and regulations pertaining thereto.

#### 1.05 CHEMICALS

- A. All chemicals used during project construction or furnished for project operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, paint, fuel, solvent or reactant of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. The handling, storage, use and disposal of all such chemicals and disposal of residues shall be in strict accordance with all applicable rules and regulations of Federal, State and local jurisdictional agencies and the printed instructions of the manufacturer and all regulatory requirements. Copies of antidote literature shall be kept at the storage site and at the Contractor's job site office. A supply of antidotes shall be kept at the Contractor's office.

#### 1.06 NOISE CONTROL

- A. Noise resulting from the Contractor's work shall not exceed the noise levels and other requirements stated in local ordinances. The Contractor shall be responsible for curtailing noise resulting from his operation. He shall, upon written notification from the Owner or the noise control officers, make any repairs, replacements, adjustments, additions and furnish mufflers when necessary, to fulfill requirements.

#### 1.07 EROSION ABATEMENT AND WATER POLLUTION

- A. It is imperative that any Contractor dewatering operation should not contaminate or disturb the environment of the properties adjacent to the work. The Contractor shall, therefore, schedule and control his operations to confine all runoff water from disturbed surfaces, water from dewatering operations that becomes contaminated with lime silt, muck and other deleterious matter, fuels, oils, bitumens, calcium chloride, chemicals and other polluting materials.
- B. The Contractor shall construct temporary silting basin(s) of adequate size and provide all necessary temporary materials, operations and controls including, but not limited to, filters, coagulants, screens, and other means necessary to attain the required discharge water quality.
- C. The Contractor shall be responsible for providing, operating and maintaining materials and equipment used for conveying the clear water to the point of discharge. All pollution prevention procedures, materials, equipment and related items shall be operated and maintained until such time as the dewatering operation is discontinued. Upon the removal of the materials, equipment and related items, the Contractor shall restore the area to the condition prior to its commencing work.

#### 1.08 PRECAUTIONS DURING ADVERSE WEATHER

- A. During adverse weather, and against the possibility thereof, the Contractor shall take all necessary precautions so that the work may be properly done and satisfactory in all

respects. When required, protection shall be provided by use of tarpaulins, wood and building paper shelters, or other acceptable means. The Contractor shall be responsible for all changes caused by adverse weather.

- B. The Owner may suspend construction operations at any time when, in his judgment, the conditions are unsuitable or the proper precautions are not being taken, whatever the weather conditions may be, in any season.

#### 1.09 HURRICANE AND STORM WARNINGS

- A. During such periods of time as are designated by the United States Weather Bureau as being a hurricane alert, watch or warning, the Contractor shall perform all precautions as necessary to safeguard the work and property, including the removal of all small equipment and materials from the site, lashing all other equipment and materials to each other and to rigid construction, and any other safety measures as indicated below.

- B. The Contractor shall submit to the Owner, for review and approval, a Plan of Action describing the procedures to be followed by the Contractor in the event of a Hurricane Alert, Watch, or Warning.

- C. Upon Notification of a Hurricane Alert:

1. Upon issuance of a Hurricane Alert by the County Manager, all Contractors performing work within the right-of-way of a designated evacuation route shall immediately secure their work, backfill all excavations within the right-of-way and suitably prepare the roadway surface for full traffic flow. This work shall be completed within 24 hours of the issuance of the alert. Work shall not recommence until the "All Clear" is issued by the Owner.
2. Contractors performing at all other locations shall remove all unnecessary debris, materials, and equipment from the job site. The Contractor shall also keep his crew on standby on weekends and holidays during the Hurricane Alert period.

- D. Notification of a Hurricane Watch:

1. Contractors shall implement their approved Plan of Action to protect the project and the public.

- E. Upon Notification of a Hurricane Warning

1. Contractors shall implement their approved Plan of Action to protect the project and the public.
2. For work within the public rights-of-way, the Contractor will be notified by the Owner to suspend his construction operations. The Contractor will backfill all open trenches, remove all construction equipment and materials from the right-of-way and secure operations pending further notice.

#### 1.10 PERIODIC CLEANUP AND BASIC SITE RESTORATION

- A. During construction, the Contractor shall regularly remove from the site all accumulated debris and surplus materials of any kind which results from its operations. Unused

equipment and tools shall be stored at the Contractor's yard or base of operations for the project.

- B. The Contractor shall perform the cleanup work on a regular basis and as frequently as ordered by the Owner. Basic site restoration in a particular area shall be accomplished immediately following the installation or completion of the required facilities in that area. Furthermore, such work shall also be accomplished, when ordered by the Owner, if partially completed facilities must remain incomplete for some time period due to unforeseen circumstances.
- C. Upon failure of the Contractor to perform periodic clean-up and basic restoration of the site to the Owner's satisfaction, the Owner may, upon 3 days prior written notice to the Contractor, employ such labor and equipment as it deems necessary for the purpose, and all costs resulting therefrom shall be charged to the Contractor and deducted from amounts of money that it may be due.
- D. The Contractor's storage shall be limited to on-site storage only. Off-site storage of materials, if required, shall be arranged for by the Contractor and a copy of an agreement for use of other property shall be furnished to the Owner.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01570

TRAFFIC REGULATIONS AND MAINTENANCE OF TRAFFIC

PART 1 – GENERAL

1.01 TRAFFIC CONTROL

- A. Contractor shall obey all traffic laws and comply with all the requirements, rules and regulations of the Florida State Department of Transportation, Palm Beach County, and other local authorities having jurisdiction, to maintain adequate warning signs, lights, barriers, etc., for the protection of traffic on public Rights of Way in the project areas.
- B. The traffic control devices, warning devices, safety devices and barriers shall meet the requirements of National Cooperative Highway Research Report 350 (NCHRP 350), current Manual of Uniform Traffic Control Devices and any current FHWA directives.
- C. The Contractor shall maintain traffic and protect the public from all damage to persons and property within the Contract Limits, in accordance with the Contract Documents and all applicable state, county and local regulations. He shall conduct his operations so as to maintain and protect access, for vehicular and pedestrian traffic, to and from all properties and business establishments adjoining or adjacent to those streets affected by his operations, and to subject the public to a minimum of delay and inconvenience. Suitable signs, barricades, railing, etc., shall be erected and the work outlined by adequate lighting at night. Danger lights shall be provided as required. Watchmen and flagmen shall be provided as may be necessary for the protection of traffic.
- D. Maintenance of Traffic Plans (M.O.T.): When required for specific repairs, the Contractor shall immediately prepare and submit Maintenance of Traffic (M.O.T.) Plans for approval by authorities having jurisdiction. The traffic maintenance plan must meet the requirements of such authorities. Said M.O.T. Plans shall be in written form with sketches or drawings as necessary and shall comply with the State of Florida Department of Transportation standards for M.O.T. in construction areas. The Plans shall be submitted as soon as possible and not later than two weeks prior to any applicable construction work. A copy of the approval shall be provided to the Owner.
- E. The Contractor shall maintain one copy of the approved M.O.T. plan at the construction site for inspection. The Owner reserves the right to observe the M.O.T. plan in use and to make any changes as field conditions warrant. Any changes shall supersede the plan and be done at the Contractor's expense.
- F. The Contractor and his personnel are cautioned against parking vehicles in the business zones for any extended period of time. If necessary, the Contractor shall obtain offsite parking areas for his personnel.
- G. All dirt spilled from the Contractor's trucks on existing pavements shall be removed by the Contractor whenever in the opinion of the Owner the accumulation is sufficient to cause the formation of mud, dust, interference with traffic or create a traffic hazard.

H. The Contractor shall comply with all traffic regulations and perform maintenance of traffic as part of his site operation. No separate payment item shall be made.

1.02 PEDESTRIAN TRAFFIC

A. The Contractor shall include provisions for pedestrian where applicable.

B. It shall be the responsibility of the Contractor to install any necessary pavement, road rock, pavement marking and signage and/or any pedestrian signalization and/or signal modification to accommodate an existing or alternate walk route.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

## SECTION 01600

### MATERIALS

#### PART 1 – GENERAL

##### 1.01 THE REQUIREMENT

- A. The word "Products", as used herein, is defined to include purchased items for incorporation into the Work, regardless of whether specifically purchased for the project or taken from Contractor's stock of previously purchased products. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of Work. Definitions in this paragraph are not intended to negate the meaning of other terms used in Contract Documents, including "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction", and similar terms, which are self-explanatory and have recognized meanings in the construction industry.
- B. All equipment, materials, instruments or devices incorporated in this project shall be new and unused, unless indicated otherwise in the Contract Documents.
- C. Shop drawings shall be submitted to the Owner for all materials and equipment in accordance with Section 01300, Submittals. Any product submitted, which in the opinion of the Owner can be considered an equal or substitute, shall comply with the requirements in Section 01300-1.060.

##### 1.02 QUALITY ASSURANCE

- A. All materials and equipment shall conform to Section 01400, "Quality Control".

##### 1.03 PRODUCT DELIVERY-STORAGE-HANDLING

- A. The Contractor shall deliver, handle, and store products in accordance with supplier's written recommendations and as directed by the Owner, and by methods and means which will prevent damage, deterioration, and loss including theft. Delivery schedules shall be controlled to minimize long-term storage of products at site and overcrowding of construction spaces. In particular, the Contractor shall provide delivery/installation coordination to ensure minimum holding or storage times for products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other sources of loss.
- B. Equipment and materials to be incorporated in the Work shall be delivered sufficiently in advance of their installation and use to prevent delay in the execution of the Work, and they shall be delivered as nearly as feasible in the order required for executing the Work.
- C. The Contractor shall protect all equipment and materials from deterioration and damage. The equipment and materials shall be handled and stored by the manufacturer, fabricator supplier and Contractor before, during, and after shipment to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, damage or theft of any kind

whatsoever. Any equipment exhibiting any of the above, shall be removed and replaced at the Contractor's expense for both labor and materials.

- D. Products shall be transported by methods to avoid product damage and shall be delivered in undamaged condition in supplier's unopened containers or packaging, dry.
- E. The Contractor shall provide equipment and personnel to handle products and materials by methods to prevent soiling and damage.
- F. The Contractor shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

#### 1.04 STORAGE AND PROTECTION

- A. General: Products shall be stored in accordance with supplier's written instructions, with seals and labels intact and legible. Sensitive products shall be stored in weather-tight enclosures and temperature and humidity ranges shall be maintained within tolerances required by supplier's written instructions.
- B. For exterior storage of fabricated products, they shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering; ventilation shall be provided to avoid condensation.
- C. Loose granular materials shall be stored on solid surfaces in a well-drained area and shall be prevented from mixing with foreign matter.
- D. Storage shall be arranged to provide access for maintenance of stored items and for inspection. The Contractor shall periodically inspect to assure products are undamaged and are maintained under required conditions. The Contractor shall maintain a log of inspections and shall make said log available to the Owner on request.
- E. The Contractor shall verify that storage facilities comply with supplier's product storage requirements and verify that supplier-required environmental conditions are maintained continually.
- F. The Contractor shall verify that surfaces of products exposed to the elements are not adversely affected and that any weathering of finishes is acceptable under requirements of Contract Documents.
- G. Weather Conditions: Work that may be affected by inclement weather shall be suspended until proper conditions prevail. In the event of impending storms, the Contractor shall take necessary precautions to protect all work, materials and equipment from exposure.
- H. Fire Protection: The Contractor shall take all necessary precautions to prevent fires at or adjacent to the Work, including its own buildings and trailers. Adequate fire extinguisher and hose line stations shall be provided throughout the work area.

#### 1.05 FASTENERS

- A. All necessary bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be furnished by the Contractor in accordance herewith. Bolts shall have suitable washers and, where so required, their nuts shall be hexagonal.

- B. All anchor bolts and other types of anchors embedded, drilled, inserted or driven in concrete, including nuts, washers, plates, and bolt sleeves, shall be Type 316 stainless steel unless otherwise specifically specified as another material.
- C. Unless otherwise specified, stud, tap, and machine bolts shall be of the best quality refined bar iron. Hexagonal nuts of the same quality of metal as the bolts shall be used.

**1.06 SALVAGED AND EXCAVATED MATERIALS**

- A. In the absence of special provisions in other Sections of the Specifications, salvage materials, equipment or supplies that occur are the property of the Owner and shall be cleaned and stored as directed by the Owner. Materials/equipment which the Owner does not wish to retain shall be disposed by the Contractor at no additional costs.
- B. All materials, including excavated materials needed for backfilling operation, shall be stored on site. Where additional area is needed for stockpiling, off-site storage of any materials shall be arranged for by the Contractor and a copy of an agreement for use of other property shall be furnished to the Owner. Backfill materials shall not be stored at one location for greater than five (5) calendar days.

**PART 2 -- PRODUCTS**

(NOT USED)

**PART 3 -- EXECUTION**

(NOT USED)

- END OF SECTION -

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SECTION 01700

CLOSEOUT

PART 1 – GENERAL

1.01 FINAL CLEANUP

- A. The Contractor shall promptly remove from the vicinity of the completed Work, all rubbish, unused materials, concrete forms, construction equipment, temporary structures and facilities, construction signs, tools, scaffolding, materials, supplies and equipment which may have been used in the performance of the work. The Contractor shall broom clean paved surfaces and rake clean other surfaces of grounds. Final acceptance of the Work by the Owner will be withheld until the Contractor has satisfactorily complied with the foregoing requirements for final cleanup of the project site.
- B. The Contractor shall thoroughly clean all materials, equipment and structures; all marred surfaces shall be touched up to match adjacent surfaces.
- C. The Contractor shall remove spatter, grease, stains, fingerprints, dirt, dust, labels, tags, packing materials and other foreign items or substances from interior and exterior surfaces, equipment, signs and lettering.
- D. The Contractor shall remove paint, clean and restore all equipment and material nameplates, labels and other identification markings.
- E. The Contractor shall maintain cleaning until project, or portion thereof, is accepted by the Owner.
- F. The Contractor shall:
  - 1. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
  - 2. Use each type of cleaning material on only those surfaces recommended by the cleaning material manufacturer.
  - 3. Use only materials which will not create hazards to health or property.

1.02 CLOSEOUT TIMETABLE

- A. The Contractor shall establish dates for testing, acceptance periods, and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow the Owner and its authorized representatives sufficient time to schedule attendance at such activities.

1.03 FINAL SUBMITTALS

- A. Before the final acceptance of the project, the Contractor shall submit to the Owner certain records, certifications, etc., which are specified elsewhere in the Contract Documents. Missing, incomplete or unacceptable items, as determined by the Owner, shall constitute

grounds for withholding final payment to the Contractor. A partial list of such items appears below, but it shall be the Contractor's responsibility to submit any other items which are required in the Contract Documents:

1. Written Test results of project components.
2. Written guarantees, where required.
3. Certificates of inspection and acceptance by local governing agencies having jurisdiction.
4. Video recordings and logs of all lines televised.
5. Pre-construction photos
6. Releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.

#### 1.04 PUNCH LISTS

- A. Final cleaning shall be scheduled upon completion of the project.
- B. The Owner will make his final inspection whenever the Contractor has notified the Owner that the work is ready for the inspection. Any work not found acceptable and requiring cleaning, repair and/or replacement will be noted on the "Punch" list. Work that has been inspected and accepted by the Owner shall be maintained by the Contractor, until final acceptance of the entire project.
- C. Whenever the Contractor has completed the items on the punch list, he shall again notify the Owner that it is ready for final inspection. This procedure will continue until the entire project is accepted by the Owner. The "Final Payment" will not be processed until the entire project has been accepted by the Owner and all of the requirements in previous Article 1.03 "Final Submittals" have been satisfied.

#### 1.05 TOUCH-UP AND REPAIR

- A. The Contractor shall touch-up and repair damage to all existing facilities and surfaces. If in the opinion of the Owner the touch-up work is not satisfactory, the Contractor shall repeat the item.

#### 1.06 MAINTENANCE AND GUARANTEE

- A. The Contractor shall comply with all maintenance and guarantee requirements of the Contract Documents.
- B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing constructed by the Contractor which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless the Contractor shall have obtained a statement in writing from the affected private Owner or public agency releasing the Owner from further responsibility in connection with such repair or resurfacing.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

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SECTION 02222

EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. Excavate, grade and backfill as required for the site underground piping systems, as directed or as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 15000 – Piping and Fittings, General

1.03 SUBMITTALS

- A. General: Submit information and samples to the Owner for review as specified herein in accordance with Section 01300 entitled "Submittals".
- B. Dewatering: The Contractor shall submit to the Owner its proposed methods of handling trench water and the locations at which the water will be disposed of. Methods shall be acceptable to the Owner before starting the excavation.
- C. Bedding and Backfill Materials: The Contractor shall notify the Owner of the off-site sources of bedding and backfill materials, and submit to the Owner a representative sample weighing approximately 25 lbs.
- D. Sheeting System: Drawings of any proposed sheeting system and design computations shall be submitted to the Owner; however, the review of these Drawings shall in no way relieve the Contractor of the responsibility to provide a safe and satisfactory sheeting and shoring system. Sheeting and shoring shall be designed by the Contractor, and the proposed design shall be sealed by a Professional Engineer registered in the State of Florida. If the Owner is of the opinion that at any point sufficient or proper supports have not been provided, it may direct the Contractor to install additional supports at the Contractor's expense.

1.04 JOB CONDITIONS

- A. The Owner will not assume responsibility for variations of sub-soil quality or conditions. The Contractor shall examine the site or undertake its own subsurface investigation to identify all conditions that may affect its work.

1.05 QUALITY CONTROL

- A. An independent testing laboratory may be retained by the Owner to do appropriate testing as described in Section entitled "Quality Control". In this event, the Contractor shall schedule its Work so as to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of its progress. Payment of independent testing shall be per City of Boca Raton General Condition Article 54.

## 1.06 GROUNDWATER

- A. The Contractor shall be responsible for anticipating groundwater conditions and shall provide positive control measures as required. Such measures shall ensure stability of excavations, groundwater pressure control, prevention of tanks, pipes, and other structures from being lifted by hydrostatic pressures, and avoiding the disturbance of subgrade bearing materials.

## 1.07 TRENCH SAFETY ACT COMPLIANCE

- A. The Contractor by signing and executing the contract is, in writing, assuring that it will perform any trench excavation in accordance with the Florida Trench Safety Act, Section 553.60 et. seq.
- B. The Contractor acknowledges that this cost is included in the applicable items of the Proposal and Contract and in the Grand Total Bid and Contract Price.
- C. The Contractor is, and the Owner is not, responsible to review or assess the Contractor's safety precautions, programs or costs, or the means, methods, techniques or technique adequacy, reasonableness of cost, sequences or procedures of any safety precaution, program or cost, including but not limited to, compliance with any and all requirements of Florida Statute Section 553.60 et. seq. cited as the "Trench Safety Act". The Contractor is, and the Owner is not, responsible to determine if any safety or safety related standards apply to the project, including but not limited to, the "Trench Safety Act".

## 1.08 PROTECTION OF PROPERTY AND STRUCTURES

- A. The Contractor shall, at its own expense, sustain in place and protect from direct or indirect injury, all pipes, poles, conduits, walls, buildings, and all other structures, utilities, and property in the vicinity of its Work. Such sustaining shall be done by the Contractor. The Contractor shall take all risks attending the presence or proximity of pipes, poles, conduits, walls, buildings, and all other structures, utilities, and its Work. It shall be responsible for all damage, and assume all expenses, for direct or indirect injury and damage, caused by its Work, to any such pipe, structures, etc., or to any person or property, by reason of injury to them, whether or not such structures, etc., are identified in advance by the Owner.
- B. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrian and vehicular traffic of such excavations. Barricades with flashing lights shall also be placed along excavation from sunset each day to sunrise of the next day until such excavation is entirely refilled, compacted, and paved. All excavations shall be barricaded where required to meet OSHA, local and Federal Code requirements, in such a manner to prevent persons from falling or walking into any excavation within the site fenced property limits.

## PART 2 -- PRODUCTS

### 2.01 MATERIALS

- A. General: Materials shall be furnished as required from on-site excavations or from acceptable off-site sources as required. The Contractor shall notify the Owner of the

sources of each material at least ten calendar days prior to the anticipated use of the materials.

## 2.02 BEDDING

- A. Pipe Bedding: In general, clean sandy excavated materials, that is free from organics, clay and construction debris, can be used as pipe bedding when construction is in a dry condition and when the bedding is not sided by muck. Pipe bedding material shall consist of washed and graded limerock (3/8"-7/8"). Separation of suitable material for pipe bedding from other material shall be made during the excavation.
- B. Sand shall be used for all copper and other service lines.
- C. In the case of a "dry" installation, sand shall be used for PVC and ductile iron pipe where the bottom of the trench is located in the limestone zone.
- D. In the case of a "wet" installation, pearock shall be used for PVC and ductile iron pipe where the bottom of the trench is located in the limestone zone.
- E. Precast concrete items shall use crushed stone.

## 2.03 PEAROCK

- A. Pearock shall consist of hard, durable particles of proper size and gradation, and shall be free from organic material, wood, trash, sand, loam, clay, excess fines, and other deleterious materials. Pearock shall conform to the requirements of ASTM C 33, Size Number 8, graded within the following limits:

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
1/2 inch	100
3/8 inch	85 to 100
No. 4	10 to 30
No. 8	0 to 10
No. 16	0 to 5

## 2.04 CRUSHED STONE (3/4-INCH ROCK)

- A. Crushed stone shall consist of hard, durable, subangular particles of proper size and gradation, and shall be free from organic material, wood, trash, sand, loam, clay, excess fines, and other deleterious materials. Crushed stone shall conform to the requirements of ASTM C 33, Size Number 57, graded within the following limits:

(Continued on Next Page)

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
1 1/2 inch	100
1 inch	95 to 100
1/2 inch	25 to 60
No. 4	0 to 10
No. 8	0 to 5

### PART 3 -- EXECUTION

#### 3.01 EXCAVATION

- A. The Contractor shall perform all excavation of every description and of whatever substance encountered, to the dimensions, grades and depths shown on the Drawings, or as directed. All excavations shall be made by open cut and in accordance with the Trench Safety Act, except for service routings on private property from rear of properties to the front of properties where directional boring shall be used. All existing utilities such as pipes, poles and structures shall be carefully located, supported and protected from injury; in case of damage, they shall be restored at the Contractor's expense.
- B. Pipe trenches for piping shall be excavated to a width within the limits of the top of the pipe and the trench bottom so as to provide a clearance on each side of the pipe barrel, measured to the face of the excavation, or sheeting if used, of 8 inches to 12 inches. Where the pipe size exceeds 12 inches, the clearance shall be from 12 inches to 18 inches. All pipe trenches shall be excavated to a level where suitable material is reached, a minimum of 8 inches below the excavated depth, which will allow for a minimum of 36-inches of covering unless otherwise indicated by the Owner. Excavation depths in other types of materials and conditions shall be made as hereinafter specified.
- C. In areas where trench widths are not limited by right-of-way and/or easement widths, property line restrictions, existing adjacent improvements, including pavements, structures and other utilities, and maintenance of traffic, the trench sides may be sloped to a stable angle of repose of the excavated material but only from a point one foot above the crown of the pipe. A substantially and safely constructed movable shield, "box" or "mule" may be used in place of sheeting when the trench is opened immediately ahead of the shield and closed immediately behind the shield as pipe laying proceeds inside the shield.
- D. Ladders or steps shall be provided for and used by Workers to enter and leave trenches, in accordance with OSHA requirements.
- E. Excavation for appurtenances shall be sufficient to provide a clearance between their outer surfaces and the face of the excavation or sheeting, if used, of not less than 12 inches. Manhole excavations shall be carried to sufficient depth to permit their construction on the undisturbed bottom of the excavation.

- F. Excavated unsuitable material shall be removed from the site and disposed of by the Contractor. Materials removed from the trenches shall be stored and in such a manner that will not interfere unduly with any on-site operations, traffic on public roadways and sidewalks and shall not be placed on private property. In congested areas, such materials as cannot be stored adjacent to the trench or used immediately as backfill shall be removed to other convenient places of storage acceptable to the Owner at the Contractor's expense.
- G. Excavated material that is suitable for use as backfill shall be used in areas where sufficient material is not available from the excavation. Suitable material in excess of backfill requirements shall be either used on the site as directed by the Owner or disposed of the Contractor.
- H. Barriers shall be placed at excavations in accordance with OSHA requirements.
- I. Exploratory Excavation: Exploratory excavation shall mean obtaining the horizontal and vertical position of a subsurface facility using approved methods.
1. The Contractor shall provide these services as requested in writing by the Owner to aid in (1) the design of projects, and (2) to facilitate orderly construction of municipal utilities, etc.
  2. The Contractor shall provide all equipment, personnel, and supplies required to perform its locating services. The Contractor shall determine which equipment, personnel, and supplies are required to perform its locating services.
  3. When available, the Contractor shall secure all plans, plates, maps, or other records of subsurface facilities from their Owners.
  4. The Contractor shall obtain all necessary permits from City, County, or other municipal jurisdictions to allow the Contractor to work in existing streets, roads, and rights of way for the purpose of marking, measuring, excavating, and recording the location of existing underground utilities. The Contractor shall not be responsible, however, to obtain permits for boring, digging, or other excavating work that is not to be performed by the Contractor pursuant to this Contract.
  5. The Contractor shall comply with applicable underground utility damage prevention laws.
  6. The Contractor shall coordinate with utility company inspectors as required.
  7. The Contractor shall excavate test holes to expose the utility to be measured in such a manner to ensure the safety of the excavation and the integrity of the utility to be measured. The maximum size opening within the roadway shall not exceed one (1) square foot.
  8. Primary Locating Information: Horizontal location referenced to physical structures using a minimum of three swing ties. Depth from paving to top of utility measured in inches. Appropriate data to be shown on test hole sketch. Outside diameter of pipe or width of duct banks and configuration of non-encased multi-conduit systems. Utility structure material composition, when reasonably ascertainable. Paving thickness and type, and where applicable, the general soil type, site conditions, and depths of any notable horizon changes.

### 3.02 SHEETING AND BRACING

- A. The Contractor shall furnish, place and maintain sheeting and bracing to support sides of the excavation as necessary to provide safe Working conditions in accordance with OSHA requirements, and to protect pipes, structures and other Work from possible damage. Where wood sheeting or certain designs of steel sheeting are used, the sheeting shall be cut off at a level of 2 feet above the top of the installed pipe and that portion below the level shall be left in place. If interlocking steel sheeting is used, it may be removed providing removal can be accomplished without disturbing the bedding, pipe or alignment of the pipe. Any damage to the pipe bedding, pipe or alignment of the constructed utility caused by the removal of sheeting shall be cause for rejection of the affected portion of the Work. The Owner may permit sheeting to be left in place at the request and expense of the Contractor.
- B. If the Owner is of the opinion that at any point sufficient or proper supports, have not be provided, it may order additional supports put in at the Contractor's expense. The Contractor shall be responsible for the adequacy of all sheeting used and for all damage resulting from sheeting and bracing failure or from placing, maintaining and removing it.

### 3.03 REMOVAL OF WATER

- A. General: It is a basic requirement of these Specifications that excavations shall be free from water before pipe or structures are installed.
- B. The Contractor shall provide pumps, and other appurtenant equipment necessary to remove and maintain water at such a level as to permit construction in a dry condition. The Contractor shall continue dewatering operations until backfilling has progressed to a sufficient depth over the pipe to prevent flotation or movement of the pipe in the trench or so that it is above the water table. If at any point during the dewatering operation it is determined that fine material is being removed from the excavation sidewalls, the dewatering operation shall be stopped if acceptable to the Owner. If any of the subgrade or underlying material is disturbed by movement of groundwater, surface water, or any other reason, it shall be replaced at the Contractor's expense with crushed stone or gravel.
- C. The Contractor shall use dewatering systems that include automatic starting devices, and standby pumps that will ensure continuous dewatering in the event of an outage of one or more pumps.
- D. Disposal: Water from the trenches and excavation shall be disposed of in such a manner as will not cause injury to public health, to public or private property, to the Work completed or in progress, to the surface of the streets, cause any interference with the use of the same by the public, or cause pollution of any waterway or stream. The Contractor shall submit its proposed methods of handling trench water and locations at which the water will be disposed of to the Owner for review and shall receive acceptance before starting the excavation. Disposal to any surface water body will require silt screens to prevent any degradation in the water body. The Contractor shall have responsibility for acquiring all necessary permits for disposal.

### 3.04 TRENCH STABILIZATION

- A. No claim for extras, or additional payment will be considered for cost incurred in the

stabilization of trench bottoms that are rendered soft or unstable as a result of construction methods, such as improper or inadequate sheeting, dewatering or other causes. In no event shall pipe be installed when such conditions exist and the Contractor shall correct such conditions so as to provide proper bedding or foundations for the proposed installation at no additional cost to the Owner before placing the pipe or structures.

### 3.05 PIPE BEDDING

- A. Pipe trenches shall be excavated as described in Article 3.01. The resulting excavation shall be backfilled with acceptable pipe bedding material, up to the level of the centerline of the proposed pipe barrel. This backfill shall be tamped and compacted to provide a proper bedding for the pipe and shall then be shaped to receive the pipe. Bedding shall be provided under the branch of all fittings to furnish adequate support and bearing under the fitting.
- B. Any excavation below the levels required for installation of the pipe bedding shall be backfilled with acceptable bedding material, tamped, compacted and shaped to provide proper support for the proposed pipe, at the Contractor's expense.

### 3.06 BACKFILL

- A. Pipeline trenches shall be backfilled to a level minimum 12 inches above the top of the pipe with select backfill (selected backfill) obtained from the excavation. Such material shall be placed in 6-inch layers, each compacted to the densities specified in Article 3.07. Only hand operated mechanical compacting equipment shall be used within six inches of the installed pipe, or if acceptable to the Owner, by using excess water and passing a concrete vibrator between the pipe and the side of the trench.
- B. After the initial portion of backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the remainder of the trench may proceed. The remainder of the backfill shall be selected material obtained from the excavation and shall be placed in horizontal layers, the depth of which shall not exceed the ability of the compaction equipment employed, and in no event shall exceed a depth of 9 inches. Each layer shall be moistened, tamped, puddled, rolled or compacted to the densities specified in Article 3.07.
- C. Manholes and Vaults: Any excavation below the levels required for the proper construction of manholes or vaults shall be filled with crushed rock or limestone.

### 3.07 COMPACTION AND DENSITIES

- A. Compaction of backfill shall be 98 percent of the maximum density where the trench is located under structures or paved areas, and 95 percent of the maximum density elsewhere. More thorough compaction may be required when Work is performed in other regulatory agencies jurisdictions, such as the FDOT. Methods of control and testing of backfill construction are:
  - 1. Maximum density of the material in trenches shall be determined by ASTM D 1557.
  - 2. Field density of the backfill material in place shall be determined by ASTM D 1556 or D 2922.

- B. Testing: Laboratory and field density tests, which in the opinion of the Owner are necessary to establish compliance with the compaction requirements of these Specifications, shall be ordered by the Owner. The Contractor shall coordinate and cooperate with the testing laboratory. The testing program will be implemented by the Owner establishing depths and locations of tests. Modifications to the program will be made as job conditions change.
- C. Trench backfill which does not comply with the specified densities, as indicated by such tests, shall be reworked and recompact until the required compaction is secured, at no additional cost to the Owner. The costs for retesting such Work shall be paid for by the Contractor.

### 3.08 ADDITIONAL EXCAVATION AND BACKFILL

- A. Where organic material, such as roots, muck, or other vegetable matter, or other material which, in the opinion of the Owner, will result in unsatisfactory foundation conditions, is encountered below the level of the proposed pipe bedding material, it shall be removed to a depth of two feet below the outside bottom of the pipe or to greater depths as directed by the Owner and removed from the site. Sheeting shall be installed if necessary, to maintain pipe trenches within the limits identified by the Owner. The resulting excavation shall be backfilled with suitable backfill material, placed in 12-inch layers, tamped and compacted up to the level of the bottom of the proposed pipe bedding material. Sufficient compaction of this material shall be performed to protect the proposed pipe against settlement. Construction shall then proceed in accordance with the provisions of Article 3.05 "Pipe Bedding".
- B. Additional excavation (more than two feet below the pipe) as indicated on the trench detail shall be performed only when ordered by the Owner. Where organic or other material is encountered in the excavation, the Contractor shall bring the condition to the attention of the Owner and obtain his determination as to whether or not the material will require removal, prior to preparing the pipe bedding. The excavation of material up to a depth of two feet below the outside pipe bottom shall be considered as incidental items of construction, and the Work shall be done at the Contractor's expense. Where ordered by the Owner, the additional excavation, backfill and additional sheeting, if required, shall be paid in accordance with the Owner's Change Order procedure.

### 3.09 FINE GRADING

- A. After piping trenches backfilled, the disturbed areas of the site shall be fine graded. Any lumber, undesirable materials and rocks larger than the 3-inch size shall be removed from the surface. The completed surface shall be to the preconstruction elevation unless otherwise directed by the Owner. Minor adjustments to line and grade may be required as the work progresses in order to satisfy field conditions.

### 3.10 ALTERNATE METHOD OF CONSTRUCTION

- A. Use of This Method: A combination of conditions in the substrate, water table, or method of disposal may be encountered during the course of the work which makes dewatering impossible, or only possible through the use of unusual methods, the cost of which is excessive. When such conditions are encountered, but only after all reasonable means (pumps, well points, etc.) to dewater the excavation have been employed without success, the Contractor, may request to employ the following Alternate Method of

Construction. The concurrence of the Owner shall be obtained in writing and shall limit the use of the alternate method of construction to such specific portions of the Work as the Owner shall determine.

- B. The requirements set forth in other sections of these Specifications shall establish the required standards of construction quality for this work. Use of the alternate method of construction described hereinafter shall in no way be construed as relieving the Contractor of the work. No additional payment will be made to the Contractor for excavation, backfill, sheeting or any cost incurred for Work or materials, or any other costs incurred as a result of the use of this alternate method of construction. The prices established in the Proposal shall be for full payment for the various items of work.
- C. Subject to all the requirements stated herein, including written acceptance of the Owner, construction will be permitted in accordance with the following specifications. All requirements of these Specifications shall apply to this construction unless otherwise specifically modified herein.
- D. Removal of Water: The installation of pipe and appurtenances under water will be permitted and the requirements of Article 3.03 will be waived.
- E. Excavation shall be performed in accordance with Article 3.01.
- F. Pipe Bedding: Pipe bedding shall be placed from 6 inches below the outside bottom of the proposed pipe barrel up to the centerline of the pipe barrel. The bedding material shall be pearock as specified in Article 2.03 "Pearock". Limerock screenings, sand or other fine organic material shall not be used.
- G. The bedding material shall be placed and then be shaped to receive the pipe at the intended elevation. Bedding shall be provided under the branch of all fittings to furnish adequate support and bearing under the fitting.
- H. Backfill: After the pipe is installed, backfilling shall proceed in accordance with the provisions of Article 3.06 "Backfill" and 3.07 "Compaction and Densities". Select backfill material shall be used to backfill around the pipe and to a level one foot above the crown of the pipe. Under no circumstances will material other than select backfill or specified pipe bedding material be considered satisfactory for this purpose.
- I. If the Alternate Method of Construction is used, all backfill material, including specified pipe bedding material, shall be carefully lifted into the trench and not released to fall freely therein until the bucket or container is at or just above water level. Under no circumstances will backfill material be dumped or pushed into the trenches containing water. Below existing water level, the backfill material shall be carefully rammed into place in uniform layers, of equal depth on each side of the pipe, up to the water level. Above the water level, backfill material shall be placed and compacted for normal backfill as previously specified.

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SECTION 02500  
SURFACE RESTORATION

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. Items specified in this Section include repairs to landscaped and grassed areas that may be damaged by Contractor activities.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02510 - Asphaltic concrete pavement.
- B. Section 02512 - Pavement curb and sidewalks.
- C. Section 02580 - Pavement markings and signs.

1.03 SUBMITTALS

- A. The Contractor shall submit submittals for review in accordance with the Section entitled "Submittals".

1.04 DEFINITIONS

- A. The phrase "DOT Specifications" shall refer to the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition. The DOT Specifications are referred to herein and are hereby made a part of this Contract to the extent of such references and shall be as binding upon the Contract as though reproduced herein in their entirety.

1.05 PROTECTION OF EXISTING IMPROVEMENTS

- A. The Contractor shall be responsible for the protection of all pavements and other improvements within the work area. All damage to such improvements, as a result of the Contractor's operations, beyond the limits of the work of pavement replacement shall be repaired by the Contractor at his expense.

1.06 GUARANTEE

- A. The Contractor shall guarantee all trees, ground cover or shrubs planted or replanted under this Contract for a period of one year beyond acceptance of the project. In the event that any new tree, plant or shrub dies within the guarantee period, the Contractor shall be responsible for replacement in kind. In the event that a transplanted (reused) tree dies within the guarantee period, the Contractor shall be responsible for replacement in kind, except that the maximum height of any new tree shall be eight feet as measured from the ground surface, once planted, to the top of the tree.

## PART 2 -- PRODUCTS

### 2.01 SOD

- A. Sod shall be Floratam Sod in irrigated areas and Bahia in non-irrigated areas.

### 2.02 REPLACEMENT TREES, GROUND COVER AND SHRUBS

- A. Replacement trees, ground cover and shrubs shall be of the same type and size and sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall have healthy, well developed root systems and shall be free of disease and insect pests, eggs or larvae. Replacement shall be in accordance with City Standards.

### 2.03 MULCH

- A. Mulch shall be windproof shredded eucalyptus, mulch shall be clean, fresh, free of branches and other foreign matter. Mulch shall be used around all shrubs, ground covers and tree trunks, and placed to a minimum depth of 2 inches extending from the tree trunk outward two feet.

## PART 3 – EXECUTION

### 3.01 GRADING AND SODDING

- A. The Contractor shall regrade the work areas disturbed by his construction activities to the existing grade prior to commencement of construction.
- B. Sod shall be placed on all grassed areas disturbed by construction activities, unless otherwise indicated on the Drawings. Sodding shall be in accordance with Section 981 - Turf Materials of the DOT Specifications.
- C. Maintenance: Sufficient watering shall be done by the Contractor to maintain adequate moisture for optimum development of the sodded areas. Sodded areas shall receive no less than 1.5 inches of water per week.
- D. Repairs to Lawn Areas Disturbed by Contractor's Operations: Lawn areas damaged by Contractor's operations shall be repaired at once by proper sod bed preparation, fertilization and resodding, in accordance with these specifications. Regardless of the condition of the lawn area (weed content etc.) prior to the Contractor working in the area, all repairs shall be made with sod.
- E. The Contractor is required to mow all sodded areas immediately prior to final acceptance of the project by the City. Contractor shall mow and maintain the sod in a moist condition for a period of at least (30) days after acceptance as well as payment for the water. Sod shall also include a 4" layer of topsoil.
- F. Sprinkler System Repairs: The Contractor shall make repairs to existing private and public sprinkler systems within three days of damaging sprinkler system.

### 3.02 TREES, GROUND COVER AND SHRUBS

- A. Excavation and Plant Holes: Plant hole excavations shall be roughly cylindrical in shape, with the side approximately vertical. Plants shall be centered in the hole.

Bottoms of the holes shall be loosened at least six inches deeper than the required depth of excavation.

- B. Holes for balled and burlapped plants shall be large enough to allow at least eight inches of backfill around the earth ball. For root balls over 18 inches in diameter, this dimension shall be increased to 12 inches. Where excess material has been excavated from the plant hole, the excavated material shall be disposed of as and where directed by the Owner.
- C. Setting of Plants: When lowered into the hole, the plant shall rest on a prepared hole bottom such that the roots are level with, or slightly above, the level of their previous growth and so oriented such as to present the best appearance. The Contractor, when setting plants in holes, shall make allowances for any anticipated setting of plants.
- D. Palms of the sabal species may be set deeper than the depth of their original growth, provided that the specified clear trunk height is attained.
- E. The backfill shall be made with planting mixture and shall be firmly rodded and watered-in, so that no air pockets remain. The quantity of water applied immediately upon planting shall be sufficient to thoroughly moisten all of the backfilled earth. Plants shall be kept in a moistened condition for the duration of the Contract.
- F. Staking and Guying: Plants shall be staked in accordance with the following provisions:
  - 1. Small Trees: For trees and shrubs of less than one-inch caliper, the size of stakes and the method of tying shall be such as to rigidly support the staked plant against damage caused by wind action or other effects. Trees larger than one inch and smaller than one and one-half inch caliper shall be staked with a two-inch stake, set at least 24 inches in the ground and extending to the crown of the plant. The plant shall be firmly fastened to the stake with two strands of 14-gauge soft wire, enclosed in rubber hose, or other approved covering. The wire shall then be nailed or stapled to the stake to prevent slippage.
  - 2. Medium Trees: All trees, other than palm trees, larger than one and one-half inch caliper and smaller than two- and one-half-inch caliper shall be staked with two or more, two-inch by two-inch stakes, eight feet long, set two feet in the ground. The tree shall be midway between the stakes and held firmly in place by two strands of 12-gauge wire, applied as specified above for single stakes. The wires shall be tightened and kept tight by twisting.
  - 3. Large Trees: All trees, other than palm trees, larger than two- and one-half-inch caliper, shall be braced with three or more two-inch by four-inch wood braces, toenailed to cleats which are securely banded at two points to the palm, at a point at least six feet above the ground. The trunk shall be padded with five layers of burlap under the cleats. Braces shall be approximately equidistantly spaced and secured underground with two-inch by four-inch by 24-inch stake pads. In firm rock soils, Number 4 steel reinforcing rods or one-half inch pipe is acceptable.
  - 4. Palm Trees: Palm trees shall be braced with three or more two-inch by four-inch wood braces, toenailed to cleats which are securely banded at two points to the palm, at a point at least six feet above the ground. The trunk shall be padded with five layers of burlap under the cleats. Braces shall be approximately equidistantly

spaced and secured underground with two-inch by four-inch by 24-inch stake pads. In firm rock soils, Number 4 steel reinforcing rods or one-half inch pipe is acceptable.

- G. Pruning: All broken or damaged roots shall be cut off smoothly, and the tops of all trees shall be pruned in a manner complying with standard horticultural practice. At the time pruning is completed, all remaining wood shall be alive. All cut surfaces of one inch or more in diameter, above the ground, shall be treated with an approved commercial tree paint.
- H. Maintenance: Maintenance shall begin immediately after each plant is planted and shall continue until all work under this Contract has been completed and accepted by the Owner. Plants shall be watered, mulched, weeded, pruned, sprayed, fertilized, cultivated and otherwise maintained and protected. Settled plants shall be reset to proper grade position, planting saucer restored, and dead material removed. Guys shall be tightened and repaired.
- I. Defective work shall be corrected as soon as possible after it becomes apparent. Upon completion of planting, the Contractor shall remove excess soil and debris, and repair any damage to structures, etc., resulting from planting operations.

### 3.03 BRICK PAVERS

- A. Prior to removing brick pavers, Contractor shall take photographs of the driveway so that the pattern can be matched when reinstalling the pavers. The Contractor shall carefully stack the pavers near the house at a location acceptable to the homeowner. The pavers cannot be stacked near the road as to avoid accidental disposal on bulk pickup days. Pavers shall be properly installed on a compacted sand bed in accordance with the manufacturer's directions. The pavers shall be seal coated following installation.

### 3.04 SITE RESTORATION

- A. Site restoration on Private Property including but not limited to pavement, driveways, paved areas, sidewalks, shrubbery, trees, fences, and walls shall be completed as soon as possible within 30 days after being disturbed and to the satisfaction of the Owner.
- B. Sod Restoration on Private Property shall be completed within 3 calendar days.

- END OF SECTION -

SECTION 02510  
ASPHALTIC CONCRETE PAVEMENT

PART 1 -- GENERAL

1.01 SCOPE

- A. Construct asphaltic concrete pavement in accordance with the lines, grades and typical sections to restore surface to original condition or better, specified herein and as required for a complete installation.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. DOT Specifications: The phrase, "DOT Specification", shall refer to the Florida Department of Transportation Standard Specifications for Road and Bridge Construction. The DOT Specifications are referred to herein and are hereby made a part of this Contract to the extent of such references and shall be as binding upon the Contract as though reproduced herein in their entirety.

DOT 160	Stabilizing
DOT 210	Reworking Limerock Base
DOT 300	Prime and Tack Coats
DOT 320	Hot Mix Asphalt - Plant Methods and Equipment
DOT 330	Hot Mix Asphalt - General Construction Requirements
DOT 334	Superpave Asphalt Concrete
DOT 337	Asphaltic Concrete Friction Courses
DOT 902	Fine Aggregate
DOT 911	Base and Stabilized Base Materials
DOT 916	Bituminous Materials

1.03 SUBMITTALS

- A. The Contractor shall submit his proposed formula for the asphaltic concrete paving for review in accordance with the Section entitled "Submittals".

PART 2 -- PRODUCTS

2.01 MATERIALS

- A. Limerock Base: The limerock base shall consist of either one or two courses of Miami Oolite limerock conforming to DOT Sections 210 and 911.

- B. Prime Coat: The material used for the prime coat shall be cut-back Asphalt Grade RC-70 conforming to DOT Sections 300 and 916 for prime to be used on Miami Oolite formation limerock.
- C. Tack Coat: The material used for the tack coat shall be Emulsified Asphalt Grade RS-2 conforming to DOT Sections 300 and 916.
- D. Asphaltic Concrete: Within City of Boca Raton rights-of-way the materials and construction of the asphaltic concrete patch, wearing and surface courses shall be Type S-III Asphaltic Concrete conforming to DOT Sections 330, 334, 337 and 916. The composition and physical test properties for all mixes including Type S Asphalt Concrete are shown in Tables 331-1 and 331-2. This Section establishes Acceptance Procedures for materials and work performed under Sections 280, 290, 331, 332, 333, 335, and 337. Within FDOT and Palm Beach County (PBC) rights-of-way the materials and construction of the asphaltic concrete patch, wearing and surface courses shall be Superpave.
- E. Where Type S Asphalt Concrete is specified in the Contract, if approved by the Owner, the equivalent fine Type SP Asphalt Concrete mixture (Traffic Level C) meeting the requirements of Section 334 may be selected as an alternate at no additional cost to the City. The equivalent mixes are as follows:

Type S-I	Type SP-12.5
Type S-II	Type SP-19.0
Type S-III	Type SP-9.5

Meet the requirements for plant and equipment specified in Section 320. Meet the general construction requirements specified in Section 330.

### PART 3 -- EXECUTION

#### 3.01 PAVEMENT REMOVAL AND REPLACEMENT

- A. General: All existing utility castings, including valves boxes, junction boxes, manholes, handholes, pull boxes, inlets and similar structures in the areas of trench restoration and pavement replacement shall be adjusted by the Contractor to bring them flush with the surface of the finished work, at no additional cost to the Owner. Includes all necessary saw-cutting and preparing roadway adjacent to ornate residential driveways. Minimum of one lane of traffic flow in each direction to be maintained during operation. Milling operation cannot progress more than 2,000 feet beyond the pavement restoration operation. Also includes disposal without stockpiling on site.
- B. The Contractor shall be responsible for the protection from damage from his construction operations, all pavements, including all limerock base courses and asphaltic surface courses, within the work area. Any base course or surface course, damaged as a result of the Contractor's operation, shall be restored in accordance with the applicable requirements of these Contract Documents, to the satisfaction of the Owner, and to the satisfaction of the governing authority having jurisdiction over the work area at no additional cost to the Owner. In order to protect himself from being held liable for any existing damaged pavement, including detour routes, the Contractor is advised to notify, in writing, the authority having

jurisdiction over the street where such defective pavement exists prior to proceeding with any work in the vicinity. A copy of all such notices shall be forwarded to the Owner.

- C. Wherever the line of the nominal repaving for trenches extends to within two feet of the edge of the existing paving, the Contractor shall repave to this edge.
- D. Permanent pavement repair shall be in accordance with the details shown on the Drawings or as directed by the Owner, with edges straight and parallel and patches rectangular in plan. Any paving replacement required beyond the limits shown in the details, and as called for in the Specifications, shall be at the Contractor's expense.
- E. Pavement markings removed or obliterated by the Contractor's operations shall be promptly replaced in kind by him at his expense, to the satisfaction of the authority having jurisdiction over the work area.
- F. Asphaltic concrete mixtures shall be obtained only from plants which comply with the requirements of DOT Section 320 as applicable, using materials specified herein, and producing the specified mixture. General construction requirements for all hot bituminous mixtures specified herein shall conform to DOT Section 330, as applicable.
- G. No mixture shall be spread when the air temperature is less than 40 degrees F, nor when the spreading cannot be finished and compacted during daylight hours.
- H. Any mixture caught in transit by a sudden rain may be laid at the Contractor's risk, if the base is in suitable condition. Under no circumstances shall asphalt material be placed while rain is falling or when there is water on the area to be covered.
- I. Traffic Loops: Traffic loops removed or damaged during construction or rendered inoperative because of cutting the traffic loop home run, shall be replaced. New traffic loops shall be provided; splicing will not be allowed.
- J. Temporary Paving: Prior to commencing excavation, the asphalt surface shall be sawcut within the limits of the allowable trench width. Temporary paving will be required along the entire route where the original paved surface is removed. Temporary paving shall be placed as soon as possible after the trench has been backfilled and compacted per the Specifications. The trench should be backfilled and compacted up to a level 1 inch below the existing pavement surface, and a temporary, cold mixed sand/asphalt pavement shall be constructed up to the level of the existing pavement surface. The liquid asphalt shall be Grade RC-70, conforming to the requirements of DOT Section 916-2. The sand shall conform to the requirements of DOT Section 902 for fine aggregate.
- K. The cold mix is to be installed one block at a time, not crossing any intersections, or to a maximum of 1,200 feet. Work in said 1,200 feet shall be completed before the Contractor may move forward with his excavation work. Backfill, compaction and temporary paving is to keep pace with the pipe installation.
- L. The temporary pavement shall be maintained by the Contractor in a condition satisfactory to the Owner until its removal. Removal shall include any surplus backfill material. The removed temporary pavement and surplus backfill material shall be properly disposed of by the Contractor, at his expense.

- M. No payment shall be made for temporary paving work. The cost for such work shall be considered incidental to pipeline construction and included in the bid prices for the respective pipe payment items.
- N. Sand seal on the limerock base course will not be permitted in lieu of temporary paving.

### 3.02 PAVEMENT REPAIR

- A. All damage to pavement as a result of work under this Contract shall be repaired in a manner satisfactory to the Owner and at no additional cost to the Owner. The repair shall include the preparation of the subgrade, the placing and compacting of the limerock base, the priming of the base, the placing and maintaining of the surface treatment, all as specified herein.
- B. The width of all repairs shall extend at least 12 inches beyond the limit of the damage. The edge of the pavement to be left in place shall be cut to a true edge with a saw or other method acceptable to the Owner so as to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.
- C. When a pipeline is installed in the middle of the road, or the trench is partially on two road lanes, pavement shall be milled, and asphalt shall be placed for the width of the two traffic lanes that have been disturbed.

### 3.03 FINAL PAVING

- A. General: The Contractor shall remove the temporary pavement and any surplus backfill and shall replace it with the specified compacted limerock base course to the extent required by the Contract Documents.
- B. When a pipeline is installed in a lane parallel to the roadway, the lane shall be milled, and asphalt shall be placed for the width of one full traffic lane.
- C. When a pipeline is installed parallel to the road and the edge of the asphalt is damaged, a minimum of two feet of asphalt shall be removed and replaced.
- D. All paving work shall be completed according to the Contract Documents and DOT Standards. Where the two are not in agreement, the more stringent requirement shall prevail.
- E. Subgrade: The backfill previously placed and compacted shall be excavated to the required depth below the existing road surface, and the existing paving shall be cut back to a width of one full lane, using an abrasive disc saw to trim the edges to straight and true lines. The subbase material shall be stabilized to have a minimum LBR of 40. The minimum acceptable density at any location in the top twelve inches of the subgrade shall be 98 % of maximum dry density as determined by AASHTO T-180.
- F. Limerock Base: The limerock base shall be constructed in accordance with DOT Section 210, to the thickness and width indicated on the Drawings. The limerock base shall have a minimum LBR of 100. The maximum depth of each lift shall be 6 inches. Pavement base shall be constructed in minimum two lifts.

- G. After spreading of the base material is completed, the entire surface shall be scarified and shaped so as to produce the exact grade and cross section after compaction. For double course base, this scarifying shall extend to a depth sufficient to penetrate slightly the surface of the first course.
- H. When the material does not have the proper moisture content to ensure the required density, wetting or drying shall be required. If the material is deficient in moisture, water will be added and uniformly mixed in by disking the base course to its full depth. If the material contains an excess of moisture, it shall be allowed to dry before being compacted. Wetting and drying operations shall involve manipulation of the entire width and depth of the base as a unit. As soon as proper conditions of moisture are attained, the material shall be compacted to an average density not less than 98 percent maximum density as determined in more than one course, the density shall be obtained in each lift of the base.
- I. During final compacting operations, if blading of any areas is necessary to obtain the true grade and cross section, the compacting operations for such areas shall be completed prior to making the density determinations on the finished base.
- J. Unless otherwise directed by the Owner, the surface shall be "hand-planed" with a blade grader immediately prior to the application of the prime coat to remove the thin glaze or cemented surface and to allow free penetration of the prime material. The materials planed from the base shall be removed from the base area.
- K. If cracks or checks appear in the base, either before or after priming, which in the opinion of the Owner, would impair the structural efficiency of the base course, the Contractor shall remove such cracks or checks by rescarifying, reshaping, adding base material where necessary and recompacting, at no additional cost to the Owner.
- L. **Mixing Base and Subgrade:** If at any time the subgrade material shall become mixed with the base course material, the Contractor shall, reshape and compact the subgrade and replace the materials removed with clean base material, which shall be shaped and compacted as specified above.
- M. **Prime Coat:** After the limerock base course has been properly prepared and is clean, dry and ready to receive the wearing surface, a prime coat shall be uniformly applied at a rate of 0.15 gallon per square yard, immediately followed by the asphaltic concrete. The work shall be performed in accordance with Section 300 of the DOT Specifications. The prime coat shall be applied to the entire limerock base course uniformly and shall thoroughly coat all surfaces. Care shall be taken to apply the prime coat and bond the edges of surrounding pavement. The prime coat shall not advance ahead of the paving by more than 300 feet in business or residential areas, unless otherwise authorized by the Owner. All work associated with prime coats shall comply with DOT Section 300.
- N. **Permanent Asphaltic Concrete Patch:** The spreading, compacting and jointing of the permanent asphaltic concrete patch shall be in accordance with DOT Sections 330 and 334 to the thickness indicated on the Drawings.
- O. Where the width of the repair permits, the material shall be placed by means of an acceptable mechanical spreader and finisher. The mixture shall be compacted to true grade and cross section by means of a tandem roller weighing not less than eight tons. The compacted asphaltic concrete mixture shall not be, in any case, less than one inch in

thickness. Rolling shall proceed as closely behind the spreader as possible, and all material shall be completely compacted the same day it is placed.

- P. Tack Coat: After the asphaltic concrete patch has been properly prepared and is clean, dry and ready to receive the asphaltic concrete overlay, a tack coat shall be uniformly applied at a rate of 0.10 gallon per square yard, immediately followed by the asphaltic concrete overlay. The tack coat shall be applied to the entire asphaltic concrete patch uniformly and shall thoroughly coat all surfaces. Care shall be taken to apply the tack coat and bond the edges of surrounding pavement. The tack coat shall not advance ahead of the paving by more than 300 feet in business or residential areas, unless otherwise authorized by the Owner. All work associated with tack coats shall comply with DOT Section 300.

### 3.04 OVERLAYS

- A. Overlays shall consist of a machine-laid asphaltic concrete wearing surface overlay which shall be nominal one-inch-thick asphaltic concrete meeting the material requirements of the previously specified pavement repairs.
- B. In general, the overlay will be applied in a full lane width or widths, after the permanent paving repairs over the trench have been made.
- C. All longitudinal and transverse asphalt replacement overlay wearing surfaces shall butt into adjacent existing asphalt wearing surfaces in full lane asphalt restoration. The finish elevation of the new full lane overlay shall meet existing elevations adjacent to the new work.
- D. The existing asphaltic concrete surface shall be saw cut for its full depth or 1-inch minimum, and then stripped back for at least 2 feet into the area to be overlaid to a second cut which shall also be in clean, straight lines. The second, or interior, cut edge shall be rolled with a tandem roller weighing not less than 8 tons before the overlay is applied. The stripped area shall be used to provide a smooth transition between the overlay and the existing pavement. Before placing the overlay, all cut edges and the stripped area shall be tack coated with emulsified asphalt as specified herein below.
- E. If the Contractor requests in writing to "feather" the longitudinal edge, and if written permission is granted to "feather" the asphalt by the Owner, a sanded mix of 70-30 type shall be used. "Feathering" shall begin 18 inches from the tapered edge.
- F. Prior to installing a full lane width overlay over existing asphalt, the trench and shoulders over the pipe shall be sawcut and filled with asphalt to the required depth and terminating flush with the existing adjacent asphalt in accordance with the municipality having jurisdiction over the work. The overlay shall be installed as detailed above.
- G. When a minor amount of asphalt surface will remain, generally with large pipe installations after the pipe is installed and the required longitudinal saw cutting the asphalt, the Contractor may request permission to remove all the asphalt in the lane, at his expense, by saw cutting the asphalt adjacent to the existing lane, then placing the overlay flush with the adjacent asphalt. This would require that the previously specified pavement repairs finish elevation be lowered 1 inch to allow for the overlay.
- H. Before the overlay is applied, existing surfaces shall be swept clean of dirt and debris, using a power-driven broom if warranted by the size of the location to be overlaid as determined

by the Owner. Pavement edges shall be cleared of all encroaching vegetation, loose sand, rock and all other foreign matter. When the existing surface is thoroughly clean, a tack coat of Emulsified Asphalt shall be applied at the rate of approximately 0.10 gallon per square yard, immediately followed by the asphaltic concrete overlay. The tack coat shall not advance ahead of the paving by more than 300 feet in business or residential areas, unless otherwise acceptable to the Owner.

- I. Machine-laid overlay shall be placed by means of an approved mechanical spreader and finisher, and the mixture shall be compacted to true grade and cross section by means of a tandem roller weighing not less than 8 tons.
- J. The compacted overlay shall be thicker as required to produce a smooth, uniform surface, free of any irregularities, but shall not be less than one inch in thickness. Existing depressed areas in the asphalt collecting water after a rainfall shall be corrected before placing the asphalt overlay. Rolling shall proceed as close behind the spreading of the asphalt as possible, and all materials shall be completely compacted the same day it is placed.

#### 3.04 PAVEMENT REPAIR

- A. All damage to pavement as a result of work under this Contract shall be repaired in a manner satisfactory to the Owner and at no additional cost to the Owner. The repair shall include the preparation of the subgrade, the placing and compacting of the limerock base, the priming of the base, the placing and maintaining of the surface treatment, all as specified herein.
- B. The width of all repairs shall extend at least 12 inches beyond the limit of the damage. The edge of the pavement to be left in place shall be cut to a true edge with a saw or other method acceptable to the Owner so as to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.

- END OF SECTION -

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## SECTION 02526

### CONCRETE PAVEMENT, CURB AND SIDEWALKS

#### PART 1 -- GENERAL

##### 1.01 SCOPE

- A. Damaged concrete pavement, curbs and sidewalks, and other improvements shall be reconstructed as new to existing lines and grades and dimensions. Where pavement, curbs, and sidewalks are partially damaged on private property, the Contractor shall fully reconstruct the structure in-kind to provide an entirely new structure.

##### 1.02 SUBMITTALS

- A. Shop drawings for reinforcing, joint material and mix designs shall be submitted for review in accordance with the Section entitled "Submittals".

#### PART 2 -- PRODUCTS

##### 2.01 CONCRETE

- A. Concrete shall be Class B as specified in Division 3, unless noted or specified otherwise.

##### 2.02 REINFORCING AND WELDED WIRE FABRIC

- A. Joint reinforcing and welded wire fabric shall conform to the requirements of Division 3.

##### 2.03 PREFORMED JOINT FILLER

- A. Preformed joint filler shall be sponge rubber or cork and conform to the requirements of AASHTO Designated M153, Type I or II.

##### 2.04 CURING COMPOUND

- A. Curing Compound shall conform to the requirements of AASHTO M148, Type I.

#### PART 3 -- EXECUTION

##### 3.01 SUBGRADE CONDITION

- A. The finished subgrade shall be maintained in a smooth, compact condition and any areas which are disturbed prior to placing of the concrete shall be restored at no additional cost to the Owner.
- B. The subgrade shall be moist at the time the concrete is placed. Water shall be uniformly applied ahead of the paving operations as directed by the Owner. If the Contractor does not maintain the subgrade in the required moist condition, a polyethylene sheet vapor barrier will be required between the subgrade and the concrete.
- C. The subgrade shall be accurately trimmed to the required elevation with a 1/4-inch tolerance. High areas shall be trimmed to proper elevation. Low areas may be filled with

suitable material and compacted to the specified density or filled with concrete integrally with the placing of the pavement.

- D. Boulders, rocks or obstructions larger than 1-inch diameter shall be removed to a minimum depth of 6-inches below finished subgrade. The subgrade shall be compacted at optimum moisture content to 98 percent of maximum dry density in accordance with ASTM D1557 method D.

### 3.02 SETTING FORMS

- A. The forms shall be accurately set to line and grade and such that they rest firmly, throughout their entire length upon the compacted subgrade surface. Forms shall be joined neatly and tightly and braced to test the pressure of the concrete and the finishing operations. The alignment and grade of all forms shall be approved before and immediately prior to the placing of concrete.

### 3.03 MIXING CONCRETE

- A. Concrete shall be mixed in accordance with Division 3.

### 3.04 PLACING CONCRETE

- A. The concrete shall be distributed on the subgrade to such depth, that, when it is consolidated and finished, the slab thickness required by the Drawings will be obtained at all points and the surface will at no point be below the grade specified for the finished surface, after application of the allowable tolerance. The concrete shall be deposited on the subgrade in a manner which will require as little rehandling as possible.
- B. Fabric reinforcement shall be placed at mid slab depth, and the fabric shall be maintained at this location during the placing and finishing operations.
- C. Concrete shall be thoroughly consolidated against and along the faces of all forms, by means of hand-operated, spud-type vibrators. Vibration at any one location shall not continue so long as to produce puddling or the accumulation of excessive grout on the surface. In no case shall the vibrator be operated longer than 15 seconds in any one location.

### 3.05 STRIKING-OFF, CONSOLIDATING AND FINISHING CONCRETE

- A. Immediately after the placing, the concrete shall be struck off, consolidated and finished, to produce a finished pavement conforming to the cross section, width and surface sequence of operations shall be as follows: strike-off; vibratory consolidation; screening; floating; removal of laitance; straight-edging; and final surface finish.

### 3.06 STRAIGHT-EDGING AND SURFACE CORRECTIONS

- A. After floating has been completed and the excess water removed, but while the concrete is still in a plastic state, the surface of the concrete shall be tested for trueness with an accurate 10 foot straight-edge. The straight-edge shall be furnished by the Contractor. The straight-edge shall be held in successive positions parallel to the road center line, in contact with the surface, and the whole area tested from one side of the slab to the other as necessary. Any depressions shall be immediately filled with freshly mixed concrete

and struck-off; consolidated and refinished. High areas shall be cut down and refinished. Straight-edge testing and surface correction shall continue until the entire surface appears to conform to the required grade and cross section.

### 3.07 FINAL FINISH

- A. As soon as the water sheen has disappeared from the surface of the pavement and just before the concrete becomes nonplastic, a light broom finish shall be given to the surface.

### 3.08 EDGING

- A. After the final finish has been applied, but before the concrete has become nonplastic, the edges of the pavement along each side of the strip being placed, on each side of construction joints and along any structure extending into the pavement, shall be carefully rounded to a 1/4-inch radius except as otherwise indicated. A well-defined and continuous radius shall be produced and a smoother, dense mortar finish obtained. All concrete shall be completely removed from the top of the joint filler.
- B. All joints shall be checked with a straight-edge before the concrete has become nonplastic and, if one side of the joint is higher than the other or the entire joint is higher or lower than the adjacent slabs, corrections shall be made as necessary.

### 3.09 JOINTS

- A. Construction Joints: Construction joints shall be located as directed by the Owner.
- B. Expansion Joints around Structures: Expansion joints shall be formed by placing premolded expansion joint material about all structures and features projecting through, into or against the pavement. Unless otherwise indicated, such joints shall be 1/2 inch in width. Expansion joints shall be sealed with a joint sealer. Sealant application procedures shall be as recommended by the manufacturer.
- C. Transverse Expansion Joints: Open type transverse expansion joints shall be provided at all sidewalk returns and at 50 foot intervals and wherever indicated on the Drawings. Open type joints shall be formed by staking a 1/4-inch-thick metal bulkhead in place and placing concrete on both sides. After the concrete has set sufficiently to preserve the width and shape of the joint, the bulkhead shall be removed. After the sidewalk has been finished over the joint, the slot shall be opened and edged with a tool having a 1/2-inch radius. Transverse expansion joints shall be cleaned and filled with joint filler strips 1/4-inch-thick conforming to the requirements of AASHTO M-153 and sealed with a joint sealer. Sealant application procedures shall be as recommended by the manufacturer.
- D. Scored Joints: Scored joints shall be either formed or sawed at 5-foot intervals and shall extend to a depth of at least one fourth of the sidewalk slab thickness.

### 3.10 CURING

- A. After the finishing operations have been completed and as soon as the concrete has hardened sufficiently that marring of the surface will not occur, the entire surface and the edges of the newly placed concrete shall be covered and cured with membrane curing compound.

- B. Curing compound shall be uniformly applied to the surfaces to be cured, in a single coat, continuous film, at the rate of one gallon to not more than 200 square feet, by a mechanical sprayer.
- C. Curing compound shall not be applied during periods of rainfall. Curing compound shall not be applied to the inside faces of joints to be sealed. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional compound. Upon removal of side forms the sides of the slabs exposed shall immediately be coated to provide a curing treatment equal to that provided for the surface.

### 3.11 SIDEWALK CONSTRUCTION

- A. The Contractor shall furnish a template and shall thoroughly check the subgrade prior to depositing concrete. Sidewalks shall be given a light broom finish.

### 3.12 CURBS

- A. Curbs shall be constructed in uniform sections ten feet in length except where shorter sections are necessary for closures or arcs. The sections shall be separated by sheet metal templates set perpendicular to the face and tip of the curve and not less than 2 inches longer than the depth of the curb. The templates shall be held firmly during the placing of the concrete and shall be allowed to remain in place until the concrete has set sufficiently to hold its shape but shall be removed while the forms are still in place.
- B. After the concrete has sufficiently set for a minimum of 12 hours, the Contractor shall remove the forms and backfill the spaces on each side. The earth shall be compacted in satisfactory manner with out damage to the concrete work. Minor defects shall be filled with a mortar composed of one part Portland cement and two parts fine aggregate.

### 3.13 PAVEMENT CURB AND SIDEWALK REPAIR

- A. All damage to pavement, curb or sidewalk as a result of work under this Contract shall be repaired in a manner satisfactory to the Owner and at no additional cost to the Owner. The repair shall include all work as specified herein.
- B. The width of all repairs shall extend at least 12 inches beyond the limit of the damage. The edge of the pavement curb or sidewalk to be left in place shall be cut to a true edge with a saw or other approved method so as to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.

### 3.14 FALSEWORK

- A. Falsework shall be stored at the contractor's staging area at all times when not in use. The Contractor shall maintain control of the site and at the completion of each day remove any unused falsework and equipment. After the herein stated curing times, falsework is to be removed in its entirety from the project site and no remnants shall be left. The work shall be kept neat, and the site kept tidy to the Owner's satisfaction.

- END OF SECTION -

SECTION 02580

PAVEMENT MARKING AND SIGNS

PART 1 -- GENERAL

1.01 SCOPE

- A. This Section consists of reflective pavement markers, traffic stripes and markings and traffic signs as specified herein, and as required for a complete installation.

1.02 SUBMITTALS

- A. The Contractor shall submit Shop Drawings for review in accordance with the Section entitled "Submittals".

1.03 QUALITY CONTROL

- A. The phrase "DOT Specifications" shall refer to the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition. The DOT Specifications are referred to herein and are hereby made a part of this Contract to the extent of such references and shall be as binding upon the Contract as though reproduced herein in their entirety.

1.04 CERTIFICATION

- A. The Contractor shall furnish the manufacturer's certification that all signs furnished conform to these specifications and shall replace or repair at his expense all signs that fail to meet this requirement.

PART 2 -- PRODUCTS

2.01 PAVEMENT MARKING

- A. Contractor shall replace any existing reflective pavement markers, traffic stripes and markings damaged during construction.
- B. Paint for traffic stripes and markings shall be in conformance with DOT specification "Thermoplastic Traffic Stripes and Markings Paint" 711, latest edition. The colors of the paint shall be yellow or white as existed before the repair.
- C. Reflective pavement markers shall be in conformance with DOT specification Section 706-2, latest edition.

2.02 TRAFFIC SIGNS

- A. General: Contractor shall replace signs damaged during construction per Manual on Uniform Traffic Control Devices (MUTCD) and Florida Department of Transportation (FDOT) Standard Index 700. Traffic regulating signs shall conform to the colors, dimensions and requirements of the MUTCD and FDOT.

- B. Sign Panels and Support Members: Sign panels and support members shall conform to Aluminum Association Alloy 6061-T6.
- C. Bolts: Bolts shall conform to Aluminum Association Alloy 2024-T4 with an anodic coating 0.0002-inches thick minimum and chromate sealed.
- D. Nuts: Nuts shall conform to Aluminum Association Alloy 6269-T9.
- E. Reflective Sheeting: Reflective Prismatic (High Intensity) sheeting shall conform to FDOT standards.
- F. Construction Warning Signs: The Contractor shall install traffic and warning signs during construction in accordance with OSHA, DOT and County requirements.

### PART 3 -- EXECUTION

#### 3.01 PAVEMENT MARKING

- A. The surface which is to be painted shall be cleaned, by compressed air or other effective means, immediately before the start of painting, and shall be clean and dry when the paint is applied. Any vegetation or soil shall be removed from the pavement before edge striping is begun.
- B. The traffic stripe shall be of the specified width, with clean, true edges and without sharp breaks in the alignment. A uniform coating of paint shall be obtained, and the finished stripe shall contain no light spots or paint skips. Any stripes which do not have a uniform, satisfactory appearance, both day and night, shall be corrected.
- C. All newly painted stripes, including edge stripes, shall be protected until the paint is sufficiently dry to permit vehicles to cross the stripe without damage from the tires. While the center line stripes are being painted, all traffic shall be routed away from the painting operations and the newly painted stripe. When necessary, a pilot car shall be used to protect the painting operations from traffic interference.
- D. Any portions of the stripes damaged by passing traffic or from other cause shall be repainted at the Contractor's expense.
  - 1. Thermoplastic Traffic Stripes and Markings: Thermoplastic pavement markings, including stripes, pavement messages, stop bars, directional arrows, reflective pavement markers and other miscellaneous items, will be replaced as existed before the repair was made. Thermoplastic pavement markings may be placed 18 days after final asphalt lift. The thermoplastic compound shall be as specified in Section 711 of the D.O.T. Specifications, latest edition. The thermoplastic compound shall be extruded or sprayed onto the pavement surface in a molten state by mechanical means, with surface application of glass spheres, when required, and upon cooling to ambient pavement temperature shall produce an adherent pavement marking of specified thickness and width and capable of resisting deformation.
- E. The portion of the pavement surface or thermoplastic marking to which the marker is attached by the adhesive shall be cleaned of dirt, curing compound, grease, oil, moisture, loose or unsound pavement and any other material which would adversely

affect the adhesive. Reflective markers shall be installed in such a manner that the reflective face of the marker is perpendicular to a line parallel to the roadway centerline. No markers shall be installed over longitudinal or transverse joints of the pavement surface. The adhesive shall be spread on the bonding surface (not the marker) so that 100 percent of the bonding area of the marker will be covered. The adhesive application shall be of sufficient thickness so that when the marker is pressed into the adhesive, excess adhesive shall be forced out around the entire perimeter of the marker. All excessive adhesive shall be removed from in front of the reflective faces, if any adhesive or foreign matter adheres to the reflective face of the marker, the marker shall be replaced. The Owner shall determine the minimum time necessary to cure the adhesive for sufficient set to bear traffic.

- F. Reflective pavement markings shall be placed at locations of fire hydrants and watermain valves as required by City standards.

### 3.02 PAINTING TRAFFIC STRIPES

- A. All areas having traffic stripes prior to paving shall be repainted. Temporary traffic painting shall be applied immediately after asphalt pavement has been placed. Permanent traffic painting may be applied only after the proper curing time for the asphalt. Painting traffic stripes (temporary and permanent) shall meet the requirements of Section 710 of the Standard Specifications, latest edition.

### 3.03 INSTALLATION OF RAISED REFLECTIVE PAVEMENT MARKERS

- A. All areas having raised reflective pavement markers prior to paving shall have those markers replaced. Temporary pavement markers shall be applied immediately after asphalt pavement has been placed. Permanent pavement markers may be applied only after the proper curing time for the asphalt. Pavement markers and adhesive (temporary and permanent) shall meet the requirements of Section 706 of the Standard Specifications.
- B. Spacing: As shown in the Roadway and Traffic Design Standards for Design, Construction, Maintenance and Utility operations on the State Highway System by the State of Florida, Department of Transportation, current edition.

### 3.04 SIGN FABRICATION

- A. Preparation of sign blanks and fabrication of reflectorized faces shall conform to the applicable requirements of DOT Section 700.

### 3.05 INSTALLATION

- A. Sign and supports shall be erected in conformance to DOT requirements and as specified herein.
- B. All damaged signs and reflective pavement markers and traffic stripes and markings shall be replaced in conformance with this Section and DOT requirements, latest edition.

- END OF SECTION -

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SECTION 02750

WASTEWATER FLOW CONTROL

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The work specified in this Section includes all labor, materials, accessories, equipment and tools for performing all operations required to bypass pump sewage around a manhole or sewer section in which work is to be performed. The Contractor shall be prepared to bypass pump sewage as a part of his operations.
- B. The work specified in this Section also includes all labor, materials, accessories, equipment and tools for performing all operations required to bypass pump sewage around a section of force main in which work is to be performed, or around a manhole into which a force main discharges if work is to be performed in the manhole. The Contractor shall be prepared to bypass pump sewage as a part of his operations.
- C. The Contractor shall provide all pumps, piping, and other equipment to accomplish this task; perform all construction; obtain all permits; pay all costs; and perform complete restoration of all existing facilities to equal or better condition to the satisfaction of the Owner.

1.02 GENERAL

- A. When sewer line flows at the upstream manhole of the line being repaired are above the maximum allowable requirements for television survey, or do not allow the proper sewer or manhole repair, the flows shall be reduced to the levels indicated by one of the following methods: manual operation of pumping stations by Owner forces, by the Contractor plugging/blocking of the flows, or by the Contractor pumping/bypassing of the flows as acceptable to the Owner.
- B. In some applications, the wastewater flow may be plugged and contained within the capacity of the collection system. This shall only be done when it has been determined the system can accommodate the surcharging without any adverse impact.
- C. For the initial television survey, before and after any repair with the exception of joint testing and sealing, the sewer line shall be blocked completely. No flow, except infiltration/inflow, will be allowed through the respective sewer line being televised on the pre-repair television survey, and the post-repair television survey.
- D. For all other television surveys, including warranty surveys and joint testing and sealing operations, the depth of flow within the sewer shall not exceed that shown below for the respective pipe sizes as measured in the manhole.

1. Maximum Depth of Flow – Warranty Television Survey

6" - 10" Pipe .....	20% of pipe diameter
12" - 24" Pipe .....	25% of pipe diameter

Above 24" Pipe .....30% of pipe diameter

2. Maximum Depth of Flow – Joint Testing/Sealing

6" - 12" Pipe .....25% of pipe diameter

15" - 24" Pipe .....30% of pipe diameter

Above 24" Pipe .....35% of pipe diameter

E. When sewer line flows at the upstream manhole of the line being repaired, in the opinion of the Owner, are too excessive to plug while the rehabilitation is being performed, the Contractor shall submit a written plan and pump/bypass the flow as acceptable to the Owner.

F. When flows of sewage through a force main being repaired or discharging by gravity or force main to a manhole being repaired, are in the opinion of the Owner too excessive to plug or stop while the rehabilitation is being performed, the Contractor shall submit a written plan and pump/bypass the flow as acceptable to the Owner.

1.03 SUBMITTALS

A. The Contractor shall submit complete, detailed plans for this aspect of the work to the Owner for review.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 PLUGGING AND BLOCKING

A. A sewer line plug shall be inserted into the line at a manhole upstream from the section being surveyed or repaired. The plug shall be so designed that all or any portion of the operation flows can be released. During the survey portion of the operation, inspection, testing and replacement, flows shall be shut off or substantially reduced as indicated by Owner. During repairs, the flows shall be shut off or pumped / bypassed, as acceptable to the Owner. After the work tasks have been completed, flows shall be restored to normal level.

3.02 PUMPING AND BYPASSING

A. When pumping/bypassing is required, as determined by the Owner, the Contractor will supply the necessary pumps, conduits and other equipment to divert the flow of sewage around the manhole section in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flows plus additional flow that may occur during periods of rainstorms. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. A "setup"

consists of the necessary pumps, conduits and other equipment to divert the flow of sewage around a manhole section, from the start to finish of work performed in the manhole section.

- B. During a bypass operation, the pump shall be manned continuously. The Contractor shall maintain the pump and bypass equipment and shall be responsible for any damages to public or private property due to the malfunction of the same. Sound attenuated pumps as manufactured by Thompson Pumps with "Silent Knight" canopy or approved equal shall be used for all dewatering activities that require a pumping system. Contractor shall demonstrate pumping system at time of initial set-up including measuring and recording the dB levels. The Contractor shall record dB levels weekly. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum. Automated monitoring methods shall be subject to review and approval by the Owner.
- C. Equipment stoppage alarms shall automatically notify multiple responsible parties by telephone of system failure (auto-dialer) and shall automatically operate a standby pump equipped with an automatic starting device. The Contractor shall be required to demonstrate on a weekly basis, and upon request by the Owner that the auto-dialer and auto-start for the backup pump are functioning appropriately.
- D. The Contractor shall coordinate with the Owner to identify personnel that have the capability to be onsite within one hour of being notified by the installed auto-dialer of system failure to check on the backup pump and to rectify the failure.
- E. In the case of bypassing force main flows, whether such flows normally discharge into a manhole being repaired or pass through a force main being repaired, bypass shall be accomplished by one of two methods.
  - 1. In the absence of surface conditions that prevent temporary bypass piping, the force main shall be accessed by excavation and temporary piping shall be installed to bypass the repair in a manner acceptable to the Owner. In general, for manhole repairs, the Contractor shall excavate to the force main outside the manhole, cut the force main, attach bypass piping, and bypass flow to the next downstream manhole. For force main repairs, the Contractor shall excavate to the force main on each side of the repair, cut the force main on each side of the repair, attach bypass piping on each side of the repair, and bypass flow around the repair. Upon the conclusion of bypass activities and repair work, the Contractor shall install closure pieces to permanently rejoin and restore the force main to full function.
  - 2. Where surface conditions prevent the use of temporary bypass piping, and where the Owner cannot accomplish the bypass operations in-house, the Owner shall shut down the associated lift station and the Contractor shall pump from the wet well into tanker trucks for transport to a designated location. The number of tanker trucks deemed necessary for this operation shall be agreed to in advance by the Owner.

### 3.03 FLOW CONTROL PRECAUTIONS

- A. **Surcharging Sewers.** Where the raw sewage flow is blocked or plugged, sufficient precautions must be taken to protect the public health. No septic conditions shall be allowed due to Contractor's operations. The sewer lines shall also be protected from damage. The following occurrences shall not be allowed:
  - 1. No sewage shall be allowed to back up into any homes or buildings.

2. No sewage shall overflow any manholes, cleanouts or any other access to the sewers.
  3. Users upstream of the repair area shall be able to use all their water and sewer utilities without interruption.
- B. If any of the above unallowable conditions occur or are expected to occur, the Contractor shall bypass pump to alleviate one or all of the conditions. Additionally, the Contractor is required to observe the conditions upstream of the plug and be prepared to immediately start bypass pumping, if needed. It is Contractor's responsibility to pay for all damage claims.
- C. Pumps. Any sump pumps, bypass pumps, trash pumps or any other type pump which pulls sewage/water or any type of material out of the manhole or sewer shall discharge this material into another manhole, or appropriate vehicle or container acceptable to the Owner. Under no circumstances shall this material be discharged, stored or deposited on the ground, swale, road or open environment.
- D. Traffic Control. The Contractor shall take appropriate steps to ensure that all pumps, piping and hoses that carry raw sewage are protected from traffic. The Contractor is required to obtain all permits, use appropriate traffic regulating devices, notify all appropriate governmental agencies and conform to all the requirements listed in Section 01570 - Traffic Regulation and Maintenance of Traffic.
- E. Sewage Spills. In the event, during any form of "Sewage Flow Control", that raw sewage is spilled, discharged, leaked or otherwise deposited in the open environment, due to the Contractor's work, the Contractor is responsible for any clean up of solids and disinfection of the area affected. This work will be performed at the Contractor's expense with no additional cost to the Owner. The Contractor is also responsible for notifying the sewer system maintenance personnel and complying with any and all regulatory requirements in regard to the size spill with no additional cost to the Owner.

- END OF SECTION -

## SECTION 02751

### PREPARATORY CLEANING AND ROOT REMOVAL

#### PART 1 -- GENERAL

##### 1.01 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 of sewer lines 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.

##### 1.02 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 seating of internal pipe joint sealing packers or performance of other specified work. It is recognized that there are some conditions such as broken pipe and major blockages that prevent cleaning from being accomplished or where additional damage would result if cleaning were attempted or continued. Should such conditions be encountered, the Contractor will not be required to clean those specific sewer sections. If, in the course of normal cleaning operations, damage does result from preexisting and unforeseen conditions such as broken pipe, the Contractor will not be held responsible.
- B. Manhole Cleaning General. All concrete and masonry surfaces must be cleaned prior to repair. Grease, laitance, loose bricks, mortar, unsound concrete, and other materials must be completely removed. Water blasting (minimum 1,200 psi) utilizing proper nozzles shall be the primary method of cleaning; however, other methods such as wet or dry sandblasting, acid wash, concrete cleaners, degreasers or mechanical means may be required to properly clean the surface. Surfaces on which these methods are used shall be thoroughly rinsed, scrubbed, and neutralized to remove cleaning agents and their reactant products.

##### 1.03 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 (Hydrocleaning) 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 ensure 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

### 3.01 GENERAL

- A. The designated sewer sections shall be cleaned using hydraulically propelled, high-velocity jet, or mechanically powered equipment. The equipment shall dislodge, transport and remove all sludge, mud, sand, gravel, rocks, bricks, grease, roots, sticks, and all other debris from the interior of the sewer pipe and manholes. The equipment and methods selected shall be based on the conditions of lines and manholes at the time the work commences and shall be satisfactory to the Owner. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole section, the cleaning effort shall be stopped and sufficient inspection performed so that the Owner can be notified of the reason for inability to continue.

### 3.02 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 ensure 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 ensure 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. The Contractor shall employ operational hydrant meters to be obtained from the Owner and shall obtain water only from the Owner's hydrants. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.

### 3.03 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. The Contractor shall remove from the site and properly dispose of all solids or semi-solids recovered during the cleaning operation. The Contractor shall obtain permits and make arrangements as required to properly dispose of solids.
- 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 above.
- 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 Owner 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 Owner in connection with such cleanup. The Owner may also charge to the Contractor any costs incurred or penalties imposed on the Owner as a result of any spill, dump or discard. Under no circumstances is this material is 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.

### 3.04 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 disposals 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 Owner.

### 3.05 ROOT REMOVAL

- A. Roots shall be removed in the designated sections and manholes where root intrusion is indicated on the work order. Special attention should be exercised during the cleaning operation to assure almost complete removal of roots from the joints. Any roots which could prevent the traveling of the packer or could prevent the proper application of chemical sealants or could prevent the proper seating and application of cured-in-place, fold-and-formed or sectional cured-in-place liners, shall be removed. 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.

### 3.06 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 Owner. Liner installation shall not be initiated until the Owner has reviewed the post-cleaning television survey tapes and has accepted the cleaning. 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. In areas where television survey is not performed, the Owner may require the Contractor to pull a double squeegee (with each squeegee the same diameter as the sewer) through each manhole section as evidence of adequate cleaning. If internal sealing is to follow the television survey, particular attention should be given to the adequacy of the cleaning to ensure that proper seating of the sealing packer can be achieved.
- B. In the event that special cleaning involving the mechanical removal of roots, grease, and/or tuberculation has been authorized, acceptance of sewer line cleaning shall be made upon the successful completion of the post-cleaning television survey and shall be to the satisfaction of the Owner. Liner installation shall not be initiated until the Owner has reviewed the post-cleaning television survey tapes and has accepted the cleaning.
- C. 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 or draft the water by means of high-velocity jet cleaners. Water removal shall be performed until the television camera lens will no longer be submerged. This requirement may be waived by the Owner 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 02753

### MANHOLE REHABILITATION

#### PART 1 – GENERAL

##### 1.01 SCOPE

- A. Work orders will include the various manhole repairs specified in this Section. Manhole rehabilitation shall be accomplished by the application of materials that will improve the overall structural condition of the manhole. The intent of this portion of the work is to provide for aspects of sewer manhole rehabilitation and sealing using various procedures either singularly or in combination, including type of repair, methods of repair, materials and equipment as required for each manhole scheduled for rehabilitation.
1. Manhole Preparation: These work items include cleaning the manhole, sealing walls and patching the interior surfaces.
  2. Manhole Repairs - Critical Leak Areas: These work items include repairing leaks in the wall to base areas, pipe penetrations and manhole joints.
  3. Manhole Liners: These work items include installation of cementitious liners and cementitious/epoxy liners.
  4. Frame and Cover Repairs: These work items include the repair of frame and cover leaks, realigning and grouting frame, and frame and cover replacement.

##### 1.02 SUBMITTALS

- B. The Contractor shall submit shop drawings and other information as specified in accordance with Section 01300, "Submittals".
- C. With the bid, the following submittals are required.
1. Name, business address and telephone number of the Manhole Rehabilitation Contractor.
  2. The name of the manhole lining product suppliers and a list of materials to be furnished, as well as Contractor's experience with the specified manhole lining products (number of years installing the products, number of manholes lined with the products, and list of references going back three years including customer names, addresses, telephone numbers, and number of manholes). Where the Contractor proposes to utilize a sub-contractor to apply a manhole lining product, submit all required information for the sub-contractor as well.
  3. Three years of previous related experience, as documented by verifiable references, shall be required to be qualified in bidding this project. The Contractor performing the work shall be fully qualified, experienced and equipped to complete this work expeditiously and in a satisfactory manner and shall be an approved installer of the manhole lining systems as certified and licensed by the manufacturers.
  4. The Owner reserves the right to approve or disapprove the Contractor, based on the submitted qualifications.

D. Prior to contract award, the following submittals are required.

1. Name(s) of all supervisory personnel to be directly involved with Manhole Rehabilitation for this project. The Contractor shall sign and date the information provided and certify that to the extent of his knowledge, the information is true and accurate, and that the supervisory personnel will be directly involved with and used on this project. Substitutions of personnel and/or methods will not be allowed without written authorization of the Owner.
2. A certified statement from the manufacturer that the Contractor is a certified and/or licensed installer of the manhole lining products. Contractor shall initiate and enforce quality control procedures consistent with the manufacturer's recommendations. Applicators shall be completely trained and specialized in all aspects of manhole rehabilitation including grouting/sealing for active leak repair, surface preparation and wastewater corrosion materials applications.
3. Written descriptions of the manufacturer-recommended procedures for surface preparation, installation, curing, and testing of the specified manhole repair and lining products; construction method(s) and equipment to be used; and locations required for equipment and material access.
4. Where Contractor is proposing use of an alternate product "equal" to those specified, such use shall be subject to Owner review and approval. The product must meet the Owner's new product evaluation criteria and be approved for use in that particular condition. The Owner's new product evaluation process includes a requirement that significant, verifiable documentation be submitted for local installations that have performed successfully in the same application for a minimum of two years. Manhole products must demonstrate the ability to provide long-term, reliable service under corrosive environmental conditions.

#### 1.03 GUARANTEE

- A. All manhole lining installed shall be guaranteed by the Contractor for a period of two years from the date of final acceptance. During this period, all defects discovered in the lining, as determined by the Owner, shall be repaired or replaced in a satisfactory manner by the Contractor at no cost to the Owner.

#### 1.04 DELIVERY, STORAGE AND HANDLING

- A. Care shall be taken in shipping, handling and placing to avoid damaging the lining products. Any lining product or material damaged in shipment shall be replaced as directed by the Owner.
- B. Any lining product 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 site.
- C. While stored, the lining products shall be adequately packaged and protected. The lining products shall be stored in a manner as recommended by the manufacturer.

## 1.05 SITE CONDITIONS

- A. Applicator shall conform to all local, state, and federal regulations including those set forth by OSHA, the EPA, and other applicable authorities.
- B. Confined space entry, flow bypass, or maintenance of traffic plans shall be prepared by the Contractor as required to perform the specified work.

## PART 2 – PRODUCTS

### 2.01 MANHOLE FRAMES AND COVERS

- A. All manhole frame and cover material and installation requirements shall be as indicated in these documents.
- B. Replacement of manhole frames and covers shall be pursuant to requirements outlined in Section 02754.

### 2.02 RUBBER SEALS

- A. The manhole frame-chimney joint area of manholes and the precast manhole barrel joints shall be sealed with internal flexible rubber seals as manufactured by Cretex Specialty Products, or equal.
- B. Internal rubber seals used for sealing the joints between the manhole frame and chimney or corbel/cone section, shall consist of the following components:
  - 1. Rubber Sleeve and Extension: The flexible rubber sleeve extensions and wedge strips shall be extruded from a high-grade rubber compound conforming to the applicable requirements of ASTM C 923, with a hardness (durometer) of 48<sub>+5</sub>.
    - a. The sleeve shall be double pleated with a minimum unexpanded vertical height of 8 inches, a minimum thickness of 3/16 inches and shall be capable of a vertical expansion when installed of not less than 2 inches. The top and bottom section of the sleeve shall contain an integrally formed expansion band recess and multiple sealing fins.
    - b. The extension, if required, shall have a minimum thickness of 3/16 inches. The top section of the extension shall be shaped to fit into the bottom band recess of the sleeve under the bottom chimney seal band. The bottom section of the extension shall contain an integrally formed expansion band recess and multiple sealing fins matching that of the rubber sleeve.
    - c. Any splice used to fabricate the sleeve and extension shall be hot vulcanized and have a strength such that the sleeve shall withstand a 180-degree bend with no visible separation.
    - d. The continuous wedge strip used to adapt the rubber sleeve to sloping surfaces shall have the slope differential needed to provide a vertical band recess surface, be shaped to fit into the band recess and have an integral band restraint. The length of the wedge strip shall be such that, when its ends are butted together, it will cover the entire inside circumference of that band recess needing slope adjustment.

2. Expansion Bands: The expansion bands used to compress the sleeve against the manhole shall be 16-gauge stainless steel conforming to ASTM A 240, Type 316, with a minimum width of 1 3/4 inches. The expansion mechanism shall have the capacity to develop the pressures necessary to make a watertight seal and shall have a minimum adjustment range of 2 diameter inches. Studs and nuts used for this mechanism shall be stainless steel conforming to ASTM F 593 and 594, Type 316.

## 2.03 PREPATORY INFILTRATION CONTROL PRODUCTS

### A. Infiltration Control/Plugging Material

1. Prior to installing the manhole lining system, active infiltration shall be controlled according to the specifications of the lining manufacturer. Infiltration control materials shall be rapid-setting, high early strength, hand applied cementitious material for stopping infiltrating water and making repairs to concrete, brick or other masonry constructed manholes. The material shall be non-shrinking, non-metallic and non-corrosive. It shall be formulated at the factory and supplied in factory sealed and labeled pre-measured containers. The material shall be compatible with the lining material to be used.
2. Product shall be Permacast-Plug as manufactured by Action Products Marketing Corp., Strong-Plug by Strong Company, Preco-Plug by Fosroc Inc., or approved equal.

### B. Chemical Grouting Material

1. Chemical Grouts may be used for stopping very active infiltration and shall be mixed per manufacturer's recommendations and as specified in Section 02763-Chemical Grouting. The chemical grout shall be an extremely low viscosity acrylamide resin with gel times from 5 seconds to several hours. Product shall be AV-100 Chemical Grout as manufactured by Avanti International, or equal. The chemical grout shall be compatible with the lining material to be used.

### C. Patching Material

1. Voids in the existing manhole walls or damaged inverts shall be repaired prior to installing the manhole lining system. The patching material shall be a rapid setting, high early strength, corrosion resistant hand mixed and hand applied cementitious material intended for filling voids and repairing inverts in concrete, brick or other masonry constructed manholes. It shall be formulated in the factory and supplied in factory sealed and labeled pre-measured containers. The material shall be compatible with the lining material to be used.
2. Product shall be Permacast-Patch as manufactured by Action Products Marketing Corp., Strong-Seal QSR by Strong Company, Preco-Patch by Fosroc Inc., or approved equal.

## 2.04 CEMENTITIOUS AND EPOXY MANHOLE LINERS

### A. Cementitious manhole liner

1. The mortar used for manhole rehabilitation shall be a blend of portland cement,

microsilica, thermoplastic fiber, densifiers, admixtures, and other modifiers that produces a high strength, low shrinkage, and low permeability mortar for the rehabilitation of deteriorated concrete structures; produces excellent adhesion to properly prepared existing concrete or brick surfaces; restores structural integrity; seals rough, deteriorated surfaces and resists external hydrostatic water pressure; and, is suitable for permanent water immersion service. Mortar shall be applied at a minimum thickness of 1/2 inches.

2. The product shall be Mainstay ML-72 or approved equal.

B. Cementitious/Epoxy manhole liner

1. The epoxy coating shall be designed for use in applications where corrosion is anticipated or known to be aggressive; be compatible with the above specified mortar material; have a composition of 100 percent solids; be of gloss white color; and provide a high level of adhesive strength and resistance to abrasion. The coating shall be applied at a minimum thickness of 100 mils.

2. The product shall be Mainstay DS-5 or approved equal.

2.05 AROMATIC URETHANE SEALANT

A. The flexible sealant shall be a two component, aliphatic, chemically curing, urethane sealant. The sealant shall be designed for flexibility from ground movement and extended water immersion when applied to the inside wall of the adjustment ring area. Manhole seal shall be designed to prevent leakage of water into the manhole through the frame joint area and the area above the manhole cone, including all extensions to the chimney area. Extension shall include, but is not limited to, lifting rings, brick and/or block material that may have been used to achieve grade. The material shall not corrode in municipal sewer environments.

B. The sealant shall be Ring Seal as manufactured by The Rain Stopper, Flex-Seal Utility Sealant as manufactured by Sealing Systems, Inc., or approved equal.

C. A primer coat of 2-3 mils thickness shall be applied to the prepared surface.

D. The flexible sealant shall be applied on primed surfaces at a thickness of 100 mils or as specified by the Owner. The overlap of the bottom portion of casting and the top of the lowest adjustment ring should be 3 inches or greater.

PART 3 -- EXECUTION

3.01 GENERAL

A. The Contractor shall perform all work in strict accordance with all applicable OSHA Standards. Particular attention is drawn to those safety requirements involving man entry in confined spaces.

B. Flow Control: Flow control, as specified in Section 02750, "Wastewater Flow Control" shall be exercised as required to ensure that no flowing sewage comes into contact with sections of the manhole under repair.

- C. Prior to beginning work, the Owner will visually review the manhole and confirm the repair procedure indicated on the Work Order.
- D. The Contractor shall notify all property owners who discharge sewage directly to the manhole being repaired that their service will be discontinued while the lining is being placed, cured and active pipe and service connections reopened. The Contractor shall notify individual property owners at least 72 hours in advance, giving the date, start time and estimated completion time for the work being conducted. This notification shall be coordinated with the distribution of the door hangers. The Contractor shall reopen all of the existing active pipe connections in each sewer manhole following the repair.

### 3.02 PREPARATION

#### A. General:

1. The Contractor is responsible for properly preparing the existing manhole for lining prior to the installation of the lining system, including stopping all leaks, patching voids, removing steps/rungs, cleaning, and removing debris.
2. The casting and adjusting area of the manhole shall be sandblasted to remove any loose material and rust.
3. Prior to cleaning the manhole, a ¼-inch mesh screen shall be installed at the manhole outlet to catch debris. The Contractor shall clean all accumulations of debris, such as dirt and grease, loose mortar, bricks and concrete, and dispose of properly.
4. The manhole surface shall be clean, structurally sound and free from oil, grease, loose mortar, paints, protective coatings, efflorescence, laitance and airing compounds. The condition of the manhole may require the use of an environmentally safe degreasing compound; if so, the surface shall be thoroughly rinsed to eliminate any residue.
5. All existing manhole rungs/steps shall be removed, and the void patched or cut off and ground smooth.
6. When a cementitious liner or cementitious/epoxy liner is called for in the Work Order, manhole interior shall be high-pressure (4,000 psi) water cleaned and blasted to remove all deteriorated concrete and other loose material. As a minimum, 4 inches of the manhole cover frame area shall also be cleaned by blasting. After the cleaning process, the concrete structure shall be washed with a 5-10 percent solution of muriatic acid. The structure shall be cleaned again with high pressure water to remove acid residual and any loose material. The Contractor shall make provisions during blasting operations to contain all blasting abrasive material. No blasting abrasive shall be allowed into the sanitary sewer lines.

#### B. Sealing of Manhole Walls:

1. After the completion of the cleaning operation, manhole wall leaks shall be sealed by the following methods:
  - a. Plugging using the infiltration control material specified in Article 2.03; and/or

- b. Patching using the material specified in Article 2.03; and/or
- c. Chemical Grout Sealing using material specified in Article 2.03.

- i. **Equipment:** The basic equipment shall consist of chemical pumps, chemical containers, injection fittings, hoses, valves, and all necessary equipment and tools required to seal manholes. The chemical injection pumps shall be equipped with pressure meters that will provide for monitoring pressure during the injection of the chemical sealants. When necessary, liquid bypass lines equipped with pressure-regulating bypass valves will be incorporated into the pumping system.

- ii. **Sealing Procedures:** At each point of leakage within the manhole structure, a hole shall be carefully drilled from within the manhole and shall extend through the entire manhole wall. In cases where there are multiple leaks around the circumference of the manhole, fewer holes may be drilled, providing all leakage is stopped from these holes. Grout ports or sealant injection devices shall be placed in these previously drilled holes in such a way as to provide a watertight seal between the holes and the injection device. A hose, or hoses, shall be attached to the injection device from an injection pump. Chemical sealing materials as specified shall then be pumped through the hose until material refusal is recorded on the pressure gage mounted on the pumping unit or a predetermined quantity of sealant has been injected. Care shall be taken during the pumping operation to insure that excessive pressures do not develop and cause damage to the manhole structure. Upon completion of the injection, the ports shall be removed and the remaining holes filled with mortar and troweled flush with the surface of the manhole walls or other surfaces. The mortar used shall be a nonshrink patching mortar.

- 2. All materials shall be mixed and applied in accordance with the manufacturer's written instruction. Leaks may be temporarily channeled through "bleed" pipes which are removed and plugged during the final repairs. The manhole sealing repair shall be acceptable to the Owner before additional work proceeds.

- C. **Patching:** Loose material shall be removed from the area to be patched or repointed exposing a sound subbase. Holes or voids around steps, joints or pipes, spalled areas and cavities caused by missing or broken brick shall be patched and missing mortar repointed using a nonshrink patching mortar specified in Article 2.03. Cracks not subject to movement and greater than 1/16 inch in width shall be routed out to a minimum width and depth of 0.5 inches and patched with nonshrink patching mortar.

### 3.03 MANHOLE LINERS

- A. **Cementitious Liner (Spray or Spin Applied):** On those manholes identified by the Owner, the Contractor shall install the cementitious liner to the wall and bench surfaces of brick or concrete, using the following procedure:

- 1. **Preparatory Repair:**

- a. Leakage around pipe entering manhole shall be sealed.
    - b. Any service line repairs shall be made using a quick-setting patching mix per manufacturer's recommendations.

2. Mixing: If ambient temperatures are excessive, precautions shall be taken to keep the mix temperature at time of application within limits specified by the manufacturer.
  - a. Should the reconstruction process require application thickness greater than 1-inch, a base coat shall be used to build the substrate to within 1-inch of the finished dimension. For each bag of product, use the amount of water required per manufacturer's recommendation following mixing procedures as noted on product bag and using the manufacturer-approved equipment for mixing and application.
  - b. Application thickness shall not exceed the manufacturer's instructions. Prepared mix shall be discharged into a hopper and mixing shall continue to occur in such a manner as to allow spraying continuously without interruption until each application is complete.
  
3. Application:
  - a. The surface, prior to spraying base coat applications, shall be clean and free of all foreign material and shall be damp without noticeable free water droplets or running water, but totally saturated, just prior to application of each coat. Materials shall be spray applied from the bottom of the wall to the top, to within 1-inch of the original substrate dimension using as many passes as necessary. The surface is to be rough troweled after each pass. The light troweling is performed to assure that material penetrates the voids and sets the bond.
  - b. A final application is applied after the base coat applications have begun to take an initial set (disappearance of surface sheen). Again, application shall be from the bottom up. The surface is then troweled to a smooth finish being careful not to over finish or over trowel so as to bring additional water to the surface and weaken it. A brush finish is then applied to the troweled finish or top coat surface. Manufacturer's recommendations shall be followed whenever more than 24 hours have elapsed between applications.
  - c. Bench and Invert Application: The bench shall be sprayed with materials mixed per specifications and spray applied in such a manner that a gradual slope is produced from the walls to invert. The wall / bench intersection shall be rounded to a uniform radius the full circumference of the intersection. Through the use of flow-through plugs, the Contractor shall isolate the channel invert, clean and inspect the invert. If the invert has active infiltration, signs of infiltration, cracks or deterioration, the invert shall be sprayed with the materials specified.
  - d. Where the manhole to be rehabilitated is subject to vehicular traffic, the cementitious lining shall be installed to no closer than 1 inch below the bottom of the manhole frame so as to avoid transfer of impact loads to the new liner. Where the manhole to be rehabilitated is not subject to vehicular loads, the cementitious liner shall be continuous up to the manhole frame.
  
4. Curing: Caution should be taken to minimize exposure of applied product to sunlight and air movement. If application of additional coat is to be longer than 15 minutes, the manhole shall be covered. At no time should the finished product be exposed to sunlight or air movement for longer than 15 minutes before placing the manhole

cover. If ambient humidity level is below 70 percent, it shall be necessary to keep finished product damp for the first seventy-two hours.

- a. **Curing Time:** The final application shall have a minimum of eight hours cure time before subjected to active flow, or greater if recommended by the manufacturer.
  - b. **Traffic:** Traffic shall not be allowed over manholes for twenty-four hours after reconstruction is complete.
5. **Frame-Joint Area Sealing System:** A minimum of 7 days after the cementitious liner has been installed, where indicated by the Owner, the Contractor shall install the aromatic urethane internal manhole sealing system through the frame joint area. As a minimum, 4 vertical inches shall be applied on the frame, and 6 vertical inches on the cone area. Any material left on the frame from the application of the cementitious liner shall be wire-brushed prior to sealant application. Ring Seal or equal may require the proper mixing of agents, as recommended by the manufacturer's instructions. Ensure casting and structure are clean and dry prior to applying Adhesive Primer. Brush the adhesive primer onto the casting and structure surfaces where the mastic is intended to adhere. After allowing for proper drying of adhesive primer to occur, sealant may be applied by brush as evenly as possible over the chimney area that includes the frame joint area and the area of the manhole cone, including all extension to the chimney area.
6. **Testing:** Six 2-inch cubes shall be cast each day or from every 50 bags of product used. The test specimen shall be properly labeled and given to the Owner for compression strength testing as described in ASTM C 109.
7. **Warranty:** The manufacturer shall warrant that the products are produced in conformity with its standard specifications or formulations within recognized tolerances, free of adulteration or contamination, and that the product will perform in accordance with representations in the manufacturer's literature and technical data sheets when properly applied in strict conformance with the printed instructions on container and prescribed in technical data instructions and when applied to a properly prepared surface.

**B. Cementitious/Epoxy Liners**

1. Those manholes identified by the Owner shall be coated with an extremely low shrinkage cementitious repair product to waterproof and enhance the structural integrity of the manhole and then epoxy topcoat for corrosion protection after the manhole has been properly prepared.
2. The material used shall be designed, manufactured, and intended for sewer manhole rehabilitation and the specific application in which they are used.
3. The selected product or system must bear the manufacturer's certification that it will fulfill the requirements described herein when applied in accordance with the manufacturer's recommendations.
4. The materials shall be delivered to the job site in original unopened packages and clearly labeled with the manufacturer's identification and printed instructions. All

material shall be stored and handled in accordance with recommendations of the manufacturer.

5. Preparatory Repair

- a. Any bench, invert or service line repairs shall be made at this time using the quick setting patching material per manufacturer's recommendations.
- b. Invert repair shall be performed on all inverts with visible damage or infiltration. After blocking flow through the manhole and thoroughly cleaning the invert, the quick setting patch material shall be applied to the invert at a minimum thickness of 1 inch, extending out into the bench sufficiently to tie into the monolithic liner to be spray applied. The finished invert shall be smooth and free of ridges. The flow may be re-established in the manhole within thirty minutes after placement of the material.
- c. Active leaks shall be stopped using quick setting, especially formulated mixes according to manufacturer's recommendations. Some leaks may require weep holes to localize the infiltration during the application. After application, the weep holes shall be plugged with the quick setting mix prior to application of the final coat. When severe infiltration exists, drilling may be required to pressure grout using grouting procedures. Manufacturer's recommendations shall be followed when pressure grouting is required.

6. Cementitious Liner Application

- a. The Contractor shall furnish and place the cementitious base coat in each manhole as and where directed by the Owner. The installation and curing of the base coat shall be in complete accordance with the manufacturers' specifications.
  - i. Prior to placing the base coat, the Owner and the Contractor must inspect and approve the surface preparation work. The Contractor shall notify the Owner when the manholes are ready for inspection. The Contractor is responsible for ensuring proper installation conditions including surface preparation, temperature and moisture.
  - ii. All bottom and horizontal surfaces shall have the base coat material applied to the required thickness by hand troweling or spray-on methods. All cementitious linings shall be troweled smooth after application.
  - iii. All side vertical surfaces shall have the cementitious base coat applied to the required thickness in one pass or application. Non-vertical surfaces may be completed in multiple passes to prevent sloughing of material.
  - iv. Temperature limitations must be handled as appropriate and as approved by the manufacturer.
- b. Where the manhole to be rehabilitated is subject to vehicular traffic, the cementitious lining shall be installed to no closer than 1 inch below the bottom of the manhole frame so as to avoid transfer of impact loads to the new liner. Where the manhole to be rehabilitated is not subject to vehicular loads, the cementitious liner shall be continuous up to the manhole frame.

7. Epoxy Topcoat Application

- a. The Contractor shall furnish and place epoxy lining as a top coat over the previously installed cementitious base coat in each manhole as and where directed by the Owner. The installation and curing of the epoxy lining top coat shall be in complete accordance with the applicable provisions of the manufacturers' specifications.
  - i. Prior to placing the top coat, the Owner and the Contractor must inspect and approve the base coat. The Contractor shall notify the Owner when the manholes are ready for inspection. The Contractor is responsible for ensuring proper installation conditions including base coat conditions, temperature and moisture.
  - ii. All surfaces shall have the monolithic epoxy lining applied by a spray-on method or by hand troweled applications in multiple passes to gradually build up to the required thickness.
  - iii. Contractor shall regularly perform and record epoxy coating thickness readings with a wet film thickness gauge to ensure uniform thickness during application.
  - iv. Temperature limitations must be handled as appropriate and as approved by the manufacturer.

8. Product Testing

- a. Four, 2-inch cubes shall be cast each day or from every pallet of product used. The test specimens shall be properly labeled and given to the Owner for compression strength testing as described in ASTM C 109.

3.04 FRAME AND COVER REPAIRS AND REPLACEMENT

A. Work Orders will identify one of the following repairs:

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 as described in Section 02754 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 identified by the Owner, cast iron rings and covers shall be replaced by the Contractor. 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 in Paragraph 1 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.

### 3.05 RUBBER CHIMNEY SEAL

- A. 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.

### 3.06 INVERT REPLACEMENT

- A. The Contractor shall remove existing channel and benches to the base of the manhole, then rebuild channel by reshaping channel invert and building new slope of shelves or benches. Work shall include aligning inflow and outflow ports in such a manner to prevent the deposition of solids at the transition point. All inverts shall follow the grades of the pipe entering the manholes. Changes in direction of the sewer and entering branch or branches shall have a true curve of as large a radius as the size of the manhole will permit, but will be shaped to allow easy entrance of maintenance equipment including buckets, TV camera, etc.

### 3.07 TESTING

- A. After the specified rehabilitation work has been completed, the manholes shall be visually reviewed and tested in accordance with manufacturer's testing procedures by the Contractor in the presence of the Owner and found to be acceptable. The manhole environment shall be properly vented prior to testing to ensure hazardous conditions do not exist.

#### 1. Visual Review:

- a. All rehabilitated manholes shall be visually reviewed for water tightness against leakage of water into the manhole. All visible leaks and defects observed during the review shall be repaired to the Owner's satisfaction at no additional cost to the Owner. There shall be no visible infiltration.
- b. All pipe connections shall be open and clear.
- c. There shall be no cracks, voids, pinholes, uncured spots, dry spots, lifts, delaminations or other type defects in the lining.
- d. The epoxy lining topcoat shall provide a continuous monolithic surfacing with uniform thickness throughout the manhole interior and be free of pinholes, slumps and drips.

#### 2. Exfiltration Testing:

- a. Incoming and outgoing sewer and service lines shall be plugged, the plugs restrained, and the manhole filled with water to the top of the manhole frame. A soaking period of up to one hour will be allowed if bypassing of the sewage is not required or has been provided for. At the end of this optional soaking period, the manhole shall be refilled with water and the test begun. The time shall then be recorded and after a period of not less than one hour has passed, the manhole again refilled, the amount required being carefully measured. The

maximum allowable rate of exfiltration is 0.1 gallon per hour per vertical foot of depth of the manhole.

- b. Exfiltration testing shall be done on up to 10 percent of the manholes, or on one manhole, if less than 10 are being repaired, as chosen by the Owner, where each of the following type of repairs (sealing) has been performed:
  - i. Cementitious liner.
  - ii. Cementitious liner with epoxy coating.
- c. Manholes that fail the exfiltration test shall be reworked and retested by the Contractor at no additional compensation and additional manholes will be retested at the Contractor's expense. Any manholes that are visually leaking, are unacceptable, or fail the test shall be reworked and retested.

3. Testing and Verification of Liners:

- a. The Owner's inspector shall verify the thickness of cementitious liners and epoxy coatings with a wet gauge. Any area found to be less than the minimum prescribed thickness shall immediately receive the additional material needed. The resultant lined manhole wall shall be leak-free, smooth and free of honeycomb or areas of segregated aggregate.
  - b. Epoxy coatings shall be tested at 10,000 volts with a holiday detector for pinholes and holidays. Any defects shall be promptly repaired and re-tested. All repair procedures shall follow manufacturer's recommended procedures. Inspection and testing shall be performed by the Certified Applicator in the presence of the Owner at no additional cost to the Owner.
- B. Field acceptance of the epoxy manhole lining system shall be based on the Owner's evaluation of the appropriate installation of the base coat and topcoat per field inspections and on observation of the measurements of the wet film thickness. Acceptance shall also be based on the Owner's evaluation of the curing test data and final testing.
- C. 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.

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SECTION 02754

SANITARY SEWER MANHOLES

PART 1 – GENERAL

1.01 SCOPE

- A. The work specified in this Section includes all labor, materials, accessories, equipment and tools necessary to install and test precast concrete manholes, with or without outside drop connections. Manholes shall be located on existing sewer line segments or at the intersection ("T") of existing sewer lines. Work in this section also includes frame adjustment, connections to existing manholes, and connections to existing sewer.

1.02 REFERENCES

- A. American Society for Testing and Materials/Latest Edition
1. ASTM A-48 - Specification for Gray Iron Casting
  2. ASTM C-62 - Specification for Sewer and Manhole Brick
  3. ASTM C-139 - Specification for Concrete Masonry Units for Construction
  4. ASTM C-443 - Specification for Joints for Circular Concrete, Sewer and Culvert
  5. ASTM C-478 - Specification for Pre-Cast Reinforced Concrete Manhole Sections
  6. ASTM C-923 - Specification for Resilient Connections Between Reinforced Concrete Manhole Structures and Pipes
  7. ASTM C-1244 - Air Testing

1.03 SUBMITTALS

- A. The Contractor shall submit Shop Drawings and other information for review in accordance with Section 01300 – Submittals. Submittals shall include at least the following:
1. Dimensions and elevations
  2. Dewatering, sheeting and bracing plans
  3. Base Sections, riser sections, eccentric and concentric conical top sections, flat slab tops, grade rings.
  4. Pipe connection details.
  5. Ring and cover.
  6. Sectional plans and elevations showing dimensions and reinforcing steel placement.
  7. Structural calculations including assumptions.

8. Concrete design mix.
9. Manhole liner information.
10. Concrete cylinder test reports from an approved testing laboratory certifying conformance with this Section.
11. All materials shall be per City of Boca Raton Shop Drawing Submittals & Approved Utility Product List

**B. Qualification**

1. The Qualifications of the Manhole Installation Contractor shall be submitted prior to contract award. These qualifications shall include detailed description of the following:
  - a. Name, business address and telephone number of the Manhole Installation Contractor.
  - b. Name(s) of all supervisory personnel to be directly involved with Manhole Installation for this project.
  - c. The Contractor shall sign and date the information provided and certify that to the extent of his knowledge, the information is true and accurate, and that the supervisory personnel will be directly involved with and used on this project. Substitutions of personnel and/or methods will not be allowed without written authorization of the Owner.
  - d. The Contractor shall provide his references of previous project lists going back five years including his customers' name, address, and telephone number.
  - e. Five years of previous related experience shall be required to be qualified in bidding this project.

**1.04 UPLIFT**

- A. All precast concrete manholes placed below grade shall have adequate safety factors against uplift (excluding weight of soil and associated skin friction) as follows:

	<u>Water Elevation</u>	<u>Safety Factor</u>
1. High water level (H.W.L) -	3.0 feet NGVD	1.5
2. 100-year flood -	7.0 feet NGVD	1.2

**1.05 QUALITY ASSURANCE**

- A. All materials shall be new and unused.
- B. Materials' quality, manufacturing process and finished sections are subject to inspection and approval by the ENGINEER and Owner. Inspection may be made at place of manufacture, at work site following delivery, or both.

- C. Materials shall be rejected for failure to meet any requirements specified herein. Rejection may occur at place of manufacture, at work site, or following installation. Mark for identification rejected materials and remove from the site immediately. Rejected materials shall be replaced at no additional cost to the Owner.
- D. Repair minor damage to precast concrete sections by approved method, if repair is authorized by the ENGINEER and/or the Owner.

## PART 2 -- PRODUCTS

### 2.01 FRAMES AND COVERS

- A. All workmanship and materials shall be of the highest quality. The manhole ring and cover shall be the product of a manufacturer actively engaged in research, development, and manufacturing of watertight manhole rings and covers.
- B. Castings for frames and covers for manholes shall be composed of best quality, tough, gray iron, free from cold shuts, blow holes, and other imperfections, and shall meet the requirements of ASTM A-48 for Class No. 30, designed for AASHTO Highway Loading Class H-20.
- C. All bearing surfaces shall be machined to fit true and shall be watertight. No plugging or filling will be allowed.
- D. The combined weight of the frame and cover shall not be less than 530 pounds and cover shall weigh a minimum of 160 pounds.
- E. All manhole covers shall contain two non-penetrating pick holes.
- F. Frame and cover shall be set to grade. Lid adapters or adjustment rings shall not be used on new construction.
- G. Frames and covers shall be U.S. Foundry 310-DX-BWT or approved equal, bolted and watertight.

### 2.02 PRECAST MANHOLES

- A. Precast concrete manholes or sections (hereinafter referred to as "precast sections") shall be furnished with waterstops, sleeves and openings as noted on Drawings. Box out for wall pipes shall conform accurately to the sizes and elevations of the adjoining pipes. Precast sections shall be watertight and conform to the requirements of ASTM C 478 with reinforcement of ASTM A 615, Grade 60 bars and the following modifications there to:
  - 1. The minimum wall thickness shall be 8 inches.
  - 2. Cement to be used in precast manholes and grout shall be ASTM C 150, Type II.
  - 3. The date and name of manufacturer shall be marked inside each precast sections.
  - 4. No more than 2 lift holes may be cast or drilled in each section.
  - 5. Minimum 28-day concrete strength shall be 5,000 psi.

- B. Walls of manholes shall be constructed of reinforced concrete ring sections with a minimum inside diameter of forty-eight (48) inches. Riser sections shall have tongue and groove ends (tongue on top of section). Top sections shall be of eccentric cone or flat slab top design as required by the Drawings. Eccentric cones shall have the same minimum wall thickness and area of circumferential steel reinforcement as the round riser sections. Flat slab tops shall have a minimum thickness of eight (8) inches and shall be reinforced with steel in accordance with the design requirements specified in ASTM C-478. Top sections shall have a top width of such design and dimensions as to properly support the required manhole frame and cover and the lower joint shall be of tongue and groove design.
- C. Top sections of cones or flat tops shall have an opening of thirty (30) inches.

#### 2.03 REINFORCED CONCRETE BASES

- A. Pre-cast reinforced concrete bases shall normally be used in lieu of cast-in-place concrete bases.
- B. The base, for either type, shall extend six (6) inches beyond the outside face of the manhole wall and shall be at least eight (8) inches thick.
- C. Bottom section walls shall be monolithically cast with the base section to a minimum height of three feet (3') from the bottom of the base slab.
- D. Pre-poured flow lines in base are generally not accepted and will be approved only after inspection of a completed example.

#### 2.04 MANHOLE LINER

- A. The interior of all new manholes shall be lined per latest City of Boca Raton Show Drawing Submittal & Approved Utility Product list and shall be installed in strict accordance with manufacturer's instructions. Contractor shall report interior diameter of manholes prior to installation of coating and following installation of coating to confirm minimum thickness requirements has been met. Contractor shall record quantities of lining material applied, including field count and purchase receipt, to confirm installed quantities. All linings shall have a minimum five (5) year labor and materials warranty including all costs necessary and related to the repair or replacement of the defective application.
  - 1. The surface area of all non-cementitious linings/coatings shall be checked for pinholes with a high voltage holiday detector and shall have notations on the liner indicating the date of spark test and person performing the tests. The lining shall be free of any pinholes. A test report for each manhole shall be submitted to the Owner prior to acceptance. The report shall include date of testing, equipment used, manhole location, pass or fail, project name, certified tester's name and number along with tester address and contact information. If failed, what corrective measures were taken.
- B. The Contractor shall submit a shop drawing for type of manhole structure used on the project. The shop drawing shall detail the precast structure and show the concrete protective liner placement on the interior surfaces, across joints, at pipe connections, and at the adjustment area between manhole and casting. Shop drawing submittals shall be in accordance with the requirements of Section 01300 – Submittals.

2.05 MANUFACTURER

- A. Manhole structure and shall be manufactured by U.S. Precast Corporation or approved equal. Manhole liner shall be per City of Boca Raton Shop Drawing Submittals & Approved Utility Product List.

2.06 PRE-CAST CONCRETE GRADE RINGS

- A. Grade rings shall be pre-cast; reinforced concrete in solid rings a minimum of 8" wide from 1" to 4" thick.
- B. Pre-cast concrete (grade) rings shall be manufactured in accordance with ASTM C-478.
- C. Rings shall have dimensions matching inside diameter of cone or flat top sections and be of adequate outside diameter to support full manhole frame.
- D. Field molding of grade rings is prohibited.

2.07 GRADE RING SEALANTS

- A. Grade rings shall be installed using modified polymer sealant/adhesive between each sealing face, Evergrip 990 Series or equal with approved submittal.

2.08 MANHOLE CHIMNEY SEALS

- A. The frame chimney joint area of new manhole shall be sealed with flexible rubber chimney sleeve as specified in Section 02753 - Manhole Rehabilitation.

2.09 GASKETS AND FINISH

- A. Sections shall be joined with a mastic compound set into the annular space cast into the spigot ends of bell and spigot type joints to form a watertight seal. Sealing compound shall be of either bituminous or butyl rubber. Material shall be in strip or rope form, supplied with a two-piece cover to preclude adhesion until use. Approved sealing compounds:
  - 1. Ramnek
  - 2. Lockstop
  - 3. Equal with approved submittals.
- B. Finish for outside of new concrete manhole sections shall be Kop-Coat 300M Coal Tar Epoxy or approved equal.

2.10 PIPE OPENINGS

- A. Adapter couplings are required on all pipe connections to the structure, sized for respective pipe.
- B. Pipe opening shall be fitted with seals cast integrally with manhole section, sized to fit pipe specified, and set at correct elevation and location, or,

- C. Pipe openings shall be pre-cast four inches (4") larger than the pipe with a keyway all around the opening.
- D. Approved pipe seal manufacturers:
  - 1. Dura Tech, Inc. - DUAL SEAL II-III
  - 2. Press Seal Gasket Corporation - PRES SEAL
  - 3. A-Lok Products Corporation - A-Lok MH Pipe Seal
  - 4. Equal with approved submittals

#### 2.11 PIPE-TO-MANHOLE SLEEVE

- A. Sewer pipe shall be connected to new manhole by using a flexible manhole sleeve made from ethylene propylene rubber and conformed to ASTM C-923. The sleeve shall be secured to the pipe by a clamp and grouted.
- B. The sleeve shall be manufactured by Chardon Rubber Company, (440) 285-2161, or approved equal.

### PART 3 – EXECUTION

#### 3.01 PREPARATION

- A. Traffic Control. The Contractor is required to obtain all permits, use appropriate traffic regulating devices, notify all appropriate governmental agencies and conform to all the requirements listed in Section 01570 - Traffic Regulation and Maintenance of Traffic.
- B. Flow Control. Flow control shall be exercised as required to ensure that no flowing sewage comes into contact with sections of the manhole under construction.
  - 1. Plugging and Blocking of Flow. A sewer line plug shall be inserted into the line at a manhole upstream from the section to be inspected. The plug shall be so designed that all or any portion of the sewage flows can be released. During the inspection, testing and replacement portion of the construction, flows shall be shut off or substantially reduced as indicated by the Owner. The upstream manholes shall be constantly monitored for degree of surcharging. After the testing, inspection or repair is complete, flows shall be restored to normal level. See Section 02750 - Wastewater Flow Control for additional information.
  - 2. Pumping and Bypassing of Flow. Wherever lines are blocked off and the possibility of backing up the sewage and causing harm to public and private property is foreseen, it shall be the Contractor's responsibility to bypass flow from manhole to manhole.
  - 3. Bypassing shall be accomplished using sewer plugs with pump connections, by pumping down surcharged manholes, or by other methods acceptable to the Owner. All bypassed flow must be discharged to a sanitary sewer. Bypassed flow shall not be allowed to enter any storm line, drainage ditch or street gutter. See Section 02750 - Wastewater Flow Control for additional information.

4. During a bypass operation, the pump shall be manned continuously. The Contractor shall maintain the pump and bypass equipment and shall be responsible for any damages to public or private property due to the malfunction of same.
5. Sound attenuated pumps as manufactured by Thompson Pumps with "Silent Knight" canopy or approved equal shall be used for all dewatering activities that require a pumping system. Contractor shall demonstrate pumping system at a time of initial set-up including measuring and recording the dB levels. The Contractor shall record the dB levels weekly.

### 3.02 EXCAVATION AND BACKFILL

- A. The Contractor shall excavate, backfill, and compact in accordance with Section 02222, Excavation and Backfill for Utilities. Under no circumstances shall the Contractor be allowed to remove concrete or asphalt without prior cutting. The saw cutting shall be deep enough to produce an even, straight cut. Backfilling shall occur in 12-inch lifts with compaction by an engine driven hand tamp or other mechanical means as acceptable to the Owner.

### 3.03 DEWATERING, SHEETING AND BRACING

- A. The Contractor shall dewater, sheet and/or brace all excavations in accordance with Section 02222 - Excavation and Backfill for Utilities. Well points, pumps, sheeting, bracing and/or sock drain shall be used to provide a safe, dry, open hole for all repairs or replacements specified herein.

### 3.04 NEW MANHOLE CONSTRUCTION

#### A. General:

1. At the locations indicated by the Owner, the Contractor shall excavate and locate the existing piping in order to obtain the relative elevations of existing sanitary sewer pipes with respect to ground surface elevation. Excavation shall be non-disruptive and non-destructive soil extraction as provided by Accurate Locating, Inc. or approved equal. After all measurements have been obtained, the excavated hole shall be backfilled, and surface shall be restored to its original condition. Excavation and measurements shall be witnessed by the Owner. Inside measurement shall be used when replacing existing manholes.
2. The sewer pipe connections shall be cut to 2 to 3 feet outside the existing manhole exterior wall. Proper dewatering sheeting and bracing of the hole is critical; no manhole shall be allowed to be installed in an unsafe or wet hole.

- B. Bedding Requirements: Place manhole on a bed of 12-inch of "Crushed Stone" as defined in Section 02222 - Excavation and Backfill for Utilities and shown in the Drawings. Set manhole base grade so that maximum grade adjustment of 8-inches is required to bring the manhole frame and cover to final grade. The Contractor shall also use this crushed stone for bedding of all the sewer connections. No excavated fill shall be allowed in the hole until all connections are complete and proper bedding requirements have been met.

### C. Bases

#### 1. Cast-in-Place

- a. Base shall be to the design and dimensions indicated on the Drawings.
- b. Set pre-cast wall section into fresh concrete for integral joint.
- c. When using wall sections that contain no integral pipe seals, use length of pipe which extends five (5) feet minimum from outside of base dimension. Place approved waterstop on pipe at center point of wall thickness.
- d. Flow channels shall be formed directly in the concrete of the manhole base and shall be smooth and accurately shaped to a semi-circular bottom conforming to the inside of the adjacent sewer sections. Changes in the direction of the sewer and entering branches shall have a true curve of as large a radius as the size of the manhole will permit. Channels shall be so conformed as to allow the unrestricted entry of television cameras into the sewer line.
- e. Complete concrete placement around pipe openings, working well into waterstop. Finish flush on outside.
- f. All slopes (benches) outside flow channels shall be sloped gradual toward invert.

#### 2. Pre-Cast

- a. Flow channels shall be placed after pipe placement.
- b. Flow channels, same size as pipe, may be constructed directly with the pre-cast base at time of manufacture. Submit manufacturer's product data to Owner for approval before placing order.

### D. Setting Precast Sections

1. Precast reinforced concrete sections shall be set so as to be vertical and with sections in true alignment. A flexible, watertight gasket such as "Ram-Nek" or approved equal shall be used between sections. After the sections are assembled, the remaining space in the joint shall be pointed up and filled with a dense cement mortar and finished so as to make a smooth, continuous surface inside and outside the wall sections.
2. Sewer pipe connections for manholes shall be resilient, waterproof connections designed in accordance with ASTM C 923 "Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes". Resilient pipe connectors shall be installed following casting in a cored or cast opening of the manhole wall. Resilient connectors shall either be a gasket type connector approved equal to the A-Lok pipe to manhole seal as manufactured by Atlantic Concrete Products, Inc. or a flexible neoprene boot with stainless steel clamps approved equal to the Kor-N-Seal System as manufactured by the Dukor Corporation. When the pipe is installed in the resilient manhole connector, the pipe shall be capable of a 20-degree minimum deflection in any direction.
3. All holes in sections, used for their handling, shall be thoroughly plugged with mortar. All seams, keyways, and pipe connections shall be thoroughly plugged with brick and mortar inside and out as needed. The mortar shall be hammered into the holes until it

is dense, and an excess of paste appears on the surface; then finished smooth and flush with the adjoining surfaces.

4. The Invert Elevations that were surveyed by the Contractor prior to manhole construction shall be used to install the inverts in the new manhole. The inverts shall be resurveyed and submitted to the Owner for as-built purposes.

**E. Frames and covers**

1. Install pre-cast concrete grade rings, minimum of 4" and total maximum of 12", set in two (2) strips of modified polymer sealant/adhesive compound on each sealing face.
2. Bricks shall not be used for grade adjustment.
3. Set maintenance access structure frame to proper elevation and to cross-section slope where required. Set in two strips of sealing compound and cover with a bed of Portland cement and silica sand. Set frame in cement bedding and bring mortar up over frame. Recheck elevation due to possible sealant compression.
4. Contractor shall be responsible to see that all such items as mentioned under this Section are adjusted to the new paving elevation to provide a smooth even transition from pavement to maintenance access structure cover.

- F. Finish:** The outside of the precast sections shall be finished in accordance with the following:

<u>Application</u>	<u>Description</u>	<u>DFT</u>
Primary - 1 coat	Kop-Coat 300M Coal Tar Epoxy or equal	6-8
Second - 1 coat	Kop-Coat 300M Coal Tar Epoxy or equal	8-10

- G. Backfill:** The backfill shall be compacted; road subgrade (if in paved area) shall be replaced with acceptable material and compacted as specified in Section 02500 - Surface Restoration. Prior to backfilling, ensure that all concrete cradles and encasements are dry; all spalls, scars, etc. are repaired; and all coatings have been applied.

**3.05 DISPOSAL**

- A.** All excavated material such as pipe sections, concrete, debris or any other items excavated shall become property of the Contractor. The Contractor shall take full responsibility for proper disposal and include the cost in the appropriate bid items.

**3.06 SURFACE RESTORATION**

- A.** All surface restoration shall be in accordance with Section 02500 - Surface Restoration. Pavement, concrete, sod or any other surface items shall be replaced in equal or better condition than prior to repair.

### 3.07 TESTING

- A. After construction or replacement work at each manhole has been completed and the materials used have been allowed to cure, it shall be tested for excess infiltration by the Contractor in the presence of the Owner. The maximum allowable rate of infiltration is 0.0 gallon per hour per vertical foot of depth of the manhole. THERE SHALL BE NO VISIBLE INFILTRATION. All manholes must meet this requirement before acceptance by the Owner.

### 3.08 COVER ADJUSTMENT

- A. Adjustment of existing (old) work requiring raising shall be performed in accordance with Sub-Section 3.04 herein.
- B. Rises in excess of twelve (12) inches shall be made by removing the top section of the manhole and inserting pre-cast sections required to meet the required elevation.
- C. When elevation changes require removal of an existing manhole section(s), the Owner shall be consulted in advance of the work to determine the best method to accomplish the work. The Owner will inspect all work.
- D. Methods and materials for lowering manhole frames shall comply with Sub-Sections 3.04 and 3.08.

### 3.09 CONNECTIONS TO EXISTING MANHOLE

- A. Contractor shall cut an opening (core-bore) in the existing manhole to a size to allow the pipe with a waterstop attached plus one (1) inch clearance on all sides. Cut out existing concrete channel fill, allowing room to form satisfactory new flow channel.
- B. Coupling Adapters (Boots) shall be installed sized for the opening and the pipe diameter.
- C. Place length of pipe to provide joint at five (5) feet minimum from outside of manhole wall or base. Center waterstop in wall, fill opening with waterproof non-shrink grout material and form new flow channel. Second joint shall be five (5) feet ahead/back. Encase to first joint with Type II concrete.

### 3.10 CONNECTIONS TO EXISTING SEWERS

- A. For proposed sewers of a diameter equal to the existing sewer, a new manhole shall be constructed over the existing sewer to the proper invert elevation.
- B. Existing sewer service shall be maintained during base and flow channel work.
- C. When broken or damaged pipe results from this operation, replace with new pipe to meet current standards. Saw any piping to be removed to preclude cracking or irregular edges caused by breaking out with a hammer or using other methods.
- D. When replacing pipe, use pipe length to have a joint at five (5) feet minimum from manhole wall or base. Cradle and doghouse pipe to first joint with Class A concrete.
- E. For proposed sewers of eight (8) inch diameter or less, a direct connection to an existing sewer may be permitted by using a cutting-in saddle or wye. This method would generally apply to single family dwelling units. For industrial, commercial, or multifamily residences,

the Owner may require that a manhole be constructed on the property to be served and over an existing sewer should one exist. All connections to existing sewers are subject to review by the Owner on an individual basis.

- F. Proposed sewers of a diameter larger than the existing sewer to which it is to be connected will not be normally permitted without providing additional capacity to the existing sewer.

### 3.11 DROP MANHOLES

- A. Drop connection shall be made where the invert of any inlet pipe is two (2) feet, or more, higher than the invert out of the manhole.
- B. Pre-cast manhole sections shall have openings with integrally cast pipe seals to fit design elevations for new installations.
- C. When using "doghouse" sections or connecting to existing manholes refer to Sub-Section 3.09 for construction details of pipe through wall section.
- D. Connection configuration to manhole shall be made in accordance with Standard Details.
- E. Entire configuration of piping shall be encased in Type II concrete to a minimum thickness of six (6) inches.

### 3.12 PLANNED PIPE OPENINGS

- A. When future pipe connections have been planned for manholes, they shall be plugged to preclude exfiltration and infiltration.
- B. With integral pipe seals, place a pipe stopper/plug of the size required, properly secured, for any thrust caused by testing, etc.

- END OF SECTION -

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## SECTION 02757

### POINT REPAIR OF SANITARY SEWERS

#### PART 1 -- GENERAL

##### 1.01 SCOPE

- A. The work specified in this Section includes repairs to sections or segments (up to 15 feet) of existing sanitary sewers, mains or service lines, which require excavation from the surface to accurately locate sources of infiltration or inflow and to eliminate them by making necessary repairs.

##### 1.02 GENERAL

- A. Reference is made to Division 15 – “Mechanical”. Methods, procedures and requirements are similar when sections of existing pipe have been crushed, cracked, or settled, or have holes in them and are to be replaced with new pipe. Generally, point repairs are made at specific locations and involve relatively short lengths of sewer or fittings (up to 15 feet) which are to be repaired or replaced. "Isolation" of affected reaches of sewer by plugging and/or bypass pumping, if required, shall be performed as specified in Section 02750 - Wastewater Flow Control.
- B. Locations where point repairs are to be made will be made available to the Contractor through Work Orders and will be based on previously performed smoke tests and television surveys. It is understood that the exact location of pipe leaks and failures cannot always be determined before the pipe is exposed because the smoke injected into the existing pipe to detect their presence can migrate through passages in the earth, and overburden, and may not emerge directly over the leak or failure.
- C. It is also understood that the smoke testing and closed-circuit television surveys performed by others prior to the commencement of this project cannot always determine the precise cause of leakage or failure. The pipe shall be exposed, and the source located, examined and evaluated before repairs are made. Additional smoke shall be introduced into the pipe by the Contractor to aid in the final evaluation and determination of required work if necessary to locate the area to be repaired.
- D. After the designated repairs have been made, the Contractor will test them as described in this Section of these Specifications. The costs of testing will be borne by the Contractor. If a repaired joint or section should prove to be defective, the Contractor shall re-perform the work at no additional cost to the Owner and shall also be responsible for the costs of any retesting required by the Owner.
- E. Where work is to be performed on private property, the Contractor shall consult with the Owner who will make arrangements and schedules with the property owners before the Contractor performs the work.
- F. Excavation, backfill, exploratory excavation, sheeting and shoring, dewatering, conflicts with other utilities, and miscellaneous work shall conform to the requirements of Section 02222 - Excavation and Backfill for Utilities.

### 1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01300 - Submittals.

### 1.04 QUALIFICATIONS

- A. The Qualifications of the Contractor shall be submitted prior to contract award. These Qualifications shall include detailed descriptions of the following:
  1. Name, business address and telephone number of the Contractor.
  2. Name(s) of all supervisory personnel to be directly involved with this project.
  3. The Contractor shall sign and date the information provided and certify that to the extent of his knowledge, the information is true and accurate, and that the supervisory personnel will be directly involved with and used on this project. Substitutions of personnel and/or methods will not be allowed without written authorization of the Owner.
  4. The Contractor shall provide his references of previous project lists going back five years including his customers' names, addresses, and telephone numbers.
  5. To be qualified, the Contractor shall have a minimum of five years' previous experience in the work required in this section.

## PART 2 -- PRODUCTS

### 2.01 MATERIALS

- A. Pipe materials are specified in Division 15 - "Mechanical".

## PART 3 -- EXECUTION

### 3.01 PROCEDURES

- A. The point repair procedures shall be as follows:
  1. Site preparation shall be performed as described in Division 2. When the repairs are to be made on sewers or facilities lying under paved surfaces, those surfaces shall be removed to the limits specified for point repairs of the particular size pipe involved (trench width plus two feet for concrete surfaces) unless otherwise acceptable to the Owner.
  2. The Contractor shall excavate and backfill in accordance with Section 02222 - Excavation and Backfill for Utilities. Under no circumstances shall the Contractor be allowed to remove concrete or asphalt without prior cutting. The saw cutting shall be deep enough to produce an even, straight cut.
  3. Dewater, sheet and or brace all excavations in accordance with Section 02222 - Excavation and Backfill for Utilities. Well points, pumps, sheeting, bracing and/or sock drain shall be used to provide a safe, dry, open hole for all repairs or replacements specified herein.

4. Excavate down to the pipe, completely exposing the pipe up to the next undamaged section of pipe on each side.
5. Locate the leak to be repaired.
6. After the leak or failure is located and exposed, the Owner will identify the method of rehabilitation. One or a combination of the following methods shall be used:
  - a. Remove and replace section(s) of pipe or fitting. Remove section(s) of defective pipe or fitting by cutting on each side along lines perpendicular to longitudinal axis of pipe so as to leave "spigot ends" to be connected to replacement pipe. Cut or fabricate replacement section. Make connections using stainless steel shear rings as manufactured by Fernco or approved equal. Bedding or embedment shall be placed and compacted. Reconnect to service line if required. As a minimum, a total of six (6) feet of piping shall be replaced by the Contractor.

In the case of point repairs performed on service laterals, the Contractor shall:

- i. Determine the exact location of the repair by means of television inspection with an electronic locating device (sonde).
  - ii. If roots are encountered inside the lateral being repaired, a minimum of 15 feet of lateral shall be replaced.
  - iii. If the pipe being replaced reaches the private property line, a cleanout shall be installed at that location in both back yard and front yard easements.
- b. Cement-stabilized sand shall be used to supplement the embedment or backfill when accepted by the Owner. This shall consist of two sacks of cement per cubic yard of sand thoroughly mixed. Only a sufficient amount of water shall be added to assure setting-up of the cement. These mixes shall be made before placing in the trench and only enough shall be prepared to allow placing, shaping and tamping before an initial set has taken place. Cement-stabilized sand shall be used for repairs in FDOT paved right of ways.
7. The adequacy of point repairs in sewer mains shall be demonstrated by the Contractor by testing. For service lines, visual review and acceptance by the Owner will be deemed sufficient. Testing of mains may be accomplished by one of two alternate methods, depending on the depth of the line and the difference in elevation of the pipe at the ends of the reach. Smoke testing shall be used if the pipe slope exceeds one percent. Testing shall be performed while dewatering is continued and before backfilling.
  - a. **Smoke-Testing.** The reach of sewer in which the repair (or repairs) has been made shall be isolated by plugging the upstream and downstream manholes as necessary not only to temporarily eliminate the flow of sewage through it but also to prohibit the smoke from entering other reaches of sewer. Smoke shall then be introduced into one of the manholes and into the reach using smoke bombs and a blower especially designed or adapted for smoke testing sanitary sewers and acceptable to the Owner. The repaired area shall then be observed for the emergence of smoke for a period of 15 minutes. If none can be seen, the repair will be deemed to have passed the test.

- b. **Exfiltration-Testing:** This method may be used only on sewers laid on grades less than 1.00 percent. Water, colored with a bright-colored dye acceptable for usage in testing, is introduced into the pipe so as to impose a 2-foot static head over the top of the pipe at the point of repair when the pipe in the lower manhole is plugged. Observations shall then be made by the Owner to determine if leakage of the colored water occurs at the repair point. Care shall be taken, when this method is used, that:
  - i. Not more than 4-feet of static head are induced on the main at the lower end of the reach, and
  - ii. No back-up problems are caused in service lines.
- 8. Complete placement and compaction of backfill.
- 9. Restore surface features to at least as good condition as existed before construction began, including roadways, driveways and walks.

### 3.02 TELEVISION SURVEY

- A. Television survey, including Preconstruction Survey and Post Construction Survey as indicated in Section 02752 - Television Survey, is required for all point repairs of sanitary sewers.

- END OF SECTION -

SECTION 02759

REPLACEMENT OF SANITARY SERVICE LATERAL AND CLEANOUT

PART 1 – GENERAL

1.01 SCOPE

- A. This Section consists of removing existing sewer service pipe between mainline and the property line, and furnishing, installing, testing and placing in operation new sewer service piping, complete in its place, with fittings, and other appurtenances required for a complete installation.

1.02 GENERAL INFORMATION AND DESCRIPTION

- A. The pipe and fittings covered by these specifications shall be furnished by fully qualified manufacturers experienced in the fabrication, casting and manufacture of the pipe materials specified herein. The pipe and fittings shall be designed, fabricated and installed in accordance with the best practice of the trade and the standards specified herein.
- B. Portions or reaches of existing sanitary sewer service lines shall be replaced as specified in this Section. The Owner may authorize additional pipe be removed and replaced as construction proceeds and defective sections of pipe are discovered by direct visual observation.
- C. Replacement pipe to the property line including cleanout as per Owner's minimum standards shall be the same size and shall be laid between the mainline pipe and the existing service pipe which shall remain in place acceptable to the Owner unless decided otherwise by the Owner. It is the Contractor's complete responsibility to set controls as necessary to attain true line and grade for the replacement pipe.
- D. When replacing sewer service lines from adjacent buildings or residences to the run of a collector main, the Contractor shall set a time schedule for the period of service interruption in writing and obtain acceptance of it from the Owner. The Contractor shall then notify the appropriate tenants at least 24 hours in advance of the pending interruption and inform them of its time frame. Temporary pumping or other measures will be required if the period of interruption of service occurs before 8:00 a.m. or after 5:00 p.m. The importance of avoiding extended periods of public inconvenience cannot be overemphasized.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01300 - Submittals.

PART 2 -- PRODUCTS

2.01 GENERAL

- A. Pipe materials are specified in Division 15 - Mechanical.

## PART 3 -- EXECUTION

### 3.01 GENERAL

- A. The Contractor shall furnish all labor, tools, materials, and equipment necessary for installation and jointing of the pipe. All piping shall be installed in accordance with the Contract Documents in a neat workmanlike manner and shall be set for accurate line and elevation. All piping shall be thoroughly cleaned before installation, and care shall be taken to keep the piping clean throughout the installation.

### 3.02 PREPARATION

- A. Traffic Control. The Contractor is required to obtain all permits, use appropriate traffic regulating devices, notify all appropriate governmental agencies and conform to all the requirements specified in Section 01570 - Traffic Regulations and Maintenance of Traffic.
- B. Flow Control. Flow control shall be exercised as required to ensure that no flowing sewage comes into contact with sections of the sewer under repair or replacement.
  - 1. Plugging and Blocking of Flow. A sewer line plug shall be inserted into the main-line when service pipe is disconnected. The plug shall be so designed that all or any portion of the sewage flows cannot be released. During the survey, testing and replacement portion of the construction, flows shall be shut off or substantially reduced as acceptable to the Owner. After the testing, survey or repair is complete, service shall be restored to normal level. See Section 02750 - Wastewater Flow Control for additional information.
  - 2. Pumping and Bypassing of Flow. Wherever lines are blocked off and the possibility of backing up the sewage and causing harm to public and private property is foreseen, it shall be the Contractor's responsibility to bypass flow from the disconnected lateral to a down-stream manhole.
  - 3. Bypassing shall be accomplished using sewer plugs with pump connections or by other methods acceptable to the Owner. All bypassed flow must be discharged to a sanitary sewer. Bypassed flow shall not be allowed to enter any storm line, drainage ditch or street gutter. See Section 02750 - Wastewater Flow Control for additional information.
  - 4. During a bypass operation, the pump shall be manned continuously. The Contractor shall maintain the pump and bypass equipment and shall be responsible for any damages to public or private property due to the malfunction of same.

### 3.03 EXCAVATION AND BACKFILL

- A. The Contractor shall excavate and backfill in accordance with Section 02222 - Excavation and Backfill for Utilities. Under no circumstances shall the Contractor be allowed to remove concrete or asphalt without prior cutting. The saw cutting shall be deep enough to produce an even, straight cut.

### 3.04 DEWATERING, SHEETING AND BRACING

- A. The Contractor shall dewater, sheet and or brace all excavations in accordance with Section 02222 - Excavation and Backfill for Utilities. Well points, pumps, sheeting, bracing and/or

sock drain shall be used to provide a safe, dry, open hole for all repairs or replacements specified herein.

### 3.05 SHIPPING, HANDLING AND STORAGE

- A. Special care in handling shall be exercised during delivery, distribution and storage of pipe to avoid damage and setting up stresses. Damaged pipe will be rejected and shall be replaced at no additional cost to the Owner. Pipe and fittings stored prior to use shall be stored in such a manner as to keep the interior free from dirt and foreign matter.
- B. No pipe shall be dropped from cars or trucks to the ground. All pipe shall be carefully lowered to the ground by mechanical means. In shipping, pipe and fittings shall be blocked in such manner as to prevent damage to castings or lining. Any broken or chipped lining shall be carefully patched. Where it is impossible to repair broken or damaged lining in pipe because of its size, the pipe shall be rejected as unfit for use.

### 3.06 REMOVAL AND REPLACEMENT OF SEWER LATERAL PIPE AND CLEANOUT

- A. Lateral sewers shall be installed in accordance with all the applicable requirements for pipe installation. Branch fittings shall be installed in the main line sewer as it is constructed, in the locations and configuration of the original laterals or as designated by the Owner.
- B. The existing laterals shall be hand excavated to a joint, saw cut, clean and square and the appropriate adapter installed to connect the replacement laterals. Care shall be taken to maintain the slopes of the existing laterals. The laterals shall be removed and replaced from the main line to the private property line, or to a point along the existing lateral as determined by the Owner to be in acceptable condition.
- C. The Contractor shall not excavate trenches for laterals on both sides of the street at the same time unless written permission has been secured in advance to close the street.
- D. Placement of bedding / cover materials in the trench shall be the same for laterals as provided in Section 02222 - Excavation and Backfill for Utilities.
- E. After the limits of a particular portion of the existing sewer, which is to be removed and replaced, have been established on the ground, operations shall progress generally as follows:
  - 1. Carefully remove or protect surface features in work area. Excavate to completely expose the existing pipe, taking adequate precautions not to disturb any other existing underground facilities and handling excavated materials as described in other Sections of the Specifications.
  - 2. That section or reach of pipe to be replaced shall be isolated by plugging and/or by-pass pumping as described in other Sections of these Specifications, or by any other method proposed by the Contractor and acceptable by the Owner.
  - 3. Remove and dispose of the existing pipe and concrete encasement, if any. This shall be phased and coordinated with its replacement so as to minimize public inconvenience.

4. The trench bottom shall be overexcavated a minimum of 8-inches and new embedment material to go beneath the pipe placed and shaped so as to form uniform support for the pipe barrel.
5. Pipe shall be installed in accordance with the manufacturer's recommendations and to the grade and slope as its existing conditions. Pipe shall be installed and jointed, normally beginning at its low or outlet end and proceeding upstream, with the bell ends facing upstream toward the direction of flow. Replace cleanout. Make connections to new sewer main and cleanouts, and to existing pipe remaining in place. Complete embedment or encasement and place compacted backfill as necessary to avoid flotation if water should enter the trench.
6. Perform leakage test. When this has been successfully completed and acceptable to the Owner, remove temporary plugs and reconnect wyes or tees to service lines.
7. Complete placement and compaction of backfill.
8. Restore surface features to at least as good condition as existed before construction began, including roadways, driveways and walks.

### 3.07 PIPE-TO-PIPE CONNECTIONS

- A. Pipe-to-pipe connections shall be made by using stainless steel shear rings as manufactured by Fernco or approved equal.

### 3.08 TELEVISION SURVEY

- A. Television survey, including Preconstruction Survey and Post Construction Survey, as indicated in Section 02760 - Service Lateral Television Survey, is required for all replacement of sanitary sewer lateral pipe.

- END OF SECTION -

## SECTION 02760

### SERVICE LATERAL TELEVISION SURVEY

#### PART 1 – GENERAL

##### 1.01 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.

##### 1.02 GENERAL

- A. After cleaning as specified in Section 02751 – Preparatory Cleaning and Root Removal (including special cleaning involving the mechanical removal of roots, grease, and/or tuberculation where authorized), and before and after repair/replacement work, the lateral shall be visually surveyed by means of closed-circuit television in the presence of the Owner. The survey shall be performed one lateral at a time.
- B. Pre- and post-construction survey video on CD-ROM shall be delivered to the Owner on CD-ROM, accompanied with the corresponding work orders, and pre- and post-TV logs, for sewer laterals 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. The recording of multiple laterals on a single CD is acceptable.
- C. The television equipment operator shall be certified under the NASSCO (National Association of Sewer Survey Companies) PACP (Pipe Line Assessment and Certification Program).

##### 1.03 EQUIPMENT

- A. All equipment, accessories, materials, and labor to perform this service shall be furnished by the Contractor. The television camera used for the lateral survey shall be one specifically designed and constructed for such survey. A Sonde locating device shall be attached to the camera. 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 Owner; and if unsatisfactory, equipment shall be removed and replaced with adequate equipment at no additional cost to the Owner. The lateral camera shall have a pan-and-tilt capability.
- 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, "inspection" 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. The camera system shall be able to inspect 3-, 4-, and 6-inch lateral connections.
- E. The video camera shall include a titler feature capable of showing on the tape the following information:
  - 0. Work Order Number
  - 1. City and State
  - 2. Date/Time
  - 3. Contractor's Name
  - 4. Pipe Size (Diameter) and Material
  - 5. Upstream Manhole Number & Distance to Lateral
  - 6. On-going Footage Counter
- F. A Sonde shall be provided for locating unmarked sewer laterals. A sonde is a transmitter tied on a line and moved through a sewer or duct. A receiver on the surface follows its movement, documenting the line location. The pipe position is then marked on the ground. The sonde is pushed farther into the pipe, the receiver relocates the sonde, and the pipe position is marked again. This process is repeated until the desired section of pipe is traced. It is pulled out on completion of the locate. The sonde will be inserted into the lateral through a sewer cleanout or, in case of no cleanout, through a roof vent to locate the cleanout as well as unmarked sewer lateral. The sonde may also be attached to the lateral television camera.

#### 1.04 SUBMITTALS

- A. The Contractor shall submit shop drawings and other information in accordance with Section 01300 - 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.

#### 1.05 QUALIFICATIONS

- A. The Qualifications of the Contractor shall be submitted prior to contract award. These Qualifications shall include detailed descriptions of the following:
  - 0. Name, business address and telephone number of the Contractor.
  - 1. Name(s) of all supervisory personnel to be directly involved with this project.

2. The Contractor shall sign and date the information provided and certify that to the extent of his knowledge, the information is true and accurate, and that the supervisory personnel will be directly involved with and used on this project. Substitutions of personnel and/or methods will not be allowed without written authorization of the Owner.
3. Specialty technicians shall be certified by the equipment manufacturer and/or its authorized representative. Certifications shall be submitted to the Owner.
4. The Contractor shall provide his references of previous project lists going back five years including his customers' names, addresses, and telephone numbers.
5. To be qualified, the Contractor shall have a minimum of five years previous experience in the work required in this section.

## PART 2 -- PRODUCTS

- A. All inspection information and data (including video) written to digital media (DVD).

## PART 3 -- EXECUTION

### 3.01 PRECONSTRUCTION SURVEY

#### A. Procedure

1. Prior to any repair work, 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 recording.
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. If the Contractor chooses to perform the inspection from the cleanout and the cleanout is either inaccessible or does not exist, he shall install a cleanout to facilitate the inspection. All costs of material, equipment, labor, and other costs due to unspecified field conditions shall be borne by the Contractor. Payment for cleanout installation shall be made by the Owner as indicated in Section 01025, Measurement and Payment.
5. Above ground horizontal location of lateral shall be marked every five (5) feet utilizing surveyor's paint on an asphalt or concrete surface and surveyor's flags in grass. Approximate depth of laterals at these locations shall be recorded on the TV logs.

## B. Field 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 and electrically stored 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. In addition, other points of significance such as unusual conditions, roots, broken pipe, presence of scale and corrosion, and other discernible features will be recorded, and a copy of such records will be supplied to the Owner. 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. Digital photographs of the television picture of problems shall be taken by the Contractor upon request of the Owner.
3. Video Recordings. The purpose of video (DVD) 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 DVD becomes the property of the Owner. The Contractor shall have all CD-ROM and necessary playback equipment readily accessible for review by the Owner during the Project.
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 Work Order No. \_\_\_\_\_ (provided by the Owner), City of Boca Raton". 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.

## 3.02 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 the camera at all point repairs and inspect entire repaired pipe sections.
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 so that the fit of the liner to the host pipe can be evaluated.
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.

3.03 LOCATION OF LATERAL FROM RESIDENCE

A. Procedure

1. Run a sonde through a roof vent to locate cleanout as well as unmarked sewer lateral. A sonde is a transmitter tied on a line and moved through a sewer or duct. A receiver on the surface follows its movements, documenting the line location. The pipe position is then marked on the ground. The sonde is pushed farther into the pipe, the receiver relocates the sonde and the pipe position is marked again. This process is repeated until the desired section of pipe is traced. It is pulled out on completion of the locate.

B. Documentation

1. Above ground horizontal location of lateral shall be marked every five (5) feet utilizing surveyor's paint on an asphalt or concrete surface and surveyor's flags in grass. Approximate depth of laterals at these locations shall be recorded on the TV logs. Location of buried cleanouts, or location for the purposes of installing a new cleanout shall be marked by two measured distances to permanent recoverable objects. Contractor shall furnish a schematic of these locations with sufficient detail to be able to relocate from above ground, at a later date.

- END OF SECTION -

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SECTION 02763  
CHEMICAL GROUTING

PART 1 -- GENERAL

1.01 SCOPE

- A. The work specified in this Section includes all labor, materials, accessories, equipment and tools necessary for chemical grouting, sealing, and air testing sanitary sewer pipe joints, pursuant to ASTM F2304-03.

1.02 GENERAL

A. Root Removal

1. When so directed by the Owner, prior to performing chemical grouting, the Contractor shall remove roots and clean the sewer in accordance with Section 02751 - Preparatory Cleaning and Root Removal.

B. Leak Testing

1. Sewer line joint testing shall be accomplished by applying air pressure to each sewer joint, and monitoring the pressure in the void over a one-minute period. The intent of joint testing is to identify defective joints prior to the joint sealing process and check the effectiveness of the seal.
2. Testing cannot be performed and shall not be required on cracked, structurally unsound, or broken pipe, severely corroded or out-of-round pipe, or on visibly leaking joints.
3. Testing shall be required following sealing but is to be performed prior to sealing only if specifically authorized by the Owner.

C. Leak Sealing

1. Sources, or possible sources, of infiltration within the sewer system, are to be sealed to eliminate infiltration.
2. The application of the sealing grout within the pipe shall be by means of remote-controlled equipment designed to be positioned at the specific joint or crack to be sealed and to apply the grout under sufficient pressure for the grout to pass through the opening and fill voids outside the pipe as well as the opening in the pipe wall. Control of the device and review of the results shall be by operating the closed-circuit television camera and vehicle-mounted monitor conforming to the requirements of Section 02752 - Television Survey. The method of sealing used shall not damage the pipe or change pipe alignment, and the original cross sectional area shall not be permanently reduced or changed.

1.03 QUALIFICATIONS

- A. The Qualifications of the Grouting Contractor shall be submitted prior to contract award.

These Qualifications shall include detailed descriptions of the following:

1. Name, business address and telephone number of the Contractor.
2. Name(s) of all supervisory personnel to be directly involved with Grouting for this project.
3. The Contractor shall sign and date the information provided and certify that to the extent of his knowledge, the information is true and accurate, and that the supervisory personnel will be directly involved with and used on this project. Substitutions of personnel and/or methods will not be allowed without written authorization of the Owner.
4. Specialty technicians shall be certified by the equipment manufacturer and/or its authorized representative. Certifications shall be submitted to the Owner.
5. The Contractor shall provide his references of previous project lists going back three years including his customers' names, addresses, and telephone numbers.
6. To be qualified, the Contractor shall have a minimum of three years previous experience in grouting.

## PART 2 -- PRODUCTS

### 2.01 CHEMICAL JOINT SEALING MATERIALS

- A. Chemical joint sealing materials used on this project shall be AV-118 Duriflex, or AV-100 plus activators, initiators and inhibitors recommended by the manufacturer, Avanti International, Houston, Texas or an approved equal.
- B. In those lines which had root removal performed, a chemical root inhibitor shall be added to the grout prior to sealing the joints. Contractor shall submit the chemical to be used for Owner's approval prior to utilization.

## PART 3 -- EXECUTION

### 3.01 LEAK TESTING EQUIPMENT

- A. The basic equipment used shall consist of a television camera, joint testing device such as a packer, and test monitoring equipment. In combination, the equipment shall be constructed in such a way as to provide means for introducing a test medium under pressure, into the void area created by the expanding ends of the joint testing device. The testing equipment shall also have the means for regulating the flow rate of the test medium into the void area in conjunction with the means for continuously measuring the actual static pressure of the test medium at and within the void area only. The packer device shall be constructed in such a manner as to allow some flow to pass through its center annulus.
- B. Void pressure data shall be transmitted electrically and without the use of the test medium or hoses. All test monitoring shall be above ground, and in a location to allow for simultaneous continued observation of the television monitor and test monitoring equipment by the Contractor. The Owner shall witness the testing operation.

### 3.02 CONTROL TEST PROCEDURES

- A. Prior to and during the joint testing phases of the work, the Contractor shall perform Control, Intermediate, and Final testing in accordance with the latest edition of ASTM F2304.

### 3.03 JOINT TESTING PROCEDURE

- A. Sewer line joints shall be individually tested at a test pressure equal to  $\frac{1}{2}$  psi per vertical foot of pipe depth, but in no case exceeding a pressure of 10 psi and in accordance with the following procedures:

1. The packer or testing device shall be positioned within the line in such a manner as to straddle the joint to be tested.
2. The packer ends or testing device ends shall be expanded so as to isolate the joint from the remainder of the line and create a void area between the packer or testing device and the pipe joint. The ends of the testing device shall be expanded against the pipe with sufficient inflation pressure to contain the test medium within the void without leakage past the expanded end.
3. The test medium shall be introduced into the void area until a pressure or flow rate equal or greater than the required test pressure is observed with the void pressure monitoring equipment.

- a. **Air Test** – After the void pressure is observed to be equal to or greater than the required test pressure, the airflow shall be stopped and the air test supply line vented. The operator will observe this void pressure for a period of 15 s, if the pressure is maintained, with a pressure drop of less than 1 psi (7 kPa), then the joint will be considered as having passed the test. If the pressure shows additional decay during the recommended time period, it will be considered as having failed and shall be sealed as described herein. Upon completion of the sealing, the joint will be retested at the established test criteria (post-test).

- b. **Water Test** – A liquid (water) shall be introduced into the void area until a pressure equal to or greater than the required test pressure is observed with the void pressure monitoring equipment. If the required test pressure cannot be developed (due to joint leakage), the joint will have failed the test and shall be sealed as specified. The flow rate of the test liquid shall then be regulated to a rate at which the void pressure is observed to be the required test pressure for a period of 30 seconds. A reading of the test liquid flow meter shall then be taken. If the flow rate exceeds  $\frac{1}{4}$  gallon per minute (due to joint leakage), the joint will have failed the test and shall be sealed as specified.

4. The test medium shall be air or liquid.

### 3.04 TEST RECORDS

- A. During the joint testing procedure, complete records shall be kept, to include the following data:

1. Identification of the manhole section tested.

2. Type of pipe.
  3. Diameter of pipe.
  4. Length of pipe sections between joints.
  5. Depth of pipe to surface.
  6. Test pressure used and duration of test.
  7. Statement indicating the pass/fail test results for each joint tested, Location (stationing) of each joint tested and location of any joints not tested with an explanation for not testing.
- B. In the case of a "passing" joint, a single pressure reading may be recorded. In the case of a "failing" joint requiring grout, three pressures shall be recorded: the initial "failing" pressure, the zero pressure after grout has been injected and the packer deflated, and the final pressure after the grout has been injected and the packer reinflated.

### 3.05 JOINT SEALING EQUIPMENT

- A. The basic equipment shall consist of a closed circuit television system, necessary chemical sealant containers, pumps, regulators, valves, hoses, etc., and joint sealing packers for the various sizes of sewer pipe. The packer shall be a cylindrical case of a size less than pipe size, with the cables at either end used to pull it through the line. The packer device shall be constructed in such a manner as to allow a restricted amount of sewage to flow at all times. Generally, the equipment shall be capable of performing the specified operations in lines where flows do not exceed the maximum line flows as specified in Section 02750 - Wastewater Flow Control. When the packer is inflated, two widely spaced annular bladders shall be formed, each having an elongated shape and producing an annular void around the center portion of the packer.
- B. Before starting the work, a performance test demonstration verifying the accuracy and repeatability of the void pressure meter and fluid pumping equipment should be performed. If these test demonstrations fail to show that the readings are accurate,  $\pm 0.5$  psi (3 kPa) for void pressure repeatability, and  $\pm 0.1$  gallons (0.4 L) of chemical pumped into a measured container, the Contractor shall be required to make the required repair or adjustments to the equipment and gages and retest until the results are satisfactory to the Owner's representative. The test demonstration may be required at each work shift during the sealing operation.

### 3.06 JOINT SEALING PROCEDURE

- A. In the preparation and application of the sealing grout, the recommendations of the manufacturer of the grout materials shall be followed. Before joint sealing, chemical grout gel times should be measured and recorded. Gel times should also be measured and recorded whenever a new batch is made and at the end of the shift. These gel time measurements are a very effective and meaningful quality assurance procedure.
- B. Joint sealing shall be accomplished by forcing chemical sealing materials into or through infiltration points by a system of pumps, hoses, and sealing packers. Jetting or driving pipes from the surface that could damage or cause undermining of the pipe lines, will not be allowed. Excavating the pipe, which would disrupt traffic, undermine adjacent utilities

and structures, will not be allowed. The packer shall be positioned over the area of infiltration by means of a metering device and the closed circuit television in the line. It is important that the procedure used by the Contractor for positioning the packer be accurate to avoid over-pulling the packer and thus not effectively sealing the point of infiltration. The packer sleeves shall then be expanded using precisely controlled pressures. The pneumatically expanded sleeve or elements shall seal against the inside periphery of the pipe to form a void area at the point of infiltration, now completely isolated from the remainder of the pipe line. Into this isolated area, sealant materials shall be pumped through the hose system at controlled pressures, which are in excess of groundwater pressures. The pumping, metering, and packer device shall be integrated so that the proportions and quantities of materials can be regulated in accordance with the type and size of the leak being sealed.

- C. The grout must be injected beyond the joint interface into the soil surrounding the pipe joint.
- D. A color additive (dye) should be added to the grout so that a visual residual layer of grout rings the joint providing confirmation the packer was located over the joint and the void was filled during the sealing operation.
- E. No joint shall be considered sealed unless, while under continual pressure, an attempt is made to pump grout to "refusal" (up to ½ gallon per inch diameter pipe size). This is to insure that sufficient chemical has been dispersed into the soil surrounding the joint and that a temporary seal has not been made by applying a minimum amount of chemical grout to the void and the joint area inside the pipe. When chemical grout cannot be pumped to "refusal" within a volume less than or equal to ½-gal per inch diameter pipe size due to latent physical conditions, no additional work shall be undertaken until authorization to proceed has been given by the Owner.
- F. Upon completing the sealing of each individual joint, the packer shall be deflated; moved at least one packer length in either direction, and then repositioned over the joint; with the void pressure meter reading zero pressure, then reinflated and tested as specified in subsection 3.03 - Joint Testing Procedure. Should the void pressure meter not read zero, the Contractor shall clean his equipment of residual grout material or make the necessary equipment repairs to provide for an accurate void pressure reading. Joints that fail to meet the specified test criteria shall be resealed and retested until the test criteria can be met in order to receive payment.
- G. All testing shall be performed by the Contractor in the presence of the Owner. It shall be the responsibility of the Contractor to completely seal every leak authorized for sealing to the extent determined by the Owner. If, in the Owner's opinion, it is not necessary to continue with a particular leak, the crew shall move to the next joint or leak. The Contractor shall remove any small excess sealing grout inside the sewer line. Contractor shall operate his equipment with care and shall be responsible for any damage to the sewer system or other facilities caused by his operations and shall repair such damage at his expense and without delay as instructed by the Owner.

### 3.07 JOINT SEALING RECORDS

- A. Included in the records for joint sealing shall be:

1. The test pressure before (where specifically requested) and after sealing and the duration of the test.
2. The volume of grout material used to seal each joint.
3. The volume of grout placed per section.
4. The gel set time used.
5. The barrel test results.
6. The grouting material used including additives and their respective quantities.

### 3.08 LATERAL SEALING PROCEDURE

- A. The following shall apply to the sealing of all reinstated laterals after the main has been lined.
  1. The total batch shall be no more than 50 gallons. That means reducing the water in each tank by 5 gallons. This will increase the strength of the "gel" by increasing the solids to 12 percent.
  2. The "gel" time shall be 10 seconds longer than the time required by the pumps to fill the inside packer void and at no time shall the "gel" time be less than 20 seconds.

### 3.09 TELEVISION SURVEY

- A. Television survey, consisting of a continuous video that shows both pre- and post-grouting conditions and operations, is required for all grouted lines.

### 3.10 WARRANTY

- A. All chemical grouting work described herein shall be guaranteed against faulty workmanship and/or materials for a period of 2 years after the completion of the work.

- END OF SECTION -

SECTION 02764

CURED-IN-PLACE SECTIONAL PIPE LINING

PART 1 – GENERAL

1.01 SCOPE

- A. The work specified in this section consists of rehabilitating existing sanitary sewer pipe by installing a resin impregnated fiberglass/polyester felt tube into an existing pipe to restore its structural and hydraulic integrity.

1.02 GENERAL

- A. The finished sectional pipe liner in place shall be fabricated from materials which, when installed, will be chemically resistant to withstand internal exposure to domestic sewage.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings and other information to the Owner for review in accordance with Owner standards. Included shall be design calculations for the work.

PART 2 -- PRODUCTS

2.01 GENERAL

- A. The finished liner shall be fabricated from material as specified in this section which when cured will be chemically resistant to the corrosive effects of the raw sewage and hydrogen sulfide. The cured-in-place sectional pipe liner shall meet specification contained in ASTM F2599 or ASTM F261.
- B. Sectional liner ends shall be sealed to prevent infiltration using hydrophilic molded and seamless gaskets providing a uniform seal around the pipe end in accordance with ASTM F2599 or ASTM F2561.

2.02 LINER SIZING

- A. The liner shall be fabricated to a size that when installed will neatly fit the internal circumference of the conduit to be repaired as specified by the Owner.
- B. The length and number of liners shall be that deemed necessary by the Owner to effectively carry out the repairs. The Contractor shall verify the lengths in the field before cutting liner to length. In general, the minimum length shall be 6 feet for 8- to 12-inch diameter pipe, and cover a minimum of 6 inches on either side of the pipe joint.
- C. For 15- to 21-inch diameter pipe, a longer sectional liner may be required.

2.03 LINER MATERIAL

- A. The lining material shall be a fiberglass matting material and fully impregnated with an epoxy resin as specified.
- B. The mixed components of the epoxy resin shall have the following properties:

Item	Criteria
1. Solids Content	100% by weight
2. Pot Life	90 minutes at 70 degrees F
3. Shelf Life	at least 1 year (sealed)
4. Viscosity	18,000 cps (average at 70 degrees F)
5. Density	12 pounds per gallon (max.)

- C. The cured epoxy resin material shall have the following properties:

<u>Item</u>	<u>Test Value</u>	<u>Reference Standard</u>
Flexural Strength	5,000 psi	ASTM D 790
Flexural Modulus	400,000 psi	ASTM D 790

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## 2.04 LINER DESIGN

- A. The minimum required structural CIPP wall thickness shall be based on the physical properties described above and in accordance with the design equations in the appendix of ASTM F 1216, and the following design parameters:

Design Safety Factor	2.0
Retention Factor for Long-Term Flexural Modulus to be used in Design	50 %
Ovality*	2 %
Groundwater Depth = Pipe Depth (above invert)*	ft.
Soil Depth (above crown)*	ft.
Soil Modulus	700 psi
Soil Density	120 pcf
Live Load	One H20 passing truck
Design Condition	Fully deteriorated

\* Denotes information which can be provided here or in inspection video tapes or project construction plans. Multiple line segments may require a table of values.

- B. The lining manufacturer shall submit to the Owner for review complete design calculations for the liner, signed and sealed by a Professional Engineer registered in the State of Florida and certified by the manufacturer as to the compliance of his materials to the values used in the calculations. A safety factor of 2 shall be applied in the design calculation. The host pipe shall be considered fully deteriorated if unlined, and partially deteriorated if lined. The liner shall be designed to withstand a live load equivalent to one H-20 passing truck plus all pertinent dead loads, hydrostatic pressure and grout pressure (if any). For design purposes, the water table shall be considered at grade elevation. The liner shall be designed in accordance with ASTM F 1216. The buckling analysis shall account for the combination of dead load, live load, hydrostatic pressure and grout pressure (if any). The liner side support shall be considered as if provided by soil pressure against the liner. The existing pipe shall not be considered as providing any structural support. Modulus of soil reaction shall be 700, corresponding to a moderate degree of compaction of bedding and a fine-grained soil as shown in AWWA Manual M45, Fiberglass Pipe Design.
- C. Liner shall be neither accepted nor installed until design calculations are acceptable to the Owner.

## PART 3 -- EXECUTION

### 3.01 CLEANING SEWER LINES

- A. Prior to any lining of a pipe so designated, it shall be the responsibility of the Contractor to remove internal deposits from the pipeline in accordance with Section 02751 - Preparatory Cleaning and Root Removal.

### 3.02 TELEVISION SURVEY

- A. Television survey shall be performed in accordance with Section 02752 - Television Survey, including Preconstruction and Post Construction Surveys.
- B. The interior of the pipeline shall be carefully surveyed to determine the locations and extent of any structural failures. The location of any conditions which may prevent proper installation of lining materials into the pipelines shall be noted so that these conditions can be corrected. A video tape and suitable log shall be kept and turned over to the Owner.

### 3.03 FLOW BYPASSING

- A. The Contractor, when required, shall provide for the transfer of flow, through or around a section or sections of pipe that are to be repaired. The proposed bypassing system shall be acceptable in advance by the Owner. The acceptance of the bypassing system in advance by the Owner shall in no way relieve the Contractor of his responsibility and/or public liability. The flow bypassing shall be done in accordance with Section 02750 - Wastewater Flow Control.

Note: If the repair can be made in a few hours, bypass pumping may not be required. The placement carriage shall be equipped with a bypass section to allow flow once liner is pressed into place.

### 3.04 LINE OBSTRUCTIONS

- A. It shall be the responsibility of the Contractor to clear the line of obstruction. If survey reveals an obstruction that cannot be removed by conventional cleaning equipment, the Contractor shall make a point repair excavation in accordance with Section 02757 - Point Repair of Sanitary Sewers, to uncover and remove or repair the obstruction. Such excavation shall be accepted in writing by the Owner prior to the commencement of the work.

### 3.05 LINER INSTALLATION

- A. Prior to liner installation, all active severe leaks which may affect the success of liner installation shall be stopped using chemical grout. The Contractor shall impregnate the liner with the 100 percent solids epoxy. Drop cloths, tarpaulins, and etc. shall be used to prevent epoxy material from contacting the adjacent ground. Place the liner on the placement carriage and maneuver carriage and liner into position with the use of a video camera. Force the liner against the inside wall of the damaged host pipe allowing epoxy resin to permeate into any cracks in the host pipe. Allow lines to cure in accordance with the manufacturer's recommendations. Heat may be introduced to speed up curing time. Retract the placement carriage and remove from pipe.
- B. After the sectional liner has been cured in place, the Contractor shall reconnect the service connections. Cutting of the liner pipe shall be done from the interior of the pipeline using a robotic cutter. Where holes are cut through the liner, they shall be neat and smooth in order to prevent blockage at the service connections. Cut-in service connections shall be opened to a minimum of 95 percent of the flow capacity of the building sewer. Cuts shall be wire-brushed to remove jagged edges. All coupons shall be recovered at the downstream manhole and removed. All reinstated service lateral connections (between

the liner and the existing pipe) shall be grouted. The reinstatement of the service connections shall be a separate pay item.

3.06 ACCEPTANCE

- A. The finished liner shall be continuous over the entire length of the installation. The liner shall be free from visual defects, damage, deflection, holes, delamination, uncured resin, and the like. There shall be no visible infiltration through the liner or from behind the liner.

3.07 CLEANUP

- A. After the liner installation has been completed and accepted, the Contractor shall clean up the entire project area and return the ground cover to grade. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.

3.08 WARRANTY

- A. The liner shall be certified by the manufacturer for specified material properties for a particular job. The manufacturer warrants the liner to be free from defects in raw materials for two years from the date of acceptance. During the warranty period, any defects which affect the integrity or strength of the liner shall be repaired at the Contractor's expense in a manner mutually agreed by the Owner and the Contractor.

- END OF SECTION

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SECTION 02765

CURED-IN-PLACE PIPE LINING

PART 1 -- GENERAL

1.01 SCOPE

- A. It is the intent of this specification to provide for the reconstruction of pipelines and conduits by the installation of a resin-impregnated flexible tube which is formed to the original conduit and cured to produce a continuous and tight fitting Cured-In-Place Pipe (CIPP).
- B. The work specified in this Section includes all labor, materials, accessories, equipment and tools necessary to install and test CIPP lining in main lines.

1.02 GENERAL

- A. This specification references ASTM F1216 (Rehabilitation of pipelines by the inversion and curing of a resin-impregnated tube), ASTM F1743 (Rehabilitation of pipelines by pulled-in-place installation of a cured-in-place thermosetting resin pipe), and ASTM D790 (Test methods for flexural properties of unreinforced plastics) which 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.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings and other information to the Owner for review in accordance with Owner standards and Section 01300, "Submittals".
- B. With the bid, the following submittals are required.
  - 1. Documentation as outlined herein under the section titled, PRODUCT AND INSTALLER ACCEPTABILITY, including installation references of projects that are similar in size and scope to this project. The submittal shall include, at a minimum, the client contact name, phone number, and the diameter and footage of pipe rehabilitated. Documentation for product and installation experience must be satisfactory to the Owner.
- C. After contract award, the following submittals are required.
  - 1. Detailed design calculations as specified herein under the section titled, MATERIALS FOR MAIN LINES.
  - 2. Various test results as specified herein under the section titled, TESTING REQUIREMENTS.
  - 3. Documentation as specified herein under the sections titled WET-OUT AND CURE REPORT and TELEVISION SURVEY.

#### 1.04 PRODUCT AND INSTALLER ACCEPTABILITY

- A. Since sewer products are intended to have a 50 year design life, and in order to minimize the Owner's risk, only proven products and installers with substantial successful long term track records will be approved.
- B. Products and installers seeking approval must document an ability to meet all of the following criteria to be deemed commercially acceptable:
  - 1. For a product to be considered commercially proven, a minimum of 1,000,000 linear feet or 4,000 manhole-to-manhole line sections of successful wastewater collection system installations in the U.S. must be documented to the satisfaction of the Owner to assure commercial viability. In addition, at least 250,000 linear feet of the product shall have been in successful service within the State of Florida for a minimum of five years.
  - 2. For an installer to be considered as commercially proven, the installer must satisfy all insurance, financial, and bonding requirements of the Owner, and must have had at least 5 (five) years active experience in the commercial installation of the product. For sewer mains, the installer as a firm must have successfully installed at least 250,000 feet of the product in wastewater collection systems in Florida. Acceptable documentation of these minimum installations must be submitted to the Owner.
  - 3. The Contractor must be approved by the product manufacturer to install the proposed lining materials.
  - 4. The Contractor's superintendent must demonstrate at least 3 years of experience in this geographic area with the systems being bid or the Contractor shall provide the services of an authorized manufacturer's representative for the duration of the project.
  - 5. Sewer rehabilitation products submitted for approval must provide third party test results supporting the long-term performance, structural strength, and chemical resistance of the product and such data shall be satisfactory to the Owner. Test samples shall be prepared so as to simulate installation methods and trauma of the product. No product will be approved without independent third party testing verification.

#### PART 2 -- PRODUCTS

##### 2.01 MATERIALS FOR MAIN LINES

- A. The sewn tube shall consist of one or more layers of absorbent non-woven felt fabric and meet the requirements of ASTM F1216 or ASTM F1743, Section 5. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge breaks and missing sections of the existing pipe, and stretch to fit irregular pipe sections. The new jointless pipe-within-a-pipe must fit tightly against the old pipe wall and consolidate all disconnected sections into a single continuous conduit.
- B. The wetout tube shall have a uniform thickness that when compressed at installation pressures will meet or exceed the Design thickness.

- C. The tube shall be sewn to a size that when installed will tightly fit the internal circumference and length of the original pipe with minimal shrinkage, in such a way as to minimize water migration (tracking) between the liner and the host pipe. Allowance should be made for circumferential stretching during inversion, and longitudinal stretching during pull in. Overlapped layers of felt in longitudinal seams that cause lumps in the final product shall not be utilized.
- D. The minimum tube length shall be that deemed necessary by the Contractor to effectively span the distance between the access points and to facilitate a good, "non-tracking" seal. The Contractor shall verify the lengths in the field before cutting liner to length and otherwise preparing it for installation.
- E. The outside layer of the tube (before wetout) shall be coated with an impermeable, flexible membrane that will contain the resin and facilitate monitoring of resin saturation during the resin impregnation (wetout) procedure.
- F. The tube shall be homogeneous across the entire wall thickness containing no intermediate or encapsulated elastomeric layers. No material shall be included in the tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be evident.
- G. 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.
- H. Seams in the tube shall be stronger than the unseamed felt.
- I. The outside of the tube shall be marked for distance at regular intervals along its entire length, not to exceed 5 ft. Such markings shall include the Manufacturers name or identifying symbol. The tubes must be manufactured in the USA.
- J. The resin system shall be a corrosion resistant polyester, vinyl ester, or epoxy and catalyst system that when properly cured within the tube composite meets the requirements of ASTM F1216 and ASTM F1743, the physical properties herein, and those which are to be utilized in the Design of the CIPP for this project. The resin shall produce CIPP which will comply with the structural and chemical resistance requirements of this specification.
- K. The finished pipe in place shall be fabricated from materials which when cured will be chemically resistant to withstand internal exposure to domestic sewage. Resin shall be in contact with the original mainline and the impermeable membrane shall be on the interior to be exposed to the wastewater flow. All constituent materials will be suitable for service in the environment intended. The final product will not deteriorate, corrode or lose structural strength that will reduce the projected product life. In industrial areas a liner system using epoxy vinyl ester resin shall be utilized and a polyester resin may be used in non-industrial areas. The Owner shall determine the type of appropriate resin to be utilized for each line segment.
- L. The CIPP shall be designed as per ASTM F1216, Appendix X1. The CIPP design shall assume no bonding to the original pipe wall. The structural performance of the finished pipe must be adequate to accommodate all anticipated loads throughout its design life.

- M. The CIPP must have a minimum design life of fifty (50) years. The minimum design life may be documented by submitting life estimates by national and/or international authorities or specifying agencies. Otherwise, long-term testing and long-term in-service results (minimum ten (10) years) may be used, with the results extrapolated to fifty (50) years.
- N. The Contractor must have performed long-term testing for flexural creep of the CIPP pipe material installed by his 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. A percentage of the instantaneous flexural modulus value (as measured by ASTM D-790 testing) will be used in design calculations for external buckling. The percentage, or the long-term creep retention value utilized, will be verified by this testing. Values in excess of 50% will not be applied unless substantiated by qualified third party test data. The materials utilized for the contracted 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 design.
- O. The minimum required structural CIPP wall thickness shall be based on the physical and structural properties described herein and in accordance with the design equations in the appendix of ASTM F 1216, and the following design parameters:

Design Safety Factor	2.0
Retention Factor for Long-Term Flexural Modulus to be used in Design (as determined by Long-Term tests described in paragraph 2.02.B)	50 %
Ovality*	2 %
Water Table = Grade Elevation	ft.
Soil Depth (above crown)*	ft.
Soil Modulus	700 psi
Soil Density	120 pcf
Live Load	One H <sub>2</sub> O passing truck
Design Condition	Fully deteriorated

\*Denotes information which can be provided here or in inspection video tapes or project construction plans. Multiple line segments may require a table of values.

- P. The lining manufacturer shall submit to the Owner for review complete design calculations for the liner, signed and sealed by a Professional Engineer registered in the State of Florida and certified by the manufacturer as to the compliance of his materials to the values used in the calculations. The buckling analysis shall account for the combination of dead load, live load, hydrostatic pressure and grout pressure (if any). The liner side support shall be considered as if provided by soil pressure against the liner. The existing pipe shall not be considered as providing any structural support. Modulus of soil reaction shall be 700, corresponding to a moderate degree of compaction of bedding and a fine-grained soil as shown in AWWA Manual M45, Fiberglass Pipe Design.

- Q. As part of the design calculation submittal, the lining manufacturer shall submit descriptions of sampling, preparation, curing, and testing procedures; liner repair methods and materials; and a typical schedule for "wetout" of the liner together with a typical insertion and curing schedule.
- R. As part of the design calculation submittal, the lining manufacturer shall submit a tabulation of time versus temperature. This tabulation shall show the lengths of time that exposed portions of the liner will endure without self-initiated cure or other deterioration beginning. This tabulation shall be at five degree Fahrenheit increments ranging from 70 degrees F to 100 degrees F. The manufacturer shall also submit his analysis of the progressive effects of such "pre-cure" on the insertion and cured properties of the liner. This information shall be submitted in a timely fashion prior to the preconstruction conference so that the Owner may set procedures for dealing with such an instance caused by construction delays.
- S. 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 separation of the layers occurs during testing of field samples, new samples will be cut from the work. Any reoccurrence may cause rejection of the work.
- T. 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.
- U. Liner shall be neither accepted nor installed until design calculations are acceptable to the Owner. Liner shall be as manufactured by Insituform Technologies, Inc., or approved equal.

2.02 STRUCTURAL REQUIREMENTS FOR MAIN LINES

- A. Since the pipe strength is related to the uniformity and density of the pipe wall, only resin vacuum impregnation will be allowed. Resin impregnation without vacuum entraps air and creates voids which weaken the pipe wall. If reinforcing materials (fiberglass, etc.) are used, the reinforcing material must be fully encapsulated within the resin to assure that the reinforcement is not exposed, either to the inside of the pipe or at the interface of the CIPP and the existing pipe.
- B. The design for the CIPP wall thickness will be based on the following strengths, unless otherwise submitted to and approved by the Owner. Strengths in excess of these values will require documentation consisting of test results for recent installations in which 100 percent of samples tested exceeded the values claimed (minimum 3 projects with minimum 5 samples per project).

<u>Property</u>	<u>Test Method</u>	<u>Cured Composite per ASTM F1216</u>
Flexural Modulus of Elasticity	ASTM D-790	250,000 psi
Flexural Stress	ASTM D-790	4,500 psi

## 2.03 TESTING REQUIREMENTS

- A. **Chemical Resistance** - The CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. 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.
- B. **Hydraulic Capacity** - Overall, the hydraulic profile shall be maintained as large as possible. The CIPP shall provide at least 100 percent of the flow capacity of the original pipe before rehabilitation. In lieu of actual measurements, calculated capacities may be derived using commonly accepted equations and values of the Manning flow coefficients (designated "n" coefficients). The original pipe material and condition at the time of reconstruction will determine the Manning coefficient used in the host pipe.
- C. **CIPP Field Samples** - When requested by the Owner, the Contractor shall submit test results from field installations in the USA of the same resin system and tube materials as proposed for the actual installation. These test results must verify that the CIPP physical properties specified herein have been achieved in previous field applications.
- D. **Prior to any liner installation**, the Contractor shall submit technical data sheets showing the physical and chemical properties and infrared spectrum analysis per ASTM E1252 (chemical fingerprint) of the proposed resin system as modified for the cured-in-place process. Additionally, copies of the certificates of analysis for resin used on the project must be made available to the Owner upon request. The Contractor shall test each lot of resin used by conducting infrared spectrum analyses on field samples. These analyses shall be conducted at the Contractor's expense.
- E. **The Contractor shall provide resin samples as directed by the Owner during the duration of the project** and infrared spectrography chemical fingerprints shall be run and compared to the submitted fingerprint to verify the resin used is the resin submitted for use on this project. These analyses shall be conducted at the Owner's expense.
- F. **In the case of liner installation performed under this contract**, CIPP samples shall be prepared and physical properties tested in accordance with ASTM F1216 or ASTM F1743, Section 8, using either method proposed.
  - 1. The Contractor shall submit a method to the Owner, for approval, to obtain representative samples from the installed liners. These samples will be tested by the Owner, at the Owner's expense, to verify compliance with the installed material specifications. The Contractor shall produce these test samples when so directed by the Owner. The Owner reserves the right to request samples from as many as 10 percent of the liners installed, unless a pattern of failure occurs. In this case, the Contractor will be requested to provide a greater quantity of samples, up to 25 percent, at no additional cost, and the Contractor shall bear all costs of this additional testing. Liners which do not pass these material tests will be accepted at reduced payment or rejected pursuant to Section 01025.
  - 2. The cost for sample collection shall be included in the bid price for rehabilitation.
  - 3. Test specimens shall be marked in indelible ink with the appropriate lateral or main section, work order number, date of installation, and orientation to the top of the pipe

(direction of up) so the results can be correlated to the field work performed. All test results shall use this designated labeling as a reference.

4. The extraction and labeling of test specimens shall be done in the presence of the Owner. The Owner and Contractor shall, upon completion of sample extraction and labeling, both sign a chain-of-custody form that shall subsequently accompany the sample at all times and shall ultimately be received and signed at the testing laboratory. Test reports shall include a copy of the chain-of-custody form with all signatures to ensure that reported test results are for the correct sample.
  5. The flexural properties must meet or exceed the values specified herein.
  6. Wall thickness of samples shall be determined as described in paragraph 8.1.6 of ASTM F1743.
  7. Visual inspection of the CIPP shall be by closed-circuit television.
- G. When directed in advance by the Owner for specific installations, the Contractor shall implement more extensive monitoring of temperatures inside the liner to verify proper curing.
1. Temperature sensors shall be placed between the host pipe and the liner in the bottom of the host pipe (invert) throughout the reach to record the heating and cooling that takes place on the outside of the liner during processing. The sensors shall be spaced apart at intervals no greater than 20-feet for pipe sizes up to 15-inches in diameter, and no greater than 10-feet for pipe sizes 18-inches and larger. Additionally, sensors shall be strategically placed at points where a significant heat sink is likely to be anticipated. The monitoring of these sensors shall be by a computer which can record the temperatures at this interface throughout the processing of the cured-in-place liner utilizing a tamper-proof database. The proposed temperature sensor monitoring system and related software shall be as manufactured by ZIA Systems ([www.ziasystems.com](http://www.ziasystems.com)) or approved equal.
  2. Prior to installing the liner in the host pipe, the temperature monitoring system's proper functioning shall be confirmed by hooking it up to the computer and seeing that the sensors are reporting their ambient temperatures. No more than two sensors in sequence can be found faulty during this test. If three or more sensors in sequence are discovered faulty, a new sensor array shall be pulled into the host pipe replacing the previously installed array, and the new array shall be again tested for its proper functioning.
  3. Curing of the resin system shall be in accordance with the directions and established procedures of the cured-in-place product manufacturer with respect to the temperatures achieved and the duration of holding the liner at those temperatures. If any sensor or sensors along the reach indicates that there is a localized issue with respect to achieving proper curing per the written installation procedure, the Contractor shall address the issue immediately using previously established protocols for such an event.
  4. The sensor array's database shall have an output report that identifies each sensor by its station in the reach and shows the maximum temperature achieved during the processing of the cured-in-place liner and the time sustained at or above the Manufacturer's required curing temperature at each sensor. The Contractor shall

deliver to the Owner a certified copy of the curing report output from the temperature monitoring system used in the control of the curing process or shall provide the Owner with access to the website where the secure report can be obtained.

### PART 3 -- EXECUTION

#### 3.01 CLEANING/SURFACE PREPARATION

- A. It shall be the responsibility of the Contractor to clean the pipeline with a high-pressure water jet and to remove all internal debris out of the pipeline in accordance with Section 02751, "Cleaning and Root Removal".

#### 3.02 SEWER REPAIRS

- A. Any protruding pieces of concrete, dropped joints, or broken pipe shall be subjected to point repairs so that the pipe is left in a clean smooth condition in all respects ready for lining, unless otherwise jointly determined by the Contractor and the Owner that the defect will not compromise the integrity of the liner.
- B. If conditions such as broken pipe and major blockages are found that will prevent proper cleaning, or where additional damage would result if cleaning is attempted or continued, the Contractor shall advise the Owner so that point repair(s) may be authorized prior to completion of cleaning.

#### 3.03 JOINT, CRACK, ANNULAR SPACE, AND LINER END CHEMICAL SEALING

- A. Prior to cured-in-place liner installation, all active leaks of a magnitude to compromise the integrity of the liner shall be stopped using chemical grout, at no additional cost to the Owner.
- B. Materials used on this Project shall have the following properties: react quickly to form a permanent watertight seal; resultant seal shall be flexible and immune to the effects of wet/dry cycles; non-biodegradable and immune to the effects of acids, alkalis, and organics in sewage; component packaging and mixing compatible with field conditions and worker safety; excess sealant left inside pipe shall be readily removable; and, be compatible with the CIPP liner resin system utilized. The chemical sealing materials shall be acrylic resin type and shall be furnished with activators, initiators, inhibitors and any other materials recommended by the manufacturer for a complete grout system. Sealing grout shall be furnished in liquid form in standard manufacturer's containers. Sealing grout shall be AV-100 manufactured by Avanti International, or approved equal.
- C. The Contractor shall modify his equipment as necessary to seal the leaks, however both his equipment and sealing method must meet the approval of the Owner prior to use. Extreme caution shall be utilized during leak sealing (pressure) operations in order to avoid damaging already weakened sewer pipes. If any damage occurs, it shall be repaired at the Contractor's cost and to the satisfaction of the Owner. Excessive pumping of grout which might plug a service lateral shall be avoided. Any service laterals blocked by the grouting operation shall be cleared immediately by the Contractor.

### 3.04 FLOW CONTROL

- A. Flow control shall be exercised as required to ensure that no flowing sewage comes into contact with sections of the sewer under repair. See Section 02750, "Wastewater Flow Control" for additional information.

### 3.05 LINER INSTALLATION FOR MAIN LINES

- A. The pre-lining video of the prepared pipe shall be reviewed and be acceptable to the Owner for cleanliness and smoothness before the Contractor begins to line the pipe.
- B. The Contractor shall present to the Owner, for review, a description of his methods for avoiding liner stoppage due to conflict and friction with such points as the manhole entrance and the bend into the pipe entrance. He shall also present plans for dealing with a liner stopped by snagging within the pipe. This information shall be rendered to the Owner in a timely fashion prior to the preconstruction conference.
- C. The Contractor shall immediately notify the Owner of any construction delays taking place during the insertion operation. Such delays shall possibly require sampling and testing by an independent laboratory of portions of the cured liner at the Owner's discretion. The cost of such test shall be borne by the Contractor and no extra compensation will be allowed. Any failure of sample tests or a lack of immediate notification of delay shall be automatic cause for rejection of that part of the work at the Owner's discretion.
- D. The Contractor shall designate a location where the tube will be impregnated with resin prior to installation. The Contractor shall allow the Owner to inspect the materials and the "wet-out" procedure.
- E. The Contractor shall submit construction schedules for advance approval by the Owner. At no time will any service lateral remain inoperative for more than an 8-hour period. Any service that will be out of service for more than 8 hours will be temporarily by-passed into a mainline sanitary sewer, at the Contractor's expense.
- F. The materials and processes must be reasonably available for pre-installation, installation and post-installation inspections. Areas which require inspection include, but are not limited to, the following:
  - 1. Product materials should exhibit sufficient transparency to visually verify the quality of resin impregnation.
  - 2. Temperature sensing devices, such as thermocouples, shall be located between the existing pipe and the CIPP to ensure the quality of the cure of the wall laminate.
- G. After the inversion is complete, the Contractor shall supply a suitable heat source and water recirculation equipment to circulate heated water throughout the pipeline. The equipment shall be capable of delivering hot water throughout the pipeline to uniformly raise the water temperature to a level required to effectively cure the resin. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supply. Another such gage shall be placed between the tube and the host pipe at the termination end at or near the bottom to determine the temperatures during cure. Water temperature in the pipe during the cure period shall be as recommended by the resin manufacturer.

- H. Initial cure shall be deemed complete when the exposed portions of the tube appear to be hard and sound and the temperature sensor indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of a duration recommended by the resin manufacturer and may require continuous recirculation of the water to maintain the temperature. The Contractor shall have on hand at all times, for use by his personnel and the Owner, a digital thermometer or other means of accurately and quickly checking the temperature of exposed portions of the liner.
- I. CIPP installation shall be in accordance with ASTM F1216, Section 7, or ASTM F1743, Section 6, with modifications as listed herein.
- J. Resin Impregnation: The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. A vacuum impregnation process shall be used. To insure thorough resin saturation throughout the length of the felt tube, the point of vacuum shall be no further than 25 feet from the point of initial resin introduction. After vacuum in the tube is established, a vacuum point shall be no further than 75 feet from the leading edge of the resin. The leading edge of the resin slug shall be as near to perpendicular as possible. A roller system shall be used to uniformly distribute the resin throughout the tube. If the Installer uses an alternate method of resin impregnation, the method must produce the same results. Any alternate resin impregnation method must be proven.
- K. Tube Insertion: The wetout tube shall be positioned in the pipeline using either inversion or a pull-in method. If pulled into place, a power winch should be utilized and care should be exercised not to damage the tube as a result of pull-in friction. The tube should be pulled-in or inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point.
- L. Temperature gauges shall be placed inside the tube at the invert level of each end to monitor the temperatures during the cure cycle.
- M. Curing shall be accomplished by utilizing hot water under hydrostatic pressure in accordance with the manufacturer's recommended cure schedule.
- N. Cooldown: The Contractor shall cool the hardened pipe to a temperature below 100 F before relieving the hydrostatic head. Cooldown may be accomplished by the introduction of cool water into the inversion standpipe to replace water being pumped out of the manhole. Care should be taken in release of static head so that vacuum will not be developed that could damage the newly installed liner.
- O. Finish: The new pipe shall be cut off in the manhole at a suitable location. The finished product shall be continuous over the length of pipe reconstructed and be free from dry spots, delamination and lifts. A watertight seal shall be made at the inside manhole wall using extra polyester fiber felt and epoxy resin, or another method if approved by the Owner. Pipe entries and exists shall be smooth, free of irregularities, and watertight. No visible leaks shall be present, and the Contractor shall be responsible for grouting to remove leaks or fill voids between the host pipe and the liner. During the warranty period, any defects which will affect the integrity or strength of the product shall be repaired at the Contractor's expense, in a manner mutually agreed upon by the Owner and the Contractor.

### 3.06 REINSTATEMENT OF SERVICE LATERALS, BRANCH CONNECTIONS, AND DROP MANHOLE CONNECTIONS

- A. After the pipe has been cured in place, the Contractor shall reconnect the existing service connections. This shall be done from the interior of the pipeline without excavation using a robotic cutter. Where holes are cut through the liner, they shall be neat and smooth in order to prevent blockage at the service connections. Cut-in service connections shall be opened to a minimum of 95 percent of the flow capacity of the building sewer. Cuts shall be wire-brushed to remove jagged edges. All coupons shall be recovered at the downstream manhole and removed. The Contractor shall stop all visible leaks, including at service connections as required. All reinstated service lateral connections (between the liner and the existing pipe) shall be grouted. The reinstatement of the service connections shall be a separate pay item.
- B. It is the intent of these specifications that service laterals be reopened without excavation, utilizing a remote controlled cutting device, monitored by a video TV camera. The Contractor shall certify he has a minimum of 2 complete working cutters plus spare key components on the site before each liner installation. 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.
- C. Unless otherwise directed by the Owner, all laterals will be reinstated. The Owner will provide specific direction concerning any laterals that will be abandoned and will therefore not require reinstatement. The Contractor shall abandon a lateral by not reinstating the lateral only with the written consent of the Owner.
- D. The language in this section applies equally to branch connections and drop manhole connections.

### 3.07 ACCEPTANCE

- A. The finished liner shall be continuous over the entire length of the installation. The liner shall be free from visual defects, damage, deflection, holes, delamination, uncured resin, and the like. No pinholes, cracks, thin spots, dry spots, or other defects in the liner will be permitted. There shall be no visible infiltration through the liner or from behind the liner at manholes and service connections. Cut-ins and attachments at service connections shall be neat and smooth.
- B. Ridges or wrinkles in the installed liner shall be accepted or rejected at the sole discretion of the Owner. If, in the opinion of the Owner, such defects could cause structural weakening of the liner, impede the progress of a camera during internal television inspection, or encourage solids deposition and potential interruptions to flow, such defects shall be corrected at the Contractor's expense in a manner acceptable to the Owner.

### 3.8 WET-OUT AND CURE REPORT

- A. The Contractor shall submit "wetout" and "cure" reports documenting the specific details of the liner's vacuum impregnation and saturation with resin and the CIPP installation of the liner. A copy of all "wetout" and "cure" records shall be made available to the Owner upon request and shall be turned over to the Owner on a weekly basis and prior to request for payment. If the "wetout" and "cure" reports are not presented prior to a payment request for a repair work order, payment for the work will not be made and the request will

be rejected. At a minimum, this report shall include, in addition to Contractor and Work Order identification:

1. Line identification and location
2. Wet-out date
3. Sample identification(s) and technician
4. Installation (in sewer) date
5. Host sewer pipe inside diameter
6. Liner thickness
7. Liner length
8. Liner and resin batch numbers
9. Resin type
10. Wet out length
11. Quantity of resin and catalyst utilized
12. Wet out technicians
13. Time wet out started and completed
14. Applicable remarks
15. Boiler and liner heating fluid pressure and temperature versus time log during cure period
16. Cool down report

### 3.9 CLEANUP

- A. After the liner installation has been completed and accepted, the Contractor shall cleanup the entire project area and return the ground cover to the original or better condition. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.

### 3.10 TELEVISION SURVEY

- A. Television survey, including Preconstruction Survey and Post Construction Survey, as indicated in Section 02752 "Television Survey", is required for all cured-in-place lining, and shall be completed within 2 weeks of liner installation.

### 3.11 PUBLIC NOTIFICATION

- A. The Contractor shall make every effort to maintain service usage throughout the duration of the project. In the event that a service connection will be out of service, the maximum amount of time of no service shall be 8 hours for any property served by the sewer. 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. Whether or not an interruption in service is expected, written notice to be delivered to each home or business the day prior to the beginning of work being conducted on the section, and a local telephone number of the Contractor the home or business can call to discuss the project or any problems which could arise.
2. Personal contact with any home or business which cannot be reconnected within the time stated in the written notice.

### 3.12 WARRANTY

- A. The Contractor shall warrant all work and materials installed for two years from the date of final acceptance. The date of final acceptance shall be the date that final payment is made to the Contractor. During the warranty period, any defects which 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.

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## SECTION 02770

### CURED-IN-PLACE MAINLINE/LATERAL CONNECTION REPAIR SYSTEM

#### PART 1 – GENERAL

##### 1.01 SCOPE

- A. The work specified in this section consists of providing for the reconstruction of a particular mainline section and the adjacent lateral sewer pipe without excavation while providing a structural one piece leak free connection at the interface of the mainline and lateral pipelines.

##### 1.02 GENERAL

- A. The reconstruction will be accomplished using a non-woven fabric tube of particular length and a thermoset resin with physical and chemical properties appropriate for the application. The lateral tube within a translucent inversion bladder is vacuum impregnated with the resin then placed inside a protective carrying device. The mainline liner that is physically attached to the lateral tube is affixed around a rigid launching device. The launching device and protective carrying device are conveyed into the existing sewer. When the launching device is properly positioned at the lateral connection, the mainline liner is inflated and the resin saturated tube is inverted up through the lateral pipe, using air or water pressure, by the action of the inversion bladder. Once the tube/resin composite is cured, the inversion bladder and launching/carrying devices are removed. The cured-in-place mainline/lateral connection repair system shall be "T-Liner" as manufactured by LMK Technologies, Incorporated. "Substitutes" and "Or-Equals", as defined in the *Standard General Conditions of the Construction Contract* (Engineers Joint Contract Documents Committee, 2002), will be considered for approval at the Owner's sole discretion.

##### 1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings, samples of materials, and other information to the Owner for review in accordance with Owner standards. Included shall be design calculations for the work.

##### 1.04 QUALIFICATIONS

- A. The Qualifications of the Contractor shall be submitted prior to contract award. These Qualifications shall include detailed descriptions of the following:
  1. Name, business address and telephone number of the Contractor.
  2. Name(s) of all supervisory personnel to be directly involved with this project.
  3. The Contractor shall sign and date the information provided and certify that to the extent of his knowledge, the information is true and accurate, and that the supervisory personnel will be directly involved with and used on this project.

Substitutions of personnel and/or methods will not be allowed without written authorization of the Owner.

4. Specialty technicians shall be certified by the equipment manufacturer and/or its authorized representative. Certifications shall be submitted to the Owner.
5. The Contractor shall provide his references of previous project lists going back two years including his customers' names, addresses, and telephone numbers.
6. To be acceptable, a minimum of 400 T-Liner installations must be documented.
7. To be acceptable, the installer must have had a minimum of two (2) years active experience in the commercial installation of the product.

## PART 2 -- PRODUCTS

### 2.01 GENERAL

- A. The finished liner shall be fabricated from material as specified in this section which when cured will be resistant to the corrosive effects of the raw sewage and hydrogen sulfide.

### 2.02 LINER SIZING

- A. The liner shall be fabricated to a size that when installed will neatly fit the internal circumference of the conduit to be repaired as specified by the Owner.

### 2.03 LINER MATERIAL

- A. The liner shall be one piece and will consist of a lateral portion and the mainline portion with one or more layers of flexible needled felt or an equivalent non-woven material. The liner will be continuous in length and the wall thickness shall be uniform. No overlapping sections shall be allowed in the circumference or the length of the lateral liner. The tube will be capable of conforming to offset joints, bells, and disfigured pipe sections. The mainline liner will be flat with one end overlapping the second end and sized accordingly to create a circular lining equal to the diameter of the mainline pipe. The resin will be polyester or vinyl ester with proper catalysts as designed for the specific application. The cured-in-place pipe shall provide a smooth bore interior. Each installation shall have a design report documenting the design criteria for a deteriorated pipe section, relative to the hydrostatic pressures, depth of soil cover, and type of soil. The mainline sectional liner shall be a full-circle, minimum 16-inch long CIPP liner integrally manufactured to the lateral liner providing a seamless connection between the mainline pipe liner and the lateral liner. Installation will be accomplished remotely using air or water for inversion and curing. The cured pipe repair system shall be watertight and shall conform to the existing pipe and eliminate any leakage or connection to the outside of the host pipe/service.
- B. The composite of the materials above will, upon installation inside the host pipe, exceed the minimum test standards specified by the American Society for Testing Methods.

<u>Item</u>	<u>Test Value</u>	<u>Reference Standard</u>
Flexural Strength	4,500 psi	ASTM D 790
Flexural Modulus	250,000 psi	ASTM D 790

#### 2.04 LINER DESIGN

- A. The minimum required structural CIPP wall thickness shall be based on the physical properties described above and in accordance with the design equations in the appendix of ASTM F 1216, and the following design parameters:

Design Safety Factor	2.0
Retention Factor for Long-Term Flexural Modulus to be used in Design	50 %
Ovality*	2 %
Groundwater Depth = Pipe Depth (above invert)*	ft.
Soil Depth (above crown)*	ft.
Soil Modulus	700 psi
Soil Density	120 pcf
Live Load	One H20 passing truck
Design Condition (lateral pipe)	Fully deteriorated
Design Condition (lined main pipe)	Partially deteriorated
Design Condition (unlined main pipe)	Fully deteriorated

*\*Denotes information which can be provided here or in inspection video tapes or project construction plans. Multiple line segments may require a table of values.*

- B. The lining manufacturer shall submit to the Owner for review complete design calculations for the liner, signed and sealed by a Professional Engineer registered in the State of Florida and certified by the manufacturer as to the compliance of his materials to the values used in the calculations. A safety factor of 2 shall be applied in the design calculation. The lateral host pipe shall be considered fully deteriorated and the main host pipe shall be considered fully or partially deteriorated based on whether it is unlined or lined, respectively. The liner shall be designed to withstand a live load equivalent to one H-20 passing truck plus all pertinent dead loads, hydrostatic pressure and grout pressure (if any). For design purposes, the water table shall be considered at grade elevation. The liner shall be designed in accordance with ASTM F 1216. The buckling analysis shall account for the combination of dead load, live load, hydrostatic pressure and grout pressure (if any). The liner side support shall be considered as if provided by soil pressure against the liner. The existing pipe shall not be considered as providing any structural support. Modulus of soil reaction shall be 700, corresponding to a moderate degree of compaction of bedding and a fine-grained soil as shown in AWWA Manual M45, Fiberglass Pipe Design.

- C. Liner shall be neither accepted nor installed until design calculations are acceptable to the Owner.

### PART 3 – EXECUTION

#### 3.01 CLEANING SEWER LINES

- A. Prior to any lining of a pipe so designated, it shall be the responsibility of the Contractor to remove internal deposits from the pipeline in accordance with Section 02751 - Preparatory Cleaning and Root Removal. Both mainline and lateral line shall be cleaned.

#### 3.02 TELEVISION SURVEY

- A. Television survey shall be performed in accordance with Section 02752 - Television Survey, including Pre-Construction and Post-Construction Surveys. Both main line and lateral line shall be televised.
- B. The interior of the main and lateral pipelines shall be carefully surveyed to determine the locations and extent of any structural failures. The location of any conditions which may prevent proper installation of lining materials into the pipelines shall be noted so that these conditions can be corrected. A video tape and suitable log shall be kept and turned over to the Owner.

#### 3.03 FLOW BYPASSING

- A. The Contractor, when required, shall provide for the transfer of flow, through or around section or sections of pipe that are to be repaired. The proposed bypassing system shall be acceptable in advance by the Owner. The acceptance of the bypassing system in advance by the Owner shall in no way relieve the Contractor of his responsibility and/or public liability. The flow bypassing shall be done in accordance with Section 02750 - Wastewater Flow Control.

Note: If the repair can be made in a few hours, bypass pumping may not be required. The placement carriage shall be equipped with a bypass section to allow flow once liner is pressed into place.

#### 3.04 LINE OBSTRUCTIONS

- A. It shall be the responsibility of the Contractor to clear the line of obstruction. If survey reveals an obstruction that cannot be removed by conventional cleaning equipment, the Owner shall authorize or otherwise arrange for a point repair excavation in accordance with Section 02757 - Point Repair of Sanitary Sewers to uncover and remove or repair the obstruction. Such excavation by the Contractor shall be authorized in writing by the Owner prior to the commencement of the work.

#### 3.05 LINER INSTALLATION

- A. The tube shall be inspected for tears and frayed sections. The tube, in good condition, will be vacuum impregnated with the resin. The resin will be introduced into the tube creating a slug of resin at the beginning of the tube. A calibration roller will assist the resin slug to

move throughout the tube. All air in the tube shall be removed by vacuum allowing the resin to thoroughly impregnate the tube. All resin shall be contained to ensure no public property or persons are exposed to the liquid resin. The mainline liner will be saturated upon a wet-out platform. The resin impregnated sample (wick) shall be retained by the installer to provide verification of the curing process taking place in the host pipe.

- B. The saturated tube along with the inversion bladder will be inserted into the carrying device. The mainline liner will be affixed on the launching device. Both the launching and carrying device shall be pulled into the pipe using a cable winch. The pull is complete when the open port of the launching device is aligned with the interface of the service connection and mainline pipe. The resin saturated lateral tube is completely protected during the pull. No resin shall be lost by contact with manhole walls or the pipe during the pull. The resin saturated mainline liner is supported upon the rigid launcher that is elevated above the pipe invert by means of a rotating skid system. The mainline liner should not be contaminated or diluted by exposure to dirt, debris, or water during the pull.
- C. The installer shall document the placement of the liner by internal video inspection.
- D. The mainline liner shall be expanded against the mainline pipe and lateral tube inverted out of the launcher/carrying device by controlled air or water pressure. The installer shall be capable of viewing the lateral liner contacting the lateral pipe. The mainline liner and the lateral tube shall be held tightly in place against the wall of the host pipe by controlled pressure until the cure is complete. Resin shall be in contact with the original mainline and lateral pipes and coatings shall be on the interior to be exposed to the wastewater flow.
- E. When the curing process is complete, the pressure will be released. The inversion bladder and launching device shall be removed from the host pipe with the winch. No barriers, coatings, or any material other than the cured tube/resin composite, specifically designed for desirable physical and chemical resistance properties, shall be left in the host pipe. Any materials used in the installation other than the cured tube/resin composite shall be removed from the pipe by the installer.

### 3.06 ACCEPTANCE AND TESTING

- A. The finished liner shall be continuous over the entire length of the installation. The liner shall be free from visual defects, damage, deflection, holes, delamination, uncured resin, and the like. There shall be no visible infiltration through the liner or from behind the liner.
- B. The Owner may elect to direct the Contractor to verify a non-leaking main/lateral connection repair system by means of an air test in accordance with the specifications herein. Testing shall be performed at the Owner's discretion but at a frequency not to exceed one test for every ten Liners installed. The Contractor shall provide all necessary resources to perform the test. The cost for the test shall be included in the Liner installation cost, and no separate payment shall be made.
  - 1. A test plug shall be placed adjacent to the upstream and downstream ends of the mainline liner and at the uppermost end of the lateral tube. Air-pressure not less than 4 PSI shall be introduced through the test plug. The void area between the three plugs shall be pressurized at 4 PSI, held for 2 minutes and during this time the pressure shall not drop below 3 PSI.

2. If an installed cured in-place liner fails the specified air test, the following corrective measures shall be taken.
  - a. The cured in-place liner shall be re-inspected by use of a closed circuit television camera in attempt to identify the defect.
  - b. Any repairs made shall consist of materials that are structural and meet or exceed the same criteria as the cured-in-place liner is required to meet in a domestic sewer collection system. Such materials shall have a minimum life expectancy of 50 years in accordance with ASTM F-1216 (most recent version) Appendix X1 Design Considerations and Appendix X2 Chemical-Resistance Test.
  - c. Once the defect has been corrected, the renewed main/lateral connection repair system shall be re-tested in accordance with the air test procedure as described above.
  - d. Any corrective measures shall be performed at the Contractor's expense.
3. If any of the air tests fail, the Owner at its option may require the Contractor to test an additional lateral at no additional charge to the Owner. If a second air test shall fail, the Owner at its option may require the Contractor to test additional or all of the installed cured in-place main/lateral connection repair systems at no additional charge to the Owner.

### 3.07 CLEANUP

- A. After the liner installation has been completed and accepted, the Contractor shall clean up the entire project area and return the ground cover to grade. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.

### 3.08 WARRANTY

- A. The main/lateral connection repair system shall be certified by the manufacturer for specified material properties for a particular job. The manufacturer warrants the liner to be free from defects in raw materials for two years from the date of acceptance. During the warranty period, any defects which affect the integrity, strength, or satisfactory performance of the pipe shall be repaired at the Contractor's expense in a manner mutually agreed by the Owner and the Contractor.

- END OF SECTION -

## SECTION 02771

### PRESSURE SEWER PIPELINE CLEANING

#### PART 1 – GENERAL

##### 1.01 SCOPE

- A. After the force main is isolated, access pits are constructed, flow bypassing operation is demonstrated, the pipeline is opened, and leaks across the valves are mitigated, the Contractor shall clean the pipeline using poly pig devices. The purpose of the pigging operation is to provide a clean pipeline suitable for the installation of a cured-in-place liner. The work consists of providing all supervision, labor, tools, transportation, material, and equipment necessary to clean the pressure sewer pipeline using poly pigs and an approved poly pig procedure, including provision and installation of all launching and retrieval devices as required and detailed in this specification.
- B. It will be the Contractor's responsibility to install the equipment and demonstrate its function, as well as disassemble the equipment, and clean up and store materials at the direction of the Owner and Engineer.

##### 1.02 QUALIFICATIONS

- A. The materials and work specified herein shall be furnished and performed by firms who are fully experienced, reputable, and qualified in the manufacture, installation and use of the specified items. The materials specified shall be constructed and installed in accordance with the best practice and methods. Bidders must have completed ten projects of similar size and scope within the last five years.
- B. Supervisory personnel shall have a minimum of five years' experience in the cleaning and rehabilitation of wastewater force mains. Experience in other types of cleaning in other types of piping systems will not qualify. Supervisory personnel should be able to conclusively demonstrate to the satisfaction of the Engineer that they are thoroughly familiar and trained in the engineering, procedures, means and methods for the safe and responsible cleaning and restoration to maximum flow capacity of wastewater force mains. An experienced supervisor shall provide a list of ten projects, all done within the last five years, comparable in size and scope to the work herein proposed, that he has personally supervised. This list shall include the names of the project, size and length of the force main cleaned, the dates this work was performed, and names / phone numbers of project personnel for confirmation purposes.
- C. At the preconstruction meeting, the Contractor shall provide a detailed work plan for the pigging operation. The plan shall include:
  - 1. The pig selection, forces and launch and retrieval process.
  - 2. The water supply source and temporary piping required.
  - 3. The means and methods for controlling and disposing of the solids and fluids removed from the force main as a consequence of the cleaning and restoration to maximum flow capacity.

4. Contingency plans for dealing with inline problems including blockages, "lost" pigs, and system integrity problems such as breaks, leaks, piping or fitting failures.

#### 1.03 Contractor RESPONSIBILITIES

- A. Supervision: There shall be on-site, at all times during the work, one superintendent with a minimum of five years supervisory experience to survey, lay out, and supervise the construction of the work under this contract.
- B. Proposed Method of Work: The method of cleaning shall be by use of poly pigs or swabs. The contractor shall furnish polyurethane pipe cleaning pigs of the appropriate diameter and covering material for use in the pipe system to be cleaned.
- C. Cleaning: Cleaning shall restore the original flow characteristics of new pipe without over-abrading or over-cleaning the interior walls of the pipe.
- D. Equipment: The contractor shall furnish pig launching equipment of the latest design and construction and shall include the means to maintain constant monitoring of the in-line flows and pressures of the system being cleaned and the constant location of the cleaning pigs in the system.
  1. Launching and retrieval devices shall be fabricated, designed and manufactured according to ANSI standards and capable of withstanding working pressure of 150 P.S.I.G.
  2. Launch and receiving tubes shall be fabricated of steel, pipe sized one diameter larger than the system to which it will be attached with a minimum length of 2.5 times the diameter. For poly pig launchers and receivers fourteen-inch or larger, wall thickness shall be a minimum of three-eighths inch.
  3. The contractor shall also have available auxiliary centrifugal pumps for cleaning.
- E. Communication: The Contractor shall provide radio communication and job site transportation between launching and retrieval points.
- F. Report upon Completion: The contractor shall provide a written report upon completion of line cleaning to outline and detail information acquired during the cleaning process about the system or to confirm existing information.

#### 1.04 SUBMITTALS

- A. At the pre-construction conference, submit to the Engineer for review, complete detailed information including shop drawings as required, literature, and other pertinent information relating to the installation and operation of pressure sewer pipeline cleaning devices and appurtenances.
- B. A detailed cleaning plan identifying number and sizes of pigs to be utilized, time schedule and procedure to be used shall be submitted at the preconstruction meeting.

## PART 2 – PRODUCTS

### 2.01 POLY PIGS

- A. Poly pigs shall be constructed of blown elastomer poly urethane with an open cell construction and a density equal to or suitable for use in the piping system being cleaned. Poly pig configuration shall consist of a parabolic nose and a concave base, and it shall be coated with resilient surface material that will maintain a peripheral seal and will effectively clean the piping system without over abrading the interior pipe wall. Poly pig characteristics when in use shall include the ability to navigate through ninety degree and one hundred and eighty degree turns, bi-directional fittings, full port valves and comparable in-line appurtenances, reduce its cross-sectional area and restore itself to its original design configuration, be propelled by applications of hydraulic and pneumatic pressure while maintaining its primary function as an internal cleaning device of conduits. When effectively and properly applied, the poly pig shall clean and restore piping systems of all sizes, types, uses, and lengths to their design or maximum flow capacity.
- B. Furnish poly pigs in sufficient numbers and sizes, of appropriate densities, coatings and configurations to properly clean the system(s) prior to the system(s) being relined. Poly pigs shall be those as manufactured by Knapp Polly Pigs of Houston, Texas, or an approved equal.

## PART 3 – EXECUTION

### 3.01 GENERAL

- A. Equipment shall be installed in accordance with manufacturers' recommendations.
- B. Initial selection of the cleaning pigs, instruction and training of facility personnel, and provision of an Operations / Maintenance Manual shall be provided by personnel thoroughly trained, knowledgeable and experienced in the technology and procedures required for the proper and safe "pigging" of this system. Such work can be provided by a specialty contractor such as Professional Piping Services, Inc., Wesley Chapel, Florida, or an approved equal.

### 3.02 CLEANING PRECAUTIONS

- A. During all cleaning and preparation operations all necessary precautions shall be taken to protect the force main from damage. During these operations, precautions shall also be taken to ensure that no damage is caused to public or private property adjacent to the forcemain.

### 3.03 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 Owner.

- B. The Owner will designate, for disposal by the Contractor, of liquids used in the pigging operation, a sanitary manhole at an available and appropriate location. If pig recovery is accomplished in this manhole, vacuum truck(s) must be available to immediately remove solids to prevent clogging of the gravity collection system. The Contractor may elect to utilize a sediment tank to recover the pig and collect solids prior to discharging fluids into the manhole.
- C. 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.
- D. 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 above.
- E. 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 Owner 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 Owner in connection with such cleanup. The Owner may also charge to the Contractor any costs incurred or penalties imposed on the Owner 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.
- F. 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.
- G. 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.

### 3.04 INSPECTION

- A. If anomalies are encountered in the cleaning process indicating obstruction or structural defects, inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles, etc., by closed-circuit television. The interior of the pipeline shall be carefully inspected to determine the location of any conditions that may prevent proper installation of the liner, and it shall be noted so that these conditions can be corrected. A video tape and suitable log shall be kept for reference. If unseen obstructions are encountered such as, but not limited to, reducers, line valves, and protruding connections that will prevent proper installation, the Contractor shall remove such obstructions on written order from the Owner.

- END OF SECTION -

## SECTION 02772

### CURED-IN-PLACE PIPE RECONSTRUCTION OF PRESSURIZED PIPING

#### PART 1 – GENERAL

##### 1.01 INTENT

- A. It is the intent of this specification to provide for the reconstruction of the designated pressure pipe by inversion and curing a new cured-in-place-pipe (CIPP) within the existing (host) pipe. Due to the possibly unstable condition of the host pipe, the new CIPP shall be designed as a fully structural pipe, not relying on the remaining strength of the host pipe to withstand long-term external loading and internal pressure.

##### 1.02 REFERENCED DOCUMENTS

- A. This specification references ASTM F1216 which is 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 F1216, this specification will govern.

##### 1.03 SUBMITTALS

- B. The materials and work specified herein shall be furnished and performed by firms who are fully experienced, reputable, and qualified. The materials specified shall be constructed and installed in accordance with the best practice and methods. Supervisory personnel should be able to conclusively demonstrate thorough familiarity and training in the engineering, procedures, means and methods for force main lining.
- C. With the bid, the following submittals are required. Documentation for product and installation experience must be satisfactory to the Owner.
  - 1. Proposed cured-in-place liner product information, including installation references of ten force main lining projects within the last five years that are similar in size and scope to this project. The submittal shall include, at a minimum, the client contact name, phone number, the diameter and footage of pipe rehabilitated, and the date of project completion.
  - 2. An experienced supervisor shall provide a list of ten projects done within the last five years, comparable in size and scope to the work herein proposed, that he has personally supervised. The submittal shall include, at a minimum, the client contact name, phone number, the diameter and footage of pipe rehabilitated, and the date of project completion.
- D. After approval of each Work Order, the following submittals are required.
  - 1. Design - Detailed design calculations for both the internal and external loading parameters specified in Section 2.02 shall be submitted for review and approval. The design submittal shall follow the requirements specified in Section 2.02. The design submittal shall also clearly identify the physical properties used for design.

2. **Chemical Resistance** - The Contractor shall submit test results which indicate that the CIPP system proposed meets the chemical resistance requirements of Section 3.08.B.
3. **CIPP Field Samples** - The Contractor shall submit physical property test results from previous installations of the product proposed for this project. These test results shall verify that the CIPP physical properties used in the design submittal (Section 1.03.C.1) have been achieved in previous applications.

**PART 2 – PRODUCTS**

**2.01 MATERIALS**

- A. The tube shall be fabricated with non-woven synthetic fiber combined with glass fiber reinforcement. The tube shall be fabricated to dimensions such that it will stretch to a size that when installed will cure while in contact with the existing pipe.
- B. The outside layer of the tube shall be plastic coated with a translucent flexible material that clearly allows inspection of the resin impregnation (wet out) procedure.
- C. The tube shall have a uniform thickness that when compressed at installation pressures will exceed the minimum required thickness specified in the design submittals (see Section 1.03.C.1).
- D. The tube shall be homogeneous across the entire wall thickness containing no intermediate or encapsulated elastomeric layers. The tube shall contain glass fiber reinforcement quantities appropriate for the internal pressure requirements.
- E. The wall color of the interior pipe surface of the CIPP after installation shall be a light reflective color so that a clear detail examination may be made of the final product with closed circuit television inspection equipment or by man-entry.
- F. A vinyl ester resin system that is compatible with the inversion process shall be used.

**2.02 STRUCTURAL REQUIREMENTS**

- A. The CIPP shall be designed as per ASTM F1216, Appendix X1.3.2 for the Fully Deteriorated Pressure Pipe condition.
- B. The CIPP design shall assume no bonding to the original pipe wall.
- C. The design of the CIPP shall be based on the following parameters:

Diameter	*, inch
Normal Internal Operating Pressure	*, psi
Maximum Internal Pressure	*, psi
Normal Internal Operating Temperature	78, °F
Maximum Internal Temperature	80, °F
Internal Vacuum, if applicable	N/A, psi

Soil Depth (above crown)	*, feet
Ground Water Depth (above invert)	*, feet
Type of Live Load	H2O
Modulus of Soil Reaction	700, psi
Soil Density	110, lb/ft <sup>3</sup>

*\*Site Specific*

- D. The physical properties used in the design submittal (see Section 1.03.C.1) shall be clearly identified. These physical properties shall be the basis for the acceptance of prequalification submittals of previous field samples (see Section 1.03.C.3) and the acceptance of the final product (see Section 3.07.E). At a minimum, the CIPP shall have the following physical properties:

Property	ASTM Test Method	Minimum Value*
Initial Flexural Modulus of Elasticity	D790	250,000 psi
Initial Flexural Strength	D790	5,000 psi
Initial Tensile Strength	D638	4,500 psi

*\*Values are for design conditions @ 75°F (25°C)*

- E. For the external load design in Appendix X.1 of ASTM F1216, the long-term (time-corrected) flexural modulus of elasticity shall be determined by multiplying the design initial flexural modulus of elasticity by a creep retention factor ( $C_L$ ). A creep retention factor of 50% shall be applied.
- F. The external load design shall be based on an enhancement factor (K) of 7.0, an ovality (q) of  $\theta$  2%, (**or site specific**) a Poisson's (v) ratio of 0.3 and a factor of safety of 2.0.
- G. For the internal pressure design in Appendix X.1 of ASTM F1216, the design shall be based on factor of safety of 2.0 and a long-term tensile strength equal to 1/3 of the design initial tensile strength.
- H. The design physical properties shall be adjusted, as necessary, to account for the Normal Internal Operating Temperature specified in Section 2.02.C.

## 2.03 LINER END SEALS

- A. Existing pipe not rehabilitated shall be connected at each location where new liner begins and ends using standard pipe fittings. To prevent fluid from migrating between the inside surface of the existing rehabilitated host pipe and the external surface of the pipe liner, connection to liner shall be Hymax 2000 coupling or approved equal.
- B. Contractor shall submit proposed details of materials and procedures for approval prior to performance of the work.
- C. Installation and testing of end seals shall be in accordance with manufacturer's recommendation.

### **PART 3 – EXECUTION**

#### **3.01 ACCESS, CLEANING AND INSPECTION**

- A. Prior to entering access pits and performing inspection or cleaning operations, the Contractor shall make an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen in accordance with local, state, or federal safety regulations.

#### **3.02 RESIN IMPREGNATION**

- A. The tube shall be vacuum-impregnated (wet out) with resin under controlled conditions. The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and loss of resin through cracks and irregularities in the original pipe wall.
- B. The Contractor shall designate a location where the tube will be vacuum impregnated prior to installation. To ensure a thorough wet out, the point of vacuum shall be no further than 25 feet from the point of initial resin introduction. After vacuum in the tube is established, the vacuum points shall be no further than 75 feet from the leading edge of the resin. The leading edge of the resin slug shall be as near to perpendicular as possible. Vacuum points shall be sealed as they are vacated. A roller system shall be used to uniformly distribute the resin throughout the tube. The Contractor shall allow the Owner to inspect the materials and procedures used to vacuum impregnate the tube.

#### **3.03 INSTALLATION**

- A. The wetout tube shall be inserted through an approved access point by means of an inversion process and the application of a hydrostatic head sufficient to extend it to the termination point.
- B. Before the installation begins, the Contractor shall determine the minimum pressure required to hold the tube tight against the existing pipeline, 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. Tube installation forces or pressures shall be limited so as not to stretch the tube longitudinally by more than 5% of the original length.
- C. The use of a lubricant during inversion may be needed to reduce friction. The lubricant used shall be a nontoxic product that has no detrimental effects on the tube or boiler and pump system, shall not support the growth of bacteria, and shall not adversely affect the fluid to be transported.

#### **3.04 CURING**

- A. After installation is completed, a suitable heat source and water recirculation equipment shall be used to circulate heated water throughout the pipeline. The equipment shall be capable of delivering hot water throughout the pipeline to uniformly raise the water temperature above the temperature required to effect a cure of the resin. Water temperature in the line during the cure period shall be as determined by the Contractor, in accordance with Manufacturer's recommendations.

- B. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supply. To determine the temperatures during the cure cycle, a gauge shall be placed at the beginning and termination points between the impregnated tube and the invert of the existing pipe. The temperature of the cure water shall be monitored at the termination end by placing a temperature probe through a small hole in the tube, near the invert, into the cure water. The hole in the tube shall be made such that the temperature probe fits tightly and minimizes cure water leakage.
- C. Initial cure will occur during temperature heat-up and is completed when exposed portions of the new pipe appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm or cure in the resin. After initial cure is reached, the temperature shall be raised to the post-cure temperature as determined by the Contractor. The post-cure temperature shall be held for a period as determined by the Contractor, during which time the recirculation of the water and cycling of the boiler to maintain the temperature continues. The curing process shall take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of soil).

### 3.05 COOL-DOWN

- A. The CIPP shall be cooled to a temperature below 90 F (32 C) before relieving the hydrostatic head. Cool-down shall be accomplished by the introduction of cool water to replace water being drained from the system. Care shall be taken in the release of the static head so that a vacuum will not be developed that could damage the newly installed CIPP. In addition, the cure water incoming temperature during cool-down shall not decrease at a rate greater than 20 F (11°C) per hour.

### 3.06 INTERNAL END SEALS AND REINSTATEMENTS

- A. The Contractor shall install end seals in accordance with Section 2.03 at each of the CIPP beginning and termination points.
- B. The end seals shall be rated by the manufacturer for the operating pressure and shall be compatible with the piped fluid. The pipe at the end seal installation points shall be structurally sound and free of any significant pitting or heavy corrosion to ensure an adequate seal between the CIPP and the existing pipeline. Otherwise, replacement with a new spool piece at these ends may be required.

### 3.07 INSPECTION AND TESTING

- A. The installation shall be inspected by closed-circuit television.
- B. The finished CIPP shall be continuous over the entire length of an installation run and be free of dry spots, lifts, and delaminations.
- C. Two CIPP samples shall be prepared from the liner material.
  - 1. The first sample should be cut from a section of cured CIPP at an intermediate manhole or at the termination point that has been inverted through a like diameter pipe which has been held in place by a suitable heat sink, such as sandbags.

- 2. The second sample should be fabricated from material taken from the tube and the resin/catalyst system used and cured in a clamped mold placed in the downtube.
- D. The CIPP samples shall be large enough to provide a minimum of three specimens and a recommended five specimens for flexural testing and tensile testing.
- E. The CIPP samples shall be tested in accordance with ASTM D790 and D638 to confirm that the required physical properties specified in the design submittal of the proposed product (see Section 1.03.C.1) have been achieved.
- F. The CIPP shall meet the chemical resistance requirements of Section 3.08.
- G. The CIPP shall be pressure tested for water-tightness following the test protocol described in Section 3.09.
- H. A CCTV video inspection and taping shall be conducted as soon as possible after installation.

**3.08. CHEMICAL RESISTANCE**

- A. The CIPP system proposed shall meet the minimum chemical resistance requirements listed below and shall be provided as a prequalification submittal (see Section 1.03 C.2). Samples used for testing shall be of the same resin system and similar tube materials as that proposed for the project. It is required that CIPP samples without plastic coating meet these chemical testing requirements.
- B. Chemical resistance tests shall be completed in accordance with ASTM Test Method D 543 with the chemical solutions shown in Table 9.1. Exposure shall be for a minimum of one month at 73.4°F (23°C). During this period, the CIPP test specimens shall lose no more than 20% of their initial flexural strength and initial flexural modulus of elasticity.

Table 9.1: Minimum Chemical Resistance Requirements

Chemical Solution	Concentration, %
Tap water (pH 6-9)	100
Nitric acid	5
Phosphoric acid	10
Sulfuric acid	10
Gasoline	100
Vegetable oil	100
Detergent	0.1
Soap	0.1

### 3.09 TESTING

- A. This section provides procedures for pressure testing for water-tightness of CIPP used in the renovation of pressure pipelines. Pressure testing for water-tightness and a CCTV inspection shall be conducted for the CIPP liner after installation.
- B. Leak Testing: In the interest of expediting testing in consideration of sewage bypass operations, the following leakage test procedure is to be utilized.
  - 1. The test of the installed pressure pipe shall be under the hydrostatic head used during the curing process.
  - 2. The test shall be done after cool-down and before cutting the liner.
  - 3. The end of the tube shall be exposed and cinched tight to prevent any leaks prior to commencing the test period. If leaks should develop during the test, the pipe end shall be resealed, and the testing period restarted.
  - 4. Once the pipe liner is installed, the hydrostatic head will be kept on the liner. Water level shall be monitored, and makeup water added to maintain constant head on the pipeline.
  - 5. At no time will the water column in the downtube be dropped to a level that will cause the tube within the host pipe not to fit snugly at the crown.
  - 6. The test period shall be a minimum of two hours.
- C. Video Inspection: A video inspection and recording of the completed liner shall be conducted after installation. Video results shall be reviewed and accepted by the Owner prior to the pipeline being reconnected.
  - 1. 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 pipeline.
  - 2. 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 submerged conditions. The camera, television monitor, and other components of the video system shall be capable of producing a high-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 Owner; and if unsatisfactory, equipment shall be removed and replaced with adequate equipment.
  - 3. The video camera shall include a title feature capable of showing on the recorded video the following information:
    - a. City and State
    - b. Date
    - c. Contractor's Name

- d. Project Name and/or Work Order Number
  - e. Line Size
  - f. On-going Footage Counter
4. All video recordings shall be submitted to the Owner and will become the property of the Owner.
  5. Video reports or logs are to be neat and completely filled out and submitted to the Owner along with the recorded video.
  6. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary, to permit proper documentation of the liner's condition. In no case shall the television camera be operated at a speed greater than 30 feet per minute.
  7. Video Recordings: The purpose of recording shall be to supply a visual and audio record of the entire line, specifically including any problem areas, which may be replayed and reviewed. Once videotaped, the tapes become property of the Owner. The Contractor shall have all video and necessary playback equipment readily accessible for review by the Owner during the project.
- D. Acceptance: The test shall require that the quantified make-up water (from Section 3.09.B above) for the test shall not exceed 20 gallons per inch-diameter, per mile of pipe, per 24-hour day (20 GPDIM). The quantified make-up water for the test shall be extrapolated to the 24-hour rate for comparison purposes. Any visible leakage at termination points shall be eliminated. If the leakage exceeds the allowable, the Contractor shall endeavor to locate the source of the leakage and reduce it in a manner acceptable to the Owner. The pressure test for water-tightness shall be deemed acceptable if that actually measured during the test (which has been extrapolated to a 24-hour day rate) is equal to or less than the allowable make-up water rate of 20 GPDIM. The test period shall be a minimum of two (2) hours.
- 3.10 CLEAN-UP
- A. Upon acceptance of the installation, the Contractor shall install the end seals and complete the installation.

- END OF SECTION -

SECTION 03305

CONCRETE AND GROUT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish all materials for concrete in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, all in accordance with the requirements of the Contract Documents
  
- B. The following types of concrete shall be covered in this Section:
  - 1. Structural Concrete: Concrete to be used in all cases except where noted otherwise in the Contract Documents.
  
  - 2. Sitework Concrete: Concrete to be used for curbs, gutters, catch basins, sidewalks, fence and guard post embedment, underground duct bank encasement and all other concrete appurtenant to electrical facilities unless otherwise shown or noted on the Drawings.
  
- C. The following types of grout are covered in this Section:
  - 1. Non-Shrink Grout: This type of grout shall be used wherever grout or cementitious grout is called for in the Contract Documents, unless another type is specifically referenced.
  
  - 2. Epoxy Grout: This type of grout shall be used for grouting reinforcement steel into existing concrete.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Codes: Without limiting the generality of other requirements of these specifications, all work specified herein shall conform to or exceed the requirements of the South Florida Building Code and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of this Section.
  
- B. Commercial Standards:
  - ACI 301                      Specifications for Structural Concrete for Buildings.
  
  - ACI 315                      Manual of Standard Practice for Detailing Reinforced Concrete Structures.
  
  - ACI 318                      Building Code Requirements of Reinforced Concrete.
  
  - ACI 347                      Recommended Practice for Concrete Formwork.

ASTM A 185	Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
ASTM C 31	Test Methods for Making and Curing Concrete Test Specimens in the Field.
ASTM C 33	Specification for Concrete Aggregates.
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C 94	Specification for Ready-Mixed Concrete.
ASTM C 143	Test Method for Slump of Portland Cement Concrete.
ASTM C 150	Specification for Portland Cement.
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete.
ASTM C 309	Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
ASTM C 494	Specification for Chemical Admixtures for Concrete.
ASTM C 579	Test Methods for Compressive Strength of Chemical Resistant Mortars and Monolithic Surfacing.
ASTM C 827	Test Method for Early Volume Change of Cementitious Mixtures.
ASTM D 1751	Specification for Preformed Expansion Joint Fillers for Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
CRD C 621 CRSI	Manual of Standard Practice.

### 1.03 SUBMITTALS

- A. General: The Contractor shall submit shop drawings and other information to the Owner for review in accordance with Section 01300 - Submittals.
- B. Mix Designs: The Contractor shall submit shop drawings for review for proposed concrete mix designs which shall show the proportions and gradations of all materials proposed for each class and type of concrete specified herein. The mix design shall be checked by an independent testing laboratory acceptable to the Owner. All costs related to such checking shall be borne by the Contractor.
- C. Grout: The Contractor shall submit shop drawings for all types of grout for use in this Project.

- D. Accessories: The Contractor shall submit shop drawings for all types of concrete accessories to be used for this project including, but not limited to, form ties, water stops, joint materials and curing agents.
- E. Delivery Tickets: Where ready-mix concrete is used, the Contractor shall provide weighmaster delivery tickets at the time of delivery of each load of concrete. Each certificate shall show the public weighmaster's signature, the State certified equipment used for measuring and the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.
- F. Reinforcing Steel: The Contractor shall submit shop drawings of shop bending diagrams, placing lists, and Drawings of all reinforcing steel prior to fabrication.

#### 1.04 QUALITY ASSURANCE

- A. Tests on component materials and for compressive strength and shrinkage of concrete will be performed as specified herein. Test for determining slump will be in accordance with the requirements of ASTM C 143.
- B. The cost of all laboratory tests on cement, aggregates, and concrete, will be borne by the Owner. However, the Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications.
- C. Concrete for testing shall be supplied by the Contractor at no cost to the Owner, and the Contractor shall provide assistance to the Owner in obtaining samples. The Contractor shall dispose of and clean up all excess material.
- D. Field Compression Tests: Compression test specimens shall be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the Owner to ensure continued compliance with these specifications. At least one set of test specimens shall be made for each 50 yards of concrete placed. Each set of test specimens shall be a minimum of 4 cylinders.
- E. Compression test specimens for concrete shall be made in accordance with ASTM C31. Specimens shall be 6-inch diameter by 12-inch-high cylinders.
- F. Compression tests shall be performed in accordance with ASTM C 39. One test cylinder will be tested at 7 days and 2 at 28 days. The remaining cylinder will be held to verify test results, if needed.
- G. Evaluation and Acceptance of Concrete: Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318, Chapter 5, "Concrete Quality", and as specified herein. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for all subsequent batches of the type of concrete affected. All concrete which fails

to meet the ACI requirements and these Specifications, is subject to removal and replacement at the cost of the Contractor.

- H. Construction Tolerances: The Contractor shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the Specifications, permissible deviations will be in accordance with ACI 347.

## PART 2 – PRODUCTS

### 2.01 FORMWORK

- A. Form Materials: Except as otherwise expressly accepted by the Owner, all lumber for use as forms, shoring, or bracing shall be new material. Materials for concrete forms shall conform to the following requirements:
  - 1. Form materials shall be metal, wood, plywood, or other acceptable material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade shown.
  - 2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine plywood manufactured especially for concrete formwork and shall conform to the requirements of PS 1 for Concrete Forms, Class 1, and shall be edge sealed. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Exterior Grade.
- B. Unless otherwise shown, exterior corners in concrete members shall be provided with 3/4-inch chamfers or tooled to a 1/2-inch radius. Re-entrant corners in concrete members shall not have fillets unless otherwise shown.
- C. Form Ties: Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to ensure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1 1/2 inches; and all such fasteners shall be such as to leave holes of regular shape for reaming. Form Ties shall be Burke Penta-Tie System by The Burke Company, or equal.

### 2.02 CONCRETE MATERIALS

- A. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.
- B. All materials furnished for the work shall comply with the requirements of ACI 301, as applicable.
- C. Storage of materials shall conform to the requirements of ACI 301.

D. Materials for concrete shall conform to the following requirements:

1. Cement shall be standard brand Portland cement conforming to ASTM C 150 Type II.
2. Water shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts and other impurities.
3. Aggregates shall be obtained from pits acceptable to the Owner, shall be nonreactive, and shall conform to the SFBC and ASTM C 33. Maximum size of coarse aggregate shall be as specified herein.
4. Ready-mix concrete shall conform to the requirements of ASTM C 94.
5. Air-entraining Admixture meeting the requirements of ASTM C 260 shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 3 to 5 percent. The Owner reserves the right, at any time, to sample and test the air-entraining agent received on the job by the Contractor. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.
6. Water reducing and retarding admixtures shall be added to control the set, effect water reduction. The addition of the admixture shall be separate from the air entraining admixture and as recommended by the manufacturer. The admixture shall be completely compatible with and be manufactured by the same manufacturer as the air entraining admixture. The addition of the admixture shall be completed within one minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first. Water reducing and set retarding admixtures shall be in conformance with ASTM C 494, Type D.

2.03 CURING MATERIALS

- A. Materials for curing concrete conform to ASTM C 309 and shall be Burke Spartan, Cote Cure-Seal Hardner (with red fugitive dye) as manufactured by the Burke Company, MB 429 as manufactured by Master Builders, or equal. The curing compound shall contain a fugitive dye so that areas of application will be readily distinguishable.
- B. Polyethylene sheet for use as a concrete curing blanket shall be white and have a nominal thickness of 6 mils.

2.04 NON-WATERSTOP JOINT MATERIALS

- A. Materials for joints in concrete above grade nonhydraulic structures shall conform to the following requirements:
  1. Preformed joint filler shall be a non-extruding, resilient, bituminous type conforming to the requirements of ASTM D 1751.
  2. Elastomeric joint sealer shall be a single component, pour grade, polyurethane sealant meeting FS TT-S-230A, Type 1. Materials shall attain Shore A Hardness of 40-45.

3. Mastic joint sealer shall be a material that does not contain evaporating solvents; that will tenaciously adhere to concrete surfaces; that will remain permanently resilient and pliable; that will not be affected by continuous presence of water and will not in any way contaminate potable water; and that will effectively seal the joints against moisture infiltration even when the joints are subject to movement due to expansion and contraction. The sealer shall be composed of special asphalts or similar materials blended with lubricating and plasticizing agents to form a tough, durable master substance containing no volatile oils or lubricants and shall be capable of meeting the test requirements set forth hereinafter, if testing is required by the Owner.
- B. Joint Cleaner: Joint cleaner shall be as recommended by sealant caulking compound manufacturer.
- C. Joint Primer: Joint primer shall be as recommended by sealant manufacturer.

## 2.05 REINFORCING STEEL

- A. General: All reinforcing steel for all reinforced concrete construction shall conform to the following requirements:
  1. Bar reinforcement shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel Reinforcement with supplementary requirement S-1 and shall be manufactured in the United States.
  2. Welded wire fabric reinforcement shall conform to the requirements of ASTM A185. All welded wire fabric reinforcement shall be galvanized.
- B. Accessories: Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. Slab bolsters shall have gray plastic-coated legs.
- C. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Where the concrete blocks are used on concrete surfaces exposed to view, the color and texture of the concrete blocks shall match that required for the finished surface. Wire ties shall be embedded in concrete block bar supports.

## 2.06 CONCRETE DESIGN REQUIREMENTS

- A. General: Concrete shall be composed of cement, admixtures, aggregates and water. These materials shall be of the quantities specified. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the Owner. All changes shall be subject to review by the Owner.
- B. The Contractor is cautioned that the limiting parameters specified below are not design mixes. Additional cement or water reducing agent may be required to achieve workability

demanded by the Contractor's construction methods. The Contractor is responsible for any costs associated with furnishing concrete with the required workability.

- C. **Water-Cement Ratio and Compressive Strength:** The minimum compressive strength and cement content shall be not less than specified as follows:

Type of Work	Min. 28-Day Compressive Strength (psi)	Max. Size Aggregate (in.)	Min. Cement per cu yd (sacks)	Max. W/C Ratio (by wt.)
<b>Structural Concrete:</b>				
All reinforced concrete unless noted otherwise below.	4,000 (Class A)	3/4	6.0	0.45
<b>Sitework Concrete:</b>				
Concrete fill, pavement, curbs and sidewalks.	3,000 (Class B)	1	5.5	0.5

Note: One sack of cement equals 94 lbs.

- D. **Consistency:** The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as 3 inches, plus or minus 1 inch.

2.07 **READY-MIXED CONCRETE**

- A. Ready-mixed concrete shall conform to meeting the requirements as to materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94.
- B. Ready-mixed concrete shall be delivered to the site of the work, and discharge shall be completed within one- and one-half hour after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first. In hot weather, or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 60 minutes.

2.08 **NONSHRINK GROUT**

- A. Non-shrink grout shall be a prepackaged, inorganic, non-gas liberating, nonmetallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.
- B. Non-shrink grouts shall have a minimum 28-day compressive strength of 5,000 psi and shall meet the requirements of CRD C 621.

## 2.09 EPOXY GROUT

- A. Epoxy grout shall be a pourable, non-shrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all pre-measured and pre-packaged. The resin component shall not contain any non-reactive diluents. Resins contained butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.
- B. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.
- C. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F.
- D. The epoxy grout shall develop a compressive strength of 5000 psi in 24 hours and 10,000 psi in seven days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (0.0 percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.

## 2.10 BONDING COMPOUND

- A. For bonding freshly-mixed, plastic concrete to hardened concrete, Sikadur 32 Hi-Mod Epoxy Adhesive, as manufactured by Sika Corporation; Conesive Liquid (LPL), as manufactured by Master Builders; BurkEpoxy MV as manufactured by The Burk Company; or approved equal shall be used.

## PART 3 – EXECUTION

### 3.01 GENERAL FORMWORK REQUIREMENTS

- A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The Contractor shall assume full responsibility for the adequate design of all forms, and any forms which are unsafe or inadequate in any respect shall promptly be removed and replaced at the Contractor's expense. All design, construction, maintenance, preparation, and removal of forms shall be in accordance with the SFBC, ACI 347 and the requirements specified herein.
- B. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete.

### 3.02 FORMWORK CONSTRUCTION

- A. Vertical Surfaces: All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is called for by the Owner.

- B. Construction Joints: Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to the Owner. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete.
- C. Form Ties: Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties which cause spilling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1 inch back from the formed face or faces of the concrete.

### 3.03 REUSE OF FORMS

- A. Forms may be reused only if in good condition and only if acceptable to the Owner. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view.

### 3.04 REMOVAL OF FORMS

- A. Careful procedures for the removal of forms shall be strictly followed, and this work shall be done with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted. Members which must support their own weight shall not have their forms removed until they have attained at least 75 percent of the 28-day strength of the concrete as specified herein. Forms for all vertical walls and columns shall remain in place at least 2 days after the concrete has been placed. Forms for all parts of the Work not specifically mentioned herein shall remain in place for periods of time as determined by the Owner.

### 3.05 FABRICATION OF REINFORCING STEEL

- A. Reinforcing steel shall be accurately formed to the dimensions and shapes shown on the Drawings, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings.
- B. Bending or Straightening: Reinforcement shall not be straightened or rebent in a manner which will injure the material. Bars with kinks or bends not shown shall not be used. All bars shall be bent cold, unless otherwise permitted by the Owner. No bars partially embedded in concrete shall be field-bent except as shown or specifically permitted by the Owner.

### 3.06 PLACING REINFORCING STEEL

- A. Reinforcing steel shall be accurately positioned as shown on the Drawings and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcing steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any

displacement of the reinforcing steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. All concrete blocks used to support reinforcing steel shall be tied to the steel with wire ties which are embedded in the blocks. For concrete over formwork, the Contractor shall furnish concrete, metal, plastic, or other acceptable bar chairs and spacers.

- B. The portions of all accessories in contact with the formwork shall be made of concrete, plastic, or steel coated with a 1/8-inch minimum thickness of plastic which extends at least 1/2 inch from the concrete surface. Plastic shall be gray in color.
- C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.
- D. Bars additional to those shown which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor at its own expense.
- E. Reinforcement placing tolerances shall be within the limits specified in ACI 318, unless otherwise directed by the Owner.
- F. Welded wire fabric reinforcement placed over horizontal forms shall be supported on slab bolsters having gray, plastic-coated standard type legs as specified herein. Slab bolsters shall be spaced not less than 30 inches on centers, shall extend continuously across the entire width of the reinforcing mat, and shall support the reinforcing mat in the plane shown.
- G. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 3 feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.

### 3.07 SPLICING

- A. Reinforcement bar splices shall only be used at locations shown. When it is necessary to splice reinforcement at points other than where shown, the character of the splice shall be as acceptable to the Owner.
- B. Lap length for reinforcement bars shall be in a Class C Splice in accordance with ACI 318, unless otherwise shown. Laps of welded wire fabric shall be in accordance with the ACI 318.

### 3.08 CLEANING AND PROTECTION OF REINFORCING STEEL

- A. Reinforcing steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.
- B. The surfaces of all reinforcing steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed. Where there is a delay in depositing concrete, reinforcing shall be reinspected and, if necessary, recleaned.

### 3.09 PREPARATION OF SURFACES FOR CONCRETING

- A. **General:** No concrete shall be placed until the reinforcement steel and formwork have been erected in a manner acceptable to the Owner. The Contractor shall notify the Owner not less than two working days prior to concrete placement, allowing for inspection and any corrective measures which are required. Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.
- B. **Joints in Concrete:** Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, as determined by the Owner, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material. Such cleaning shall be accomplished by sandblasting, followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.
- C. **Existing concrete surfaces upon or against which concrete is to be placed shall be given a roughened surface for good bond. Joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material. Such cleaning shall be accomplished by hydroblasting. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.**
- D. **Placing Interruptions:** When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means that will secure proper union with subsequent work, provided that construction joints shall be made only where acceptable to the Owner.
- E. **Embedded Items:** No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the Owner at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.
- F. **All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown on the Drawings or by shop drawings and shall be acceptable to the Owner before any concrete is placed. Accuracy of placement is the responsibility of the Contractor.**
- G. **Casting Against Old Concrete:** Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydro-blasting (exposing aggregate) prior to the application of an epoxy bonding agent. Application shall be according to the bonding agent manufacturer's instructions and recommendations.
- H. **No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and**

carried out of the forms, clear of the work. No concrete shall be deposited under water nor shall the Contractor allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the Owner.

- I. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing of concrete.
- J. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2 inches clearance between said items, and any part of the concrete reinforcement will not be permitted.
- K. Cleaning: The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

### 3.10 MIXING, HANDLING, TRANSPORTING, AND PLACING

- A. General: Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this Section.
- B. Mixing: Mixing of concrete shall conform to the requirements of Chapter 7 of ACI 301.
- C. Retempering: Retempering of concrete or mortar which has partially hardened will not be permitted.
- D. Non-Conforming Work or Materials: Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the Work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by and at the expense of the Contractor.
- E. Unauthorized Placement: No concrete shall be placed except in the presence of duly authorized representative of the Owner. The Contractor shall notify the Owner in writing at least 24 hours in advance of placement of any concrete.
- F. Placement in Slabs: Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the pour. As the work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screened in an up-slope direction.
- G. Placement in Wall Forms: Concrete shall not be dropped through reinforcement steel or into any deep form, whether reinforcement is present or not, causing separation of the coarse aggregate from the mortar on account of repeatedly hitting rods or the sides of the form as it falls, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, some means such as the use of hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the

place of final deposit without separation. In no case shall the free fall of concrete exceed 4 feet below the ends of ducts, chutes, or buggies. Concrete shall be uniformly distributed during the process of depositing, and in no case after depositing shall any portion be displaced in the forms more than 6 feet in horizontal direction. Concrete in forms shall be deposited in uniform horizontal layers not deeper than 2 feet; and care shall be taken to avoid inclined layers or inclined construction joints where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in forms shall not exceed 5 feet of vertical rise per hour.

- H. The surface of the concrete -shall be level whenever a run of concrete is stopped. To insure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4 inch thick shall be tacked to the forms on these surfaces. The concrete shall be carded about 1/2 inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and all laitance shall be removed.
- I. Conveyor Belts and Chutes: All end of chutes, hopper gates and all other points of concrete discharge throughout the Contractor's conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the Owner. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the specified consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered. Sufficient illumination shall be provided in the interior of all forms so that the concrete, at the places of deposit, is visible from the deck or runway.
- J. Temperature of Concrete: The temperature of concrete, when it is being placed, shall not be more than 90 degrees F nor less than 40 degrees F in moderate weather, and not less than 50 degrees F in whether during which the mean daily temperature drops below 40 degrees F. Concrete ingredients shall not be heated to a temperature higher than that necessarily to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the Contractor shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The Contractor shall be entitled to no additional compensation on account of the foregoing requirements.

### 3.11 PUMPING OF CONCRETE

- A. If the pumped concrete does not produce satisfactory end results, the Contractor shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.
- B. The minimum diameter of the hose (conduits) shall be 4 inches.
- C. Minimum compressive strength, cement content, and maximum size of aggregates shall be as specified herein. Gradation of coarse aggregates shall conform to ASTM C 33 and shall be as close to the middle range as possible. Gradation of fine aggregate shall conform to

ASTM C 33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modulus of sand shall not be over 3.00.

### 3.12 TAMPING AND VIBRATING

- A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer, which is being consolidated, into a dense homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be high speed power vibrators (8,000 or 10,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required.
- B. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified with 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

### 3.13 FINISHING CONCRETE SURFACES

- A. General: Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions shown on the Drawings are defined as tolerances and are specified herein. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.
- B. Formed Surfaces: No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects. Where architectural finish is required, it shall be as specified or as shown on the Drawings.
- C. Unformed Surfaces: After proper and adequate vibration and tamping, all unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. The classes of finish specified for unformed concrete surfaces are designated as follows:
  - 1. Finish U1: Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8 inch. No further special finish is required.
  - 2. Finish U2: After sufficient stiffening of the screened concrete, surfaces shall be float finished with wood or metal floats or with a finished machine using flat blades. Excessive floating of surfaces while the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4 inch. Joints and edges shall be tooled where shown on the Drawings or as determined by the Owner.

3. Finish U3: After the floated surface (as specified for Finish U2) has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples and trowel marks. The finish shall be smooth and free of all irregularities.
4. Finish U4: Steel trowel finish (as specified for Finish U3) without local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise shown. The resulting surface shall be rough enough to provide a nonskid finish.

D. Uniformed surfaces shall be finished according to the following schedule:

Uniformed Surface Finish Schedule	
Area	Finish
Grade slabs and foundations to be covered with concrete or fill material	U1
Floors to be covered with topping grout	U2
Slabs to be covered with built-up roofing	U2
Slabs	U4

### 3.14 CURING AND DAMPPROOFING

- A. All concrete shall be cured for not less than 14 days after placing, in accordance with the methods specified herein for the different parts of the work and described in detail in the following paragraphs.

Finish Schedule	
Surface to be Cured or Dampproofed	Method
Unstripped forms	1
Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	3
All concrete surfaces not specifically provided for elsewhere in this Paragraph	4

- B. Method 1: Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removed. If steel forms are used, the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 14 days of placing the concrete, curing shall be continued in accordance with Method 4.
- C. Method 2: The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.

- D. Method 3: The surface shall be covered with moist earth not less than 4 hours, nor more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.
- E. Method 4: The surface shall be sprayed with a liquid curing compound. It shall be applied in accordance with the manufacturers printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film which will seal thoroughly.
- F. Care shall be exercised to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.
- G. Wherever curing compound may have been applied by mistake to faces against which concrete subsequently is to be placed and to which it is to adhere, said compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.
- H. Curing compound shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within 2 hours after removal of forms from contact with formed surfaces. Repairs required to be made to formed surfaces shall be made within the said 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound, following which repairs shall be made as provided herein.

### 3.15 PROTECTION

- A. The Contractor shall protect all concrete against injury until final acceptance by the Owner. Fresh concrete shall be protected from damage due to rain. The Contractor shall provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring.

### 3.16 TREATMENT OF SURFACE DEFECTS

- A. As soon as forms are removed, all exposed surfaces shall be carefully examined, and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the Owner. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall have them repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. All repairs and replacements herein specified shall be promptly executed by the Contractor at its own expense.
- B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2 inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting

tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The material used for repair proposed shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white Portland cement as is required to make the color of the patch match the color of the surrounding concrete.

- C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed, but shall be repaired in an approved manner with dry-packed cement grout.
- D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of this Section, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

### 3.17 CARE AND REPAIR OF CONCRETE

- A. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at anytime prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with the acceptable concrete at the Contractor's expense.

### 3.18 GROUT INSTALLATION

- A. All surface preparation, curing, and protection of cement grout shall be as specified herein. The finish of the grout surface shall match that of the adjacent concrete.
- B. The Contractor through the manufacturer of nonshrink grout and epoxy grout shall provide on-site technical assistance upon request, at no additional cost to the Owner.
- C. All mixing, surface preparation, handling, placing, consolidation, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
- D. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

- END OF SECTION -

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## SECTION 15000

### PIPING AND FITTINGS, GENERAL

#### PART 1 -- GENERAL

##### 1.01 THE REQUIREMENT

- A. The Contractor shall furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, supports, anchors, expansion joints, flexible connectors, valves, accessories, lining and coating, testing, excavation, backfill and encasement, to provide a functional installation.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02222 - Excavation and Backfill for Utilities.
- B. Section 15995 - Pipeline Testing and Disinfection.

##### 1.03 SUBMITTALS

- A. The Contractor shall submit complete shop drawings and certificates, test reports, affidavits of compliance, of all piping systems, in accordance with the requirements in the Section 01300- "Submittals", and as specified in the individual piping sections.
- B. Each shop drawing submittal shall be complete in all aspects, incorporating all information and data listed herein and all additional information required to evaluate the proposed piping material's compliance with the Contract Documents. Partial or incomplete submissions will be returned to the Contractor without review.
- C. Data to be submitted shall include, but not be limited to:
  - 1. Catalog Data consisting of specifications, service, pipe size, working pressure, wall thickness, lining, coating, illustrations and a parts schedule that identifies the materials to be used for the various piping components and accessories. The illustrations shall be in sufficient detail to serve as a guide for assembly and disassembly.
  - 2. Weight of all component parts.
  - 3. Design calculations where specified.
- D. Certifications: Prior to installation, the Contractor shall furnish an Affidavit of Compliance certified by the pipe manufacturer that the pipe, fittings and specials furnished under this Contract comply with all applicable provisions of AWWA and these specifications. No pipe or fittings will be accepted for use in the Work on this project until the affidavits have been submitted and accepted in accordance with the Section entitled "Submittals".
- E. All expenses incurred in making samples for certification of tests shall be borne by the Contractor.

#### 1.04 QUALITY ASSURANCE

- A. General: All pipe shall be subject to review at the place of manufacture. During the manufacture of the pipe, the Owner shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.
- B. Tests: Except where otherwise specified, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards.
- C. Welding Requirements: All welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWS D1.1. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

#### 1.05 MANUFACTURER'S SERVICE REPRESENTATIVE

- A. Where the assistance of a manufacturer's service representative is advisable, in order to obtain correct pipe joints, supports, or special connections, the Contractor shall furnish such assistance at no additional cost to the Owner.

#### 1.06 SHIPPING, HANDLING AND STORAGE

- A. Special care in handling shall be exercised during delivery, distribution and storage of pipe to avoid damage and setting up stresses. Damaged pipe will be rejected and shall be replaced at the Contractor's expense. Pipe and specials stored prior to use shall be stored in such a manner as to keep the interior free from dirt and foreign matter.
- B. No pipe shall be dropped from cars or trucks to the ground. All pipe shall be carefully lowered to the ground by mechanical means. In shipping, pipe and fittings shall be blocked in such manner as to prevent damage to castings or lining. Any broken or chipped lining shall be carefully patched. Where it is impossible to repair broken or damaged lining in pipe because of its size, the pipe shall be rejected as unfit for use.
- C. All mechanical joint pipe shall be laid with 1/8-inch space between the spigot and shoulder of pocket.

#### 1.07 CLEANUP

- A. After completion of the work, all remaining pipe cuttings, joining and wrapping materials, and other scattered debris, shall be removed from the site. The entire piping system shall be handed over in a clean and functional condition.

### PART 2 -- PRODUCTS

#### 2.01 GENERAL

- A. All pipes, fittings, and appurtenances shall be installed in accordance with the requirements of the applicable Sections of Division 2 and City of Boca Raton Shop Drawing Submittals & Approved Utility Product List and furnished as specified herein.

- B. Pressure Rating: All piping systems shall have pressure ratings as identified in the individual piping sections of the Specifications.

#### 2.02 SLEEVE-TYPE COUPLINGS

- A. Solid Sleeves: Solid sleeves shall be ductile iron, have a pressure rating of 250 psi and conform to ANSI/AWWA C110/A21.10. Solid sleeves shall be used as required to join two plain end pieces of pipe.

#### 2.03 PIPE THREADS

- A. All pipe threads shall be in accordance with ANSI/ASME B1.20.

#### 2.04 SEWER LATERAL REPAIR MATERIAL

- A. Sewer laterals that are damaged during construction shall be repaired with SDR 35 PVC pipe. Repair clamps shall be no hub couplings with stainless steel banding.

#### 2.05 SOLDER

- A. Solder for joining copper pipe shall be lead free.

### PART 3 -- EXECUTION

#### 3.01 GENERAL

- A. The Contractor shall furnish all labor, tools, materials, and equipment necessary for installation and jointing of the pipe. All piping shall be installed in accordance with the Drawings in a neat workmanlike manner and shall be set for accurate line and elevation. All piping shall be thoroughly cleaned before installation, and care shall be taken to keep the piping clean throughout the installation.
- B. Piping shall be attached to valves, etc., in accordance with the respective manufacturers' recommendations.

#### 3.02 LAYING PIPE

- A. Proper and suitable tools and appliances for the safe convenient handling and laying of pipe shall be used and shall, in general, agree with manufacturer's recommendations. At the time of laying, the pipe shall be examined carefully for defects, and should any pipe be discovered to be defective after being laid, it shall be removed and replaced with sound pipe by the Contractor at his expense.
- B. The Contractor shall perform all earthwork including excavation, backfill, bedding, compaction, sheeting, shoring and bracing, dewatering and grading in accordance with Division 2 "Sitework."
- C. Upon satisfactory excavation of the pipe trench and completion of the pipe bedding, a continuous trough for the pipe barrel and recesses for the pipe bells, or couplings, shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure shall be exerted on the pipe joints from the trench bottom.

- D. Pipe shall be installed in accordance with the manufacturer's recommendation. Before being lowered into the trench, the pipes and accessories shall be carefully examined, and the interior of the pipes shall be thoroughly cleaned of all foreign matter and other acceptable methods. At the close of each workday and during suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.
- E. Lines shall be laid straight, and depth of cover shall be maintained uniform with respect to finish grade, whether grading is completed or proposed at time of pipe installation. Where a grade or slope is shown on the Drawings, the Contractor shall use laser-based surveying instruments to maintain alignment and grade. At least one elevation shot shall be taken on each length of pipe and recorded. No abrupt changes in direction or grade will be allowed.
- F. All underground piping shall be properly restrained at all fittings where the pipeline changes direction, changes size, or ends, using restrained joint pipe.

### 3.03 THREADED JOINTS

- A. All threads shall be clean, machine cut and all pipe shall be reamed before erection. Taps and dies shall be cleaned, sharpened and in good condition. All threaded joints shall be made tight with Teflon tape.
- B. After having been set up, a joint shall not be backed off unless the joint is broken, the threads cleaned and new tape is applied.

### 3.04 THRUST RESTRAINT

- A. All joints shall be restrained per City Standard Detail (Appendix A) "Mechanical Thrust Restraint Minimum Pipe Lengths".

### 3.05 TESTING

- A. Field testing of pipelines shall conform to the requirements of the Section 15995 - Pipeline Testing and Disinfection.

- END OF SECTION -

SECTION 15006  
DUCTILE IRON PIPE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish and install ductile iron pipe and all appurtenant Work, complete in place, all in accordance with the requirements of the Contract Documents. All pipe and fittings shall be push-on or restrained joint pipe.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 15000 - Piping and Fittings, General.  
B. Section 15995 - Pipeline Testing and Disinfection

1.03 REFERENCED SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards:

ANSI/AWWA C110/A21.10	Ductile-Iron and Gray-Iron Fittings 3-inch through 48-inches For Water and Other Liquids
ANSI/AWWA C111/A21.11	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
ANSI/AWWA C151/A21.51	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or other Liquids
ANSI/AWWA C600	Installation of Ductile-Iron Water Mains and Appurtenances
SSPC - PA2	Measurement of Dry Paint Thickness with Magnetic Gages

1.04 SUBMITTALS

- A. Shop Drawings: The Contractor shall submit Shop Drawings of pipe and fittings in accordance with the requirements in Sections 15000, "Piping, General", and 01300, "Submittals".

PART 2 -- PRODUCTS

2.01 PIPE

- A. All ductile iron pipe shall conform to the requirements of ANSI/AWWA Standard C151/A21.51. The wall thickness and outside diameter of the pipe shall conform to ANSI/AWWA C150/A21.50 and the following:

- Pressure Class 350 for 12" and smaller
  - Pressure Class 250 for pipes larger than 12"
- B. Each pipe shall be cast with the year of manufacture, the class and the letters "DI" for ductile iron.
- C. Pipe Brand shall be per City of Boca Raton Shop Drawing Submittals & Approved Utility Product List or approved equal.

## 2.02 FITTINGS

- A. General: Fittings for use with the ductile iron pipe specified herein shall be ductile iron.
- B. Cast ductile-iron fittings shall be pressure rated at 250 psi, minimum.
- C. All fittings with mechanical joints, flange joints and push-on joints shall conform to AWWA/ANSI Standard C153/A21.53. In addition, fittings with mechanical joints and push-on joints shall conform to ANSI/AWWA Standard C111/A21.11, except that neoprene gaskets shall be used for the joint.
- D. Fittings Brand shall be per City of Boca Raton Shop Drawing Submittals & Approved Utility Product List or approved equal.

## 2.03 JOINTS

- A. All pressurized ductile iron pipe and fittings for use below grade shall have push-on or restrained joints.
- B. All ductile iron pipe and fittings shall have rubber gaskets in conformance with ANSI/AWWA Standard C111/A21.11.

## 2.04 THRUST RESTRAINED JOINTS

- A. Restrained Push-On Joint (Bell and 2<sup>nd</sup> MJ Restraint): Joints for ductile iron pipe and fittings shall be per City of Boca Raton Shop Drawing Submittals & Approved Utility Product List or equal. The restraining components, when not cast integrally with the pipe and fittings, shall be ductile iron or a high strength non-corrosive alloy steel. Tee head bolts and hexagonal nuts for all restrained joints in pipe and fittings shall be of high strength cast iron with composition, dimensions and threading as specified in ANSI/AWWA Standard C111/A21.11, except that the length of the bolts shall meet the requirements for the restrained joint design.
- B. The gasket and joint accessories shall be shipped in suitable protective containers. Each restrained joint and the pipe and fitting of which it is a part, shall be designed to withstand the axial thrust from an internal pipeline pressure of at least 250 psi at bulkhead conditions without reduction because of its position in the pipeline nor from support by external thrust blocks. Restrained joint pipe and fittings shall be capable of being deflected after assembly.
- C. Restrained Mechanical Joint Pipe: Mechanical joints for fittings and valves shall be restrained with Brand and Mode types per City of Boca Raton Shop Drawing Submittals &

Approved utility Product List or approved equal. Joints shall be made employing a tapered rubber gasket forced into a tapered groove with a ductile iron follower ring. Bolts for mechanical joints shall be high strength corrosion resistant low-alloy steel tee-head bolts with hexagonal nuts.

## 2.05 PIPE LINING

- A. **Water and Reuse:** All ductile iron pipe and fittings for potable water service and reclaimed water service shall be smooth cement-lined followed by a bituminous seal coat in accordance with AWWA C104/ANSI A21.4. Special attention shall be given to the lining of fittings. Linings shall be applied to bare metal. All lining shall extend to the faces of flanges, to the end of spigots, or to the shoulder of hubs, as the case may be.
- B. **Wastewater:** The interior lining of all ductile iron pipe and fittings for wastewater service shall be Protecto 401 Ceramic Epoxy as manufactured by the Protecto Division of Vulcan Painters, Inc., or approved equal. All fittings shall be lined with a minimum dry film thickness of 40 mils.

## 2.06 EXTERIOR COATING

- A. An asphaltic coating shall be applied to the exterior of all ductile iron pipe and fittings intended for buried service and shall conform to ANSI A21.51.

## 2.07 PVC PIPE SLEEVE

- A. PVC pipe sleeve shall be provided for all ductile iron pipe crossings under sewer and storm drainpipes. The PVC pressure pipe shall conform to the requirements of AWWA C905. The PVC sleeve shall extend 10 feet on either side of the sewer and/or storm drainpipe that the ductile iron pipeline crosses under. The ductile iron pipe shall be installed with casing spacers inside the PVC pipe sleeve and provided with a bulkhead at either end of the sleeve.
- B. The annular space between the ductile iron water main pipe and the PVC sleeve shall be filled with clean sand, having 100 percent passing a standard No. 30 sieve.

## 2.06 PIPE IDENTIFICATION PAINT

- A. All pipe shall have continuous identification paint stripe painted on the pipe to indicate service of the pipe; blue for water, green for sewer and purple for reclaimed water. For pipe striped during manufacturing, the stripes shall be applied parallel to the pipe centerline at 90-degree intervals. If paint is applied as the pipe is laid, a blue stripe shall be located along the top of the pipe. Pipe shall be color coded per FAC 62-555.320.

## 2.07 LOCATION TAPE

- A. All pipe shall have continuous identification location tape 2" wide.

## PART 3 – EXECUTION

### 3.01 INSTALLATION

- A. Unless otherwise directed, ductile iron pipe shall be laid with the bell ends in the direction of laying.
- B. Thrust restrained and mechanical joints shall be made in accordance with the manufacturer's standards except as otherwise specified herein. Joints between mechanical joint pipe and/or fittings shall be made in accordance with ANSI/AWWA Standard C600, except that deflection at joints shall not exceed one-half of the manufacturer's recommended allowable deflection, or one-half of the allowable deflection specified in ANSI/AWWA C600, whichever is the lesser amount.
- C. Before laying thrust restrained and mechanical joint pipe and fittings, all lumps, blisters and excess bituminous coating shall be removed from the bell and spigot ends. The outside of each spigot and the inside of each bell shall be wire brushed and wiped clean and dry. The entire gasket groove area shall be free of bumps or any foreign matter which might displace the gasket. The cleaned spigot and gasket shall not be allowed to touch the trench walls or trench bottom at any time. Vegetable soap lubricant shall be applied in accordance with the pipe manufacturer's recommendations, to aid in making the joint. The workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt. Deflections shall only be made after the joint has been assembled.
- D. Prior to making up flanged joints in ductile iron pipe and fittings, the back of each flange under the bolt heads and the face of each flange shall have all lumps, blisters and excess bituminous coating removed and shall be wire brushed and wiped clean and dry. Flange faces shall be kept clean and dry when making up the joint, and the workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt. Bolts and nuts shall be tightened by opposites in order to keep flange faces square with each other, and to ensure that bolt stresses are evenly distributed.
- E. Bolts and nuts in thrust restrained, mechanical and flanged joints shall be tightened in accordance with the recommendations of the pipe manufacturer for a leak-free joint. The mechanics shall exercise caution to prevent overstress. Torque wrenches shall be used until, in the opinion of the Owner, the mechanics have become accustomed to the proper amount of pressure to apply on standard wrenches.
- F. Cutting of the ductile iron pipe for inserting valves, fittings, etc., shall be done by the Contractor in a neat and workmanlike manner without damage to the pipe, the lining, or the coating. After cutting the pipe, the plain end shall be beveled with a heavy file or grinder to remove all sharp edges.
- G. Areas of loose or damaged lining associated with field cutting shall be repaired or replaced as recommended by the pipe manufacturer and required by the Owner. Repair methods shall be as recommended by the manufacturer and shall be submitted to the Owner for review.
- H. Any work within the pipe shall be performed with care to prevent damage to the lining. No cable, lifting arms or other devices shall be inserted into the pipe. All lifting, pulling or pushing mechanisms shall be applied to the exterior of the pipe barrel.

- I. Homing the pipe shall be accomplished by the use of a hydraulic or mechanical pulling device, unless otherwise accepted by the Owner. No pipe shall be driven or struck in order to seat it home.
- J. Cleaning methods shall be acceptable to the Owner, and must be sufficient to remove silt, rocks, or other debris which may have entered the pipeline during its installation and shall also follow the requirements of Section 15995, "Pipeline Testing and Disinfection".
- K. All tapping for service connection shall be provided with service saddles as specified in Section 15115, "Miscellaneous Valves".
- L. The Contractor shall furnish the necessary sand, equipment, and hoses for filling the annular space in the PVC sleeve with sand. Sand shall be conveyed by air through a hose and deposited by air pressure in its final position. The sand shall be free of lumps to flow unimpeded and to completely fill all voids. In general, sand backfill will be considered complete when no more sand can be forced into the annular space between the bulkheads. The Contractor shall protect the interior surface of the PVC sleeve from damage.

- END OF SECTION -

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SECTION 15008

PVC NON-PRESSURE PIPE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish and install all 6- to 15-inch underground PVC non-pressure pipe for gravity sewer replacement and all appurtenant work, complete in place, all in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02222 - Excavation and Backfill for Utilities.
- B. Section 02752 - Television Survey.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards:

ASTM D 1784	Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
ASTM D 2241	Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series).
ASTM D 2321	Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
ASTM D 3034	Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

1.04 SUBMITTALS

- A. Samples: The Contractor shall submit to the Owner for review, samples of all the materials proposed for use on the Work. The samples shall be clearly marked to show the manufacturer's name and product identification and shall be submitted along with the manufacturer's technical data and application instructions. All sample submittals shall conform to the requirements for "Samples" in Section 01300, "Submittals".
- B. Shop Drawings: The Contractor shall submit shop drawings and laying diagrams of all Pipe, joints, bends, special fittings, and piping appurtenances in accordance with Section 01300, "Submittals".
- C. Certificates: The Contractor shall provide manufacturer's certificates for all materials indicating conformance to the Contract Documents.

## 1.05 QUALITY ASSURANCE

- A. Testing: All materials testing will be based upon applicable ASTM Test Methods and AWWA Standards referenced herein for the materials specified.
- B. Certificates: Manufacturer's notarized certificates of compliance shall be furnished by the Contractor.
- C. The pipe shall be subjected to the specified hydrostatic strength tests, flexure tests, and crushing tests. The crushing tests shall be made on samples taken from the center of full-length sections of pipe.

## 1.06 CLEANUP

- A. In addition to the requirements of Section 01700, "Project Closeout", the Contractor, upon completion of backfilling and grading over trenches shall remove all excess materials and equipment from the site.

## PART 2 -- PRODUCTS

### 2.01 GENERAL

- A. All PVC pipe shall be continuously and permanently marked with the manufacturer's name, pipe size, and pressure rating in psi.
- B. The Contractor shall also require the manufacturer to mark the date of extrusion on the pipe. This dating shall be done in conjunction with records to be held by the manufacturer for 2 years, covering quality control tests, raw material batch number, and other information deemed necessary by the manufacturer.

### 2.02 PIPE

- A. All PVC pipe shall be joined by Compression joints unless otherwise shown or specified, and shall conform to the following requirements:
  - 1. Polyvinylchloride pipe (PVC) shall conform to the requirements of ASTM D 3034, Class SDR 35. Material for PVC pipe shall conform to the requirements of ASTM D 1784 for Class 12454-B or 12454-C as defined therein.
  - 2. Flexible rubber rings for compression type joints for PVC pipe and fittings shall conform to the requirements of ASTM D 1869.

### 2.03 FITTINGS

- A. All fittings for PVC pipe shall conform to the requirements of ASTM D 2241. The ring groove and gasket ring shall be compatible with PVC pipe ends. The flanged fittings shall be compatible with cast-iron or ductile iron pipe fittings.
- B. The strength class of the fittings shall be not less than the strength class of any adjoining pipe.

## 2.04 BEDDING MATERIAL

- A. Unless otherwise specified or shown, all material used for pipe bedding shall conform to the requirements for "Embedment materials" as specified in ASTM D 2321.

## 2.05 PVC CLEANOUTS

- A. PVC cleanouts shall have screw type access plug. Long radius wye connections and fittings shall be used in order to access cleanout operations. Tee connections shall not be acceptable. Refer to drawings for detail.

## PART 3 -- EXECUTION

### 3.01 GENERAL

- A. All laying, jointing, testing for defects and for leakage shall be performed in the presence of the Owner, and shall be subject to the Owner's approval before acceptance. All material found during the progress to have defects will be rejected and the Contractor shall promptly remove such defective materials from the site of the Work.
- B. Installation shall conform to the requirements of ASTM D 2321 and to the supplementary requirements or modifications specified herein. Wherever the provisions of this Section and the requirements of ASTM D 2321 are in conflict, the more stringent provision shall apply.

### 3.02 TRENCHING AND BACKFILL

- A. Trench excavation and backfill shall conform to the requirements of the Section entitled "Excavation and Backfill for Utilities", and as specified herein.
- B. Unless otherwise specified or shown, the maximum width of trenches shall be as specified in said ASTM D 2321.
- C. The minimum depth of cover over the top of the pipe shall be 36 inches unless otherwise shown.

### 3.03 LAYING PIPE

- A. The pipe shall be installed in accordance with the requirements of ASTM D 2321 and as specified herein and shown and the sections shall be closely jointed to form a smooth flow line. Immediately before placing each section of pipe in final position for joining, the bedding for the pipe shall be checked for firmness and uniformity of surface.
- B. Proper implements, tools, and facilities as recommended by the pipe manufacturer's standard printed installation instructions shall be provided and used by the Contractor for safe and efficient execution of the Work. All pipe, fittings, valves, and accessories shall be carefully lowered into the trench by means of backhoe, ropes, or other suitable equipment in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

- C. Cutting and machining of the pipe shall be accomplished in accordance with the pipe manufacturer's standard procedures for this operation. Pipe shall not be cut with a cold chisel, standard iron pipe cutter, nor any other method that may fracture the pipe or will produce ragged, uneven edges.
- D. The pipe and accessories shall be inspected for defects prior to lowering into the trench. Any defective, damaged or unsound pipe shall be repaired or replaced. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean during and after laying. All openings in the pipeline shall be closed with watertight expandable type sewer plugs or PVC test plugs at the end of each day's operation or whenever the pipe openings are left unattended. The use of burlap, wood, or other similar temporary plugs will not be permitted.
- E. Adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the Work shall be furnished by the Contractor.
- F. Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipes, branch connections to main sewers, or main drains, the obstruction shall be permanently supported, relocated, removed, or reconstructed by the Contractor in cooperation with owners of such utility structures.

#### 3.04 HANDLING

- A. Handling of the PVC pipe shall be done with care to ensure that the pipe is not damaged in any manner during storage, transit, loading, unloading, and installation.
- B. Pipe shall be inspected both prior to and after installation in the ditch and all defective lengths shall be rejected and immediately removed from the working area.

#### 3.05 FIELD JOINTING

- A. Each pipe compression type joint shall be joined with a lock-in rubber ring and a ring groove that is designed to resist displacement during pipe insertion.
- B. The ring and the ring seat inside the bell shall be wiped clean before the gasket is inserted. At this time a thin film of lubricant shall be applied to the exposed surface of the ring and to the outside of the clean pipe end. Lubricant other than that furnished with the pipe shall not be used. The end of the pipe shall be then forced into the ring to complete the joint.
- C. The pipe shall not be deflected either vertically or horizontally in excess of the printed recommendations of the manufacturer of the coupling.
- D. When pipe laying is not in progress, the open ends of the pipe shall be closed to prevent trench water from entering pipe. Adequate backfill shall be deposited on pipe to prevent floating of pipe. Any pipe which has floated shall be removed from the trench, cleaned, and relaid in an acceptable manner. No pipe shall be laid when, in the opinion of the Owner, the trench conditions or weather are unsuitable for such Work.

### 3.06 INSTALLATION OF BENDS, TEES, AND REDUCERS

- A. Cast-iron and PVC fittings shall be installed Utilizing standard installation procedures. Fittings shall be lowered into trench by means of rope, cable, chain, or other acceptable means without damage to the fittings. Cable, rope, or other devices used for lowering fitting into trench, shall be attached around exterior of fitting for handling. Under no circumstances shall the cable, rope or other device be attached through the fitting's interior for handling. Fittings shall be carefully connected to pipe or other facility, and joint shall be checked to insure a sound and proper joint.

### 3.07 PIPE-TO-PIPE CONNECTIONS

- A. Pipe-to-pipe connections shall be made by using flexible banded, sheer reinforced couplings or adapter couplings, each with compression joints, in compliance with ASTM C 425.

### 3.08 PIPE-TO-PIPE MANHOLE CONNECTIONS

- A. When a sound pipe stub-out exists at a manhole to which connection is to be made, a pipe-to-pipe connection shall be made as described above. If a stub-out is not present or is faulty, an opening shall be cut in the manhole wall and the connection made. The connection shall consist of a pipe stub-out with elastomeric waterstop grouted into the opening with non-shrink grout. A flexible band coupling, as shown on the details for new manholes, shall join the pipe stub-out to the replacement pipe. The invert or floor inside the manhole shall be cut and reshaped as necessary.

### 3.09 GRAVITY SEWER SERVICE LATERALS

- A. Lateral sewers shall be installed in accordance with all the applicable requirement for pipe installation. Branch fittings shall be installed in the main line sewer as it is constructed, in the locations and configuration of the original laterals or as designated by the Owner.
- B. The existing laterals shall be hand excavated to a joint, saw cut, clean and square and the appropriate adapter installed to connect the replacement laterals. Care shall be taken to maintain the slopes of the existing laterals. The laterals shall be removed and replaced from the main line to a point along the existing lateral as determined by the Owner to be in acceptable condition.
- C. The Contractor shall not excavate trenches for laterals on both sides of the street at the same time unless written permission has been secured in advance to close the street.
- D. Placement of bedding / cover materials in the trench shall be the same for laterals as provided in Section 02222 - Excavation and Backfill for Utilities.

### 3.10 TESTING

- A. Field testing of gravity sewer pipe shall conform to the requirements of Section 15995, "Pipeline Testing and Disinfection".

- END OF SECTION -

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SECTION 15009

PVC PRESSURE PIPE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish and install 4-inch to 12-inch polyvinyl chloride (PVC) pressure pipeline, complete in place, all in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 15000 – Piping and Fittings, General.
- B. Section 15995 - Pipeline Testing and Disinfection.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards:

ANSI/AWWA C104/A21.5	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
ANSI/AWWA C110/A21.10	Ductile-iron and Gray-Iron Fittings 3-in. Through 48-in. for Water and Other Liquids
ANSI/AWWA C111/A21.11	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
ANSI/AWWA C600	Installation of Ductile-Iron Water Mains and Appurtenances
ANSI/AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe 4-in. Through 12-in. for Water and Sewer Force Main
ASTM D 2584	Test Method for Ignition Loss of Cured Reinforced Resins
PPI Technical Report TR 3/4	Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials
AWWA Manual M23	PVC Pipe - Design and Installation

1.04 SUBMITTALS

- A. Shop Drawings: The Contractor shall submit shop drawings of pipe, fittings, and appurtenances in accordance with the requirements in Section 01300, "Submittals".
- B. Certifications: The Contractor shall furnish a certified affidavit of compliance for all pipe and other products, or materials furnished under this Section of the Specifications, as specified in the referenced standards and the following supplemental requirements:

1. Hydrostatic proof test reports.
  2. Sustained pressure test reports.
  3. Burst strength test reports.
- C. All expenses incurred in making samples for certification of tests shall be borne by the Contractor.

#### 1.05 QUALITY ASSURANCE

- A. Tests: Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of this Section of the Specifications, as specified in the referenced standards, as applicable.
- B. In addition to those tests specifically required, the Owner may request additional samples of any material for testing.

### PART 2 -- PRODUCTS

#### 2.01 GENERAL

- A. PVC pressure pipe (4 inch through 12 inch) shall conform to the applicable requirements of ANSI/AWWA C900 and subject to additional requirements specified herein.

#### 2.02 PIPE

- A. The pipe shall be of the diameter and pressure class specified or shown, shall be furnished complete with rubber gaskets, and all specials and fittings shall be provided as required in the Contract Documents. The dimensions and pressure classes of PVC pressure pipe with Cast-Iron Pipe Equivalent O.D.'s shall be DR 18, Class 150, and shall conform to the requirements of AWWA C900. Pipe shall be made from Class 12454-A or 12454-B virgin compounds conforming to ASTM D1784, and shall be free from voids, cracks, inclusions, and other defects.
- B. Additives and Fillers: Unless otherwise provided in alternate qualification procedures of PPI-TR3, compounds which have a Hydrostatic Design Basis (HDB) of 4000 psi at 73.4 degrees F for water shall not contain additives and fillers that exceed the recommended values in Table 1, Part Y of PPI-TR3 (e.g., allowable content range for calcium carbonate is 0.0-5.0 parts per hundred of resin). If requested by the Owner, the additive and filler content shall be determined using the pyrolysis method as specified in ASTM D 2584.
- C. Joints: A gasket push-on joint for PVC pipe shall be provided with each length of pipe. Joints shall show no sign of leakage when tested in accordance with ASTM D3139. Gaskets shall be rubber and manufactured to conform to the requirements of ASTM F477. Where required, restrained joint retainer glands shall be used on PVC pipes. Glands shall be ductile iron conforming to ASTM A536 and meet all requirements of mechanical joint bell conforming to ANSI/AWWA A21.11/C111 and ANSI/AWWA A21.53/C153. The restraining

glands shall have a pressure rating equal to that of the PVC pipe on which it is used. The restraining glands shall be Ebba Iron, Inc., Megalug 2000 series, or equal.

- D. Joint Deflection: Deflection at the joint shall not exceed 1.5 degrees or one half the maximum deflection recommended by the manufacturer. No deflection of the joint shall be allowed for joints which are overbelled or not belled to the stop mark.

## 2.03 FITTINGS

- A. PVC fittings shall be pressure Class 150 polyvinyl chloride (PVC) fittings with push-on rubber gasketed joints. The fittings shall have an outside diameter conforming to the dimensions of cast-iron pipe, and with dimension ratios (DR) of 18 (Class 150) as described in ANSI/AWWA C900. The fittings shall conform to AWWA C907 standard.
- B. Each fitting shall be clearly labeled to identify its size and pressure class.

## PART 3 -- EXECUTION

### 3.01 GENERAL

- A. All laying, jointing, testing for defects and for leakage shall be performed in the presence of the Owner, and shall be subject to his acceptance. All material found during the progress to have defects will be rejected and the Contractor shall promptly remove such defective materials from the site of the work.
- B. Installation shall conform to the requirements of AWWA M23, instructions furnished by the pipe manufacturer, and to the supplementary requirements or modifications specified herein. Wherever the provisions of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.

### 3.02 HANDLING AND STORAGE

- A. Handling: Pipe, fittings and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings or any other material be dropped or dumped into trenches.
- B. Storage: Pipe should be stored, if possible, at the job site in unit packages provided by the manufacturer. Caution should be exercised to avoid compression damage or deformation to bell ends of the pipe. Pipe should be stored in such a way as to prevent sagging or bending and protected from exposure to direct sunlight by covering with an opaque material while permitting adequate air circulation above and around the pipe. Gaskets should be stored in a cool, dark place out of the direct rays of the sun, preferably in original cartons.

### 3.03 TRENCHING AND BACKFILL

- A. Trench excavation and backfill shall conform to the requirements of Section 02222, "Excavation and Backfill for Utilities", and as specified herein.

### 3.04 INSTALLATION

- A. Bell-and-spigot pipe shall be laid with the bell end pointing in the direction of laying. Pipe shall be graded in straight lines, taking care to avoid the formation of any dips or low points. Pipe shall not be laid when the conditions of trench or weather are unsuitable. At the end of each day's work, open ends of pipe shall be closed temporarily with wood blocks or bulkheads.
- B. Pipe shall be supported at its proper elevation and grade; care being taken to secure firm and uniform support. Wood support blocking will not be permitted. The full length of each section of pipe and fittings shall rest solidly on the pipe bed, with recessed excavation to accommodate bells, joints and couplings. Anchors and supports shall be provided where necessary and where indicated on the Drawings for fastening work into place. Fittings shall be independently supported.
- C. Short lengths of pipe shall be used in and out of each rigid joint or rigid structure. Piping that does not allow sufficient space for proper installation of jointing material shall be replaced by one of proper dimensions. Blocking or wedging between bells and spigots will not be permitted.
- D. Joints shall be installed according to manufacturer's recommendations. Trenches shall be kept free of water until joints have been properly made. The maximum combined deflection at any coupling shall be in accordance with the manufacturer's recommendations.
- E. Pipe shall be cut by means of saws, power driven abrasive wheels or pipe cutters, which will produce a square cut. No wedge-type roller cutters will be permitted. After cutting, the end of the pipe shall be beveled using a beveling tool, portable type sander or abrasive disc.

### 3.05 FIELD TESTING

- A. Field testing shall conform to the requirements of Section 15995, "Pipeline Testing and Disinfection".

- END OF SECTION -

SECTION 15019

MISCELLANEOUS PIPING

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish and install all exposed and buried mill piping as shown and specified, complete, including polyethylene tubing, copper tubing, solvent-welded PVC pipe, fittings, gaskets, bolts, insulating connections, and such other specialties as required for a complete and operable piping system in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 0222 - Excavation and Backfill for Utilities
- B. Section 15000 – Piping and Fittings, General.
- C. Section 15995 - Pipeline Testing and Disinfection

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Commercial Standards:

ANSI/ASME B1.20 1	Pipe Threads, General Purpose (inch)
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings
ASTM B 584	Specification for Copper Alloy Sand Castings for General Applications
ASTM D 2000	Classification System for Rubber Products in Automotive Applications
ASTM D-1248	Polyethylene Plastics Molding and Extrusion Materials
AWWA C 901	Polyethylene (PE) Pressure Pipe and tubing, ½" through 3" for Water Service

1.04 SUBMITTALS

- A. For the materials and equipment items supplied under the provisions of this Section, the Contractor shall submit copies of the manufacturer's product specifications and performance details according to the requirements of Section entitled "Submittals."

## 1.05 QUALITY ASSURANCE

- A. Tests: Except where otherwise specified, all material used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards.
- B. Certificates: Manufacturer's notarized certificates of compliance shall be furnished by the Contractor.
- C. The pipe shall be subjected to the specified hydrostatic strength tests, flexure tests, and crushing tests. The crushing tests shall be made on samples taken from the center of full-length sections of pipe.

## 1.06 CLEANUP

- A. In addition to the requirements of Section entitled "Project Closeout", the Contractor, upon completion of backfilling and grading over trenches shall remove all excess materials and equipment from the site.

## PART 2 – PRODUCTS

### 2.01 COPPER TUBING

- A. Copper tubing shall conform to the requirements of ASTM B 88 and shall be Type K, soft temper for buried tubing and hard-drawn for above-ground application. Fittings shall be soldered or sweated on and shall be of wrought copper to ANSI B16.22. Soldered joints shall contain 95-percent tin and 5-percent antimony. No solders or fluxes containing more than 0.2 percent of lead shall be used.

### 2.02 PVC (POLYVINYL CHLORIDE) PRESSURE PIPE, SOLVENT-WELDED

- A. PVC pipe shall be made from all new rigid unplasticized polyvinyl chloride and shall be Normal Impact Class 12454-B, Schedule 80 to conform to ASTM D 1785, unless otherwise shown. Schedule 40 PVC pipe shall be used for piping sleeves under pavement, as shown on the drawings. Elbows and tees shall be of the same material as the pipe. Unless otherwise shown, joint design shall be for solvent-welded construction.

### 2.03 COMPRESSIONS COUPLINGS

- A. Compression couplings shall be provided for connections of the new service connection piping at the corporation stop, angle key meter valve branch assembly, pipe joints, and the service meter. The compression couplings shall be of similar material to the meter or pipe and shall be of the sizes to fit the pipe and fittings. The compression coupling shall have stainless steel clamp or set screws, pack joint nut with beveled gasket and a gap for adjustability. Compression couplings shall be Pack Joint Couplings as manufactured by Ford Meter Box Company or equal. Meter couplings shall be model C38-23-2.5 as manufactured by Ford Meter Box Company, or equal.

### 2.04 PIPE THREADS

- A. All pipe threads shall be in accordance with ANSI/ASME B1.20.

## 2.05 POLYETHYLENE TUBING

- A. The polyethylene compound from which the tubing is made shall be an ethylene hexene copolymer and shall comply with the applicable requirements as specified in ASTM D3350 providing a cell classification of 355434C and simultaneously be as specified in ASTM D1248 for Type 111 Category 5, Grade P34, Class C, PE3408 very high molecular weight, high density polyethylene plastic material.
- B. Polyethylene tubing shall have a working pressure at 200 PSI at 73.4 degrees F.
- C. All tubing furnished under these specifications shall conform to the following standards:
  - 1. AWWA C-901, ASTM D2239, ASTM D2737, ASTM D3350, ASTM D1248, ASTM F1248, ASTM D1693, ASTM D2837, and ASTM D3140.
- D. Tubing dimensions and tolerances shall conform to the following requirements:
  - 1. Polyethylene tubing surfaces shall be mirror smooth and shall be free from bumps and irregularities. Materials must be completely homogenous and uniform in appearance.
- E. Tubing dimensions and tolerances shall correspond with the values listed in AWWA C901 with a dimension ratio (DR) of 9.
- F. Tubing shall be fully labeled at intervals of not more than 5 feet with brand name and manufacturer, the nominal size, PE 3408, the word "Tubing" and DR9, PC200, AWWA C901, and the seal, or mark, of the testing agency.

## 2.06 HIGH DENSITY POLYETHYLENE PIPE

- A. General: High density polyethylene pipe shall be used for sewer replacement by pipe bursting.
- B. The materials of the replacement pipe shall be PE 3408 High Density Polyethylene (HDPE) pipe and conform to requirements of ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-PR) based on outside diameter, ASTM D1248, ASTM D3350 - Cell Classification PE 345434C. Sizes of the insertions to be used shall be such to increase to or renew as indicated on the Drawings. All pipe shall be made of virgin material. No rework except that obtained from the manufacturer's own production of the same formulation shall be used. The pipe shall be homogenous throughout and shall be free of visible cracks, holes, foreign material, blisters, or other deleterious faults. The minimum wall thickness of the polyethylene pipe shall have SDR 17 for gravity sewer installation and SDR 11 for force main installation, or as directed otherwise by the Owner.
- C. The replacement pipe shall be 1100 Series Driscopipe, SDR17 with 100 psi pressure rating for gravity sewer, and 1000 Series Driscopipe, SDR 11 with 160 psi pressure rating for force main, as manufactured by Philips 66, or equal.
- D. The inside diameter of the replacement pipe for gravity sewer shall be color coded and equivalent to the soft white Driscopipe Opticore pipe, or equal.

### **PART 3 – EXECUTION**

#### **3.01 INSTALLATION**

- A. **Couplings:** Pipe couplings shall be installed in strict accordance with the manufacturer's printed recommendations, using the correct style coupling and gasket for any given application.
  
- B. **Plastic Pipe:** PVC pipe joints shall be solvent-welded in accordance with the manufacturer's instructions. Expansion joints or pipe bends shall be provided to absorb pipe expansion over a temperature range of 100 degrees F, unless otherwise shown. Care shall be taken to provide sufficient supports, anchors, and guides, to avoid stress on the piping. The Contractor shall obtain the services of the pipe supplier, to instruct the pipe fitters in the correct way of making solvent welded joints. Only clean, fresh solvent shall be used at any time.

- END OF SECTION -

SECTION 15100

VALVES, GENERAL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall provide all tools, supplies, materials, equipment, and labor necessary for furnishing, epoxy coating, installing, adjusting, and testing of all valves and appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents. Where buried valves are shown, the Contractor shall furnish and install valve boxes to grade, with covers, extensions, and position indicators.
  
- B. The provisions of this Section shall apply to all valves and valve operators specified in the various Sections of these Specifications except where otherwise specified in the Contract Documents. Valves and operators in particular locations may require a combination of units, sensors, limit switches, and controls specified in other sections of these Specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 15000 – Piping and Fittings, General.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards:

ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys.
ANSI B16.21	Nonmetallic Flat Gaskets for Pipe Flanges
ANSI B18.21	Square and Hex Bolts and Screws - Inch Series
ANSI/ASME B1.20.1	General Purpose Pipe Threads (Inch).
ASTM A 48	Specification for Gray Iron Castings.
ASTM A 126	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
ASTM A 536	Specification for Ductile Iron Castings.
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings.
ASTM B 584	Specification for Copper Alloy Sand Castings for General Applications.
AWWA C550	Protective Interior Coatings for Valves and Hydrants.

#### 1.04 SUBMITTALS

- A. Shop Drawings: Shop drawings of all valves and operators including associated wiring diagrams and electrical data, shall be furnished as specified in Section 01300, "Submittals".

#### 1.05 QUALITY ASSURANCE

- A. Valve Testing: Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.
- B. Bronze Parts: Unless otherwise specified, all interior bronze parts of valves shall conform to the requirements of ASTM B 62, or, where not subject to disinfection, to ASTM B 584.

### PART 2 -- PRODUCTS

#### 2.01 VALVES

- A. General: The Contractor shall furnish all valves, stem extensions, and other accessories as shown or specified. All valves shall be new and of current manufacture. All valves shall have a minimum design pressure rating of 150 psi and capable of a test pressure of 300 psi. For service applications with pressures in excess of 150 psi, valves shall have a minimum pressure rating in excess of the service application working pressure.
- B. Cast iron parts of valves shall meet the requirements of ASTM A 126, "Standard Specifications for Grey Iron Castings for Valves, Flanges and Pipe Fittings, Class "B"". Flanged ends shall be flat-faced and have bolt circle and bolt patterns conforming to ANSI B16.1 Class 125 unless otherwise specified hereinafter.
- C. All castings shall be clean and sound, without defects of any kind and no plugging, welding or repairing of defects will be permitted. All bolt heads and nuts shall be hexagonal conforming to ANSI B18.2.1. Gaskets shall be full face and made of natural or synthetic elastomers in conformance with ANSI B16.21 suitable for the service characteristics, especially chemical compatibility and temperature. Nonferrous alloys of various types shall be used for parts of valves as specified. Where no definite specification is given, the material shall be the recognized acceptable standard for that particular application.
- D. All buried valves shall be provided with cast-iron valve boxes unless otherwise indicated. The boxes shall be asphalt varnished, or enameled cast iron, adjustable to grade, and installed perpendicularly, centered around and covering the upper portions of the valve or valve operator, or the pipe. The top of each valve box shall be placed flush with finish grade unless otherwise indicated by the Owner. Valve boxes shall be as specified elsewhere in this Section.
- E. Valve Flanges: The flanges of valves shall be in accordance with Section 15000, "Piping and Fittings, General".
- F. Gate Valve Stems: Where subject to dezincification, gate valve stems shall be of bronze to ASTM B 62, containing not more than 5 percent of zinc nor more than 2 percent of aluminum. Where dezincification is not a problem, bronze to ASTM B 584 may be used.

For valve stems with a minimum tensile strength of 60,000 psi, a minimum yield strength of 40,000 psi, and an elongation of at least 10 percent in 2 inches, as determined by a test coupon poured from the same ladle from which the valve stems to be furnished are poured.

- G. Protective Coating: Except where otherwise specified, ferrous surfaces, exclusive of stainless-steel surfaces, in the water passages of all valves 4 inch and larger, as well as the exterior surfaces of all submerged valves, shall receive a fusion-bonded epoxy coating in accordance with AWWA C550. Flange faces of valves shall not be epoxy coated. The Contractor, through the valve manufacturer, shall certify in writing that such coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with these Specifications.
- H. Valve Operators: All operators, unless otherwise specified, shall turn counter-clockwise to open. Buried valves shall have extensions with square nuts unless otherwise shown or specified, valves of sizes 4 inch and larger shall have gear-assisted operators.

## 2.02 VALVE BOXES

Valve boxes shall be of adjustable type, cast iron, suitable to withstand heavy traffic. Brand and Model types shall be per City of Boca Raton Shop Drawing Submittals & Approved Utility product List or approved equal. The covers shall be marked "WATER", "RAW WATER", "SEWER" or "REUSE" as appropriate. Bases shall be round type. The stem of a buried valve shall be within 12" of finished grade unless otherwise specified by the Owner. All links shall be locking type. Blue/white flat reflective marker shall be used to identify valve box location. Valve boxes shall be located in right of way (r/w) and/or located in utility easement. Boxes shall be coated with asphalt. Boxes shall be set 24" x 24" x 4" thick concrete pad at each valve box with one (1) No. 3 continuous and have a 3" bronze valve identification disc anchored in the concrete in accordance with City standard details.

## PART 3 -- EXECUTION

### 3.01 VALVE INSTALLATION

- A. General: All valves, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as shown and specified.

- END OF SECTION -

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## SECTION 15108

### GATE VALVES

#### PART 1 -- GENERAL

##### 1.01 THE REQUIREMENT

- A. The Contractor shall furnish and install gate valves, complete and operable, as shown and specified herein, including manual, electric, hydraulic, and pneumatic operators, epoxy coating, control units, and appurtenant work, all in accordance with the requirements of the Contract Documents.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 15100 - Valves, General.

#### PART 2 -- PRODUCTS

##### 2.01 GENERAL

- A. All buried valves shall be of the inside screw type. Valves shall be capable of being repacked under line pressure and shall have two-inch square nut operators. All ferrous surfaces of the valves, 4-inch and larger, which will be in contact with water shall receive a fusion-bonded epoxy coating conforming to AWWA C550.
- B. Valve Brand and Model types shall be per City of Boca Raton Shop Drawing Submittals & Approved Utility Product List or approved equal.

##### 2.02 DUCTILE IRON RESILIENT WEDGE GATE VALVES (4-INCH TO 12-INCH)

- A. Resilient seat valves shall comply with AWWA Standard C-509 and shall have the following design standards.
- B. All resilient seat valves are to be iron body, resilient seat type non-rising stem, opening left (counterclockwise). Valves shall be furnished with "O" ring packing (two "O" rings). The operating mechanism shall be for buried service with a 2-inch square operating nut.
- C. Valve disc shall be contoured to assure uniform seating.
- D. Valves shall be coated with a two-part thermosetting epoxy coating on inside of valve body and on valve disc. The valve shall have mechanical joint ends.
- E. Resilient seat valves shall have a maximum working pressure of 200 psi and be tested at 400 psi between disc seat ring and body seating surface. Seat ring seals shall be replaceable and made from internally reinforced molded natural rubber (ASTM D2000). Seat ring shall be attached to disc with stainless steel screws.
- F. No leakage will be allowable/permitted.

**PART 3 -- EXECUTION**

**3.01 INSTALLATION**

- A. All gate valves shall be installed in accordance with AWWA Standards and the Supplier's printed recommendations, and in accordance with the applicable provisions of Section entitled "Valves, General."

- END OF SECTION -

## SECTION 15109

### PLUG VALVES

#### PART 1 -- GENERAL

##### 1.01 THE REQUIREMENT

- A. The Contractor shall furnish and install plug valves, complete and operable, as required for force main bypass purposes and as specified herein including operators, protective coatings, and appurtenant work, all in accordance with the requirements of the Contract Documents.

#### PART 2 -- PRODUCTS

##### 2.01 PLUG VALVES

- A. Plug valves shall be of the non-lubricated, eccentric seating plug type with synthetic rubber-faced plugs as manufactured by DeZurik Company, Pratt, or equal. All valves shall be provided with limit stops and rotate 90° from fully open to fully shut. The minimum working pressure for all valves shall be 150 psi, and the test pressure shall be at least 270 psi for valves up through 12-inch and at least 230 psi for valves 14-inch and larger. The port area of valves shall be at least 80 percent of full pipe area for valves less than 24-inches and 70 percent for valves 24-inches and larger, unless otherwise specified. The body materials shall be of epoxy coated cast iron or semi-steel, unless specified otherwise. Seats shall have a welded overlay of 90 percent pure nickel and machined to a finish containing no stress cracks. Plug facings shall be of Hycar, or equal and completely suitable for use with domestic sewage.
- B. The shaft seal shall be either the bronze cartridge type with at least two O-Rings, monolithic V-Type, or pull-down packing type. If monolithic V-Type or pull-down packings are utilized, it shall be self-adjusting, self-compensating type. Packing shall be as manufactured by Chevron, or equal. Plug valves with pull down packings shall be designed with an extension bonnet so that repacking can be done without removal of the actuator.
- C. All buried valves shall have mechanical joint ends (unless otherwise shown), conforming to ANSI A21.11. For buried or submerged service, valve operators shall be totally enclosed, fully gasketed, grease packed and shall be designed to operate indefinitely when submerged under 20-feet of water. Buried service operators shall be provided with a valve extension stem, AWWA Standard operating nut and valve box. The operator shall clearly indicate valve position. The extension stem for buried service shall be sufficiently long to extend to within 12-inches of ground surface. Where required, valves shall be furnished with extension bonnets.
- D. Unless otherwise shown, all exposed valves 4-inches in diameter and larger shall have flanged ends conforming to ANSI B16.1-125/150-pound standard with face-to-face dimensions of standard plug valves. Valves smaller than 4-inches in diameter shall have screwed ends, unless otherwise noted.

- E. Valves 8-inches in diameter and larger shall be handwheel or floorstand operated where required or indicated on the Drawings through totally enclosed worm gear actuators, unless otherwise specified or shown on the Drawings. Valves 6-inches in diameter and smaller shall have lever operators, unless otherwise specified or noted on the Drawings. Manual operators for plug valves mounted above 6 feet from the operating floor shall be equipped with worm gear chainwheel actuators.
- F. The manufacturer shall certify that the plug valves are capable of operating in continuous duty service under these pressures and flow conditions.
- G. Each valve shall be hydrostatically tested and tested for bubble tightness after the operator has been mounted and adjusted. Copies of the hydrostatic and leakage test certification and certification of conformance shall be submitted to the Engineer prior to shipment.
- H. All internal and external ferrous components and surfaces of the valves, with the exception of stainless steel and finished or bearing surfaces, shall be shop painted with two coats (10 mils min. dry film thickness) of the manufacturer's premium epoxy for corrosion resistance. Damaged surfaces shall be repaired in accordance with the manufacturer's recommendations.

### PART 3 -- EXECUTION

#### 3.01 INSTALLATION

- A. All plug valves shall be installed in strict accordance with the manufacturer's published recommendations.
- B. Plug valves which are not to remain in place after bypass operation are completed shall be turned over to the Owner.

- END OF SECTION -

SECTION 15115

MISCELLANEOUS VALVES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall furnish and install miscellaneous valves as shown and as specified herein, complete and operable including accessories and, where designated, operators, all in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 15100 - Valves, General.

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Commercial Standards:

ANSI/AWWA C500	Standard for Gate Valves, for Water and Sewage Systems
AWWA C600	Standard for Installation of Ductile-Iron Water Mains and their appurtenances
ASTM A 123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel products
ASTM A 385	Practice for providing High-Quality Zinc Coatings (Hot-Dip)
ASTM A 395	Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
ASTM A 536	Specification for Ductile Iron Castings

PART 2 -- PRODUCTS

2.01 TAPPING VALVES, SLEEVES, AND SERVICE SADDLES

- A. Tapping Valve: Tapping valves 4 inches and larger shall comply with AWWA Standard C-509 and shall have the following design standards plus the valve port shall be free and full to allow clutter passage without interference.
- B. All valves are to be iron body, bronze mounted, double disc, nonrising stem, parallel seat type, opening left (counterclockwise). Non geared valves shall be furnished with "O" ring packing (two "O" rings). The operating mechanism shall be for buried service with a 2-inch square operating nut.
- C. The disc mechanism shall be designed so that the seating pressure is applied equally at four separate contact points near the outer edge of each disc or in the case of fully revolving

disc valves. This shall be accomplished by two flat rectangular contact strips producing an equivalent effect. The upper contact strip shall be faced with stainless steel.

- D. Tapping Sleeve: Cast iron tapping sleeves shall be of the mechanical joint type having a flat faced cast iron flange, recessed for a tapping valve. All end and side gaskets shall be totally confined. The throat section of tapping sleeves through 12-inch size shall conform to MSS-SP60. Test plug shall be provided on the outlet throat.
- E. Tapping sleeves shall be provided complete with all necessary bolts and nuts to joint or connect the two halves of the sleeve together. Bolts and nuts shall be standard steel square of hex head bolts and nuts which have been hot dip galvanized or the same as for the tapping valve as specified herein above.
- F. The tapping valve and sleeve shall be as manufactured by Mueller Co., American, or equal.

## 2.02 SERVICE SADDLES

- A. Service Saddles: Double strap service saddles shall be constructed to ductile iron bodies conforming to ASTM-A536 with nitrile butadiene rubber gaskets compounded for water and sewer service. The straps shall be Type 304 stainless steel with curvature accurately designed to fit pipe and shall have 2-inch iron thread as manufactured by Romac 202NS, Smith Blair Model 313 or approved equal. Casting shall be coated with fusion bonded black nylon. Gaskets shall be self-sealing Buna-N. Tapping saddles shall be per Romac 202N, Smith Blair 317, Total pipe Solution, Inc., Triple Tap Model T3 or approved equal.

## 2.03 CURB STOPS

- A. Curb Stops shall be brass conforming to ANSI/AWWA C800 with optional padlock wing. Curb Stops Brand and Model type shall be per City of Boca Raton Shop Drawing Submittals & Approved Utility Product List or approved equal.
- B. The end connections shall be Pack Joint (compression type) connections for copper, plastic, or iron pipe. The valve shall be available in sizes 3/4-inch through 2-inch. The valve shall turn easily and shall be brass Curb Stops per City of Boca Raton Shop Drawing Submittals & Approved Utility Product List or approved equal.

## 2.04 CORPORATION STOPS

- A. Corporation stops shall be brass ball valve type conforming to ANSI/AWWA C800. Iron pipe threads shall be by PJ/110 Compression.
- B. Corporation Stops Brand and Model types shall be per City of Boca Raton Shop Drawing Submittals & Approved utility Product List or approved equal.

## 2.05 METER VALVE/BRANCH ASSEMBLIES

- A. Meter valves shall be ball valve type and provided for connection to the service meters. Single meter service connections shall have a 3/4-inch angle ball meter valve. Double meter service connections shall have a branch and angle ball meter valve assembly for connection of the piping to the meters. The branch assembly shall have an inlet connection for a 1 1/2-inch service line and a 7 1/2-inch spacing between the centers of the angle ball meter valves at the outlets. Angle valves shall have screwed ends with bronze body and

composition disc. Single service angle ball meter valves shall be Model BA13-342W and double service angle ball meter valve/branch assembly shall be Model UVB43-62W as manufactured by Ford Meter Box Company or approved equal.

## 2.06 DRY-BARREL FIRE HYDRANTS

- A. All fire hydrants shall comply with AWWA Standards C 502 thereof and the following design standards.
- B. Fire hydrants shall be of the compression type, opening against the pressure and closing with the line pressure with a 5 1/4-inch minimum valve opening. The hydrant shall be equipped with two 2 1/2-inch hose and one 4 1/2-inch steamer nozzles to meet the American National Standard hose thread.
- C. Hydrants shall be furnished with a sealed oil or grease reservoir located in the bonnet so that all threaded and bearing surfaces are automatically lubricated when the hydrant is operated. The hydrant will be designed for disassembly by use of a short disassembly wrench or the hydrant shoe having integral cast tieback lugs on the main valve to permit the main valve assembly and valve seat to be removed without digging earth or disassembling the hydrant barrel.
- D. Hydrants shall be furnished with a breakable feature that will break cleanly upon impact. This shall consist of a two-part breakable safety flange with a breakable stem coupling. The upper and lower barrels shall be fluted and ribbed above and below the safety flange or have an extra strength lower barrel.
- E. The hydrant internal valve shall be 5 1/4-inch minimum. The pentagonal operating nuts and the cap nuts shall be 1 1/2-inch point to flat. Drain valve outlets shall be plugged or omitted. The hydrants shall open counterclockwise, and the direction of opening shall be cast on the top.
- F. The bury length measured from the bottom of the connecting pipe to the ground line at the hydrant, shall be 3 feet 6 inches bury (Minimum).
- G. The hydrant shall be equipped with a 6-inch mechanical joint base inlet unless otherwise specified by the OWNER.
- H. Fire hydrant spacing and flow requirements shall conform to the latest requirements of the Broward County Fire Marshal standards, plus the requirements of any local fire department having jurisdiction.
- I. Fire hydrant shall be painted with a reflective type paint and glass beads all in accordance with N.F.P.A. #291 and the requirements of the County Fire Marshal standards and any local fire department having jurisdiction.
- J. Raised reflective pavement marker in blue shall be used to identify the fire hydrant location. The placement of the reflector to be at the center line of the outside roadway lane unless otherwise directed by the Fire Marshal.
- K. Chains are to be removed.

- L. All above grade portions shall be painted with Factory Silver. Fire hydrants shall have a 250-psi working pressure. Fire hydrant Brand and Model types shall be per City of Boca Raton Shop Drawing Submittals & Approved Utility Product List or approved equal.

#### 2.07 MEGATAPE

- A. Megatape and locating metal wire shall be buried 18 inches below finished grade over the water main and sewage force mains or service lines on PVC pipe (no exceptions).

#### 2.08 SEWAGE AIR AND VACUUM/PRESSURE AIR RELEASE VALVES

- A. Sewage air and vacuum/pressure air release valve assemblies shall be installed at all the locations specified herein or indicated on the Drawings and shall be installed complete with all appurtenant piping and valves as required for a complete and operable installation. The valves shall be constructed of cast iron with stainless steel float, and all working parts shall be bronze, brass, stainless steel, or other corrosion resistant material. The valves shall be designed for a minimum working pressure of 150 psi and a test pressure of 300 psi. The valves shall include isolation valve and backflushing attachments which shall consist of blow-off valves, quick disconnect couplings, and a minimum of 5 feet of rubber hose suitable for backflushing without dismantling the valve. All air and vacuum valves shall be provided with "soft seating" material to provide drip tight closure at 1 to 65 psig. The exhaust from the valve shall be piped to a suitable disposal point. All valves 1-inch diameter and larger shall have a 1/4-inch min. diameter drain plug.
- B. The pressure air release valves shall have a 2-inch (minimum) threaded connection.
- C. All internal and external ferrous components and surfaces of the valves, with the exception of stainless steel and finished or bearing surfaces, shall be shop painted with two coats (10 mils min. dry film thickness) of the manufacturer's premium epoxy for corrosion resistance. Damaged surfaces shall be repaired in accordance with the manufacturer's recommendations.
- D. The air and vacuum valves and pressure air release valves shall be per City of Boca Raton Shop Approved Utility Product List or approved equal.

### PART 3 – EXECUTION

#### 3.01 INSTALLATION

- A. All valves shall be installed in accordance with the manufacturer's printed recommendations.

#### 3.02 TAPPING VALVES

- A. Taps shall not be made within four feet of an existing bell.

#### 3.03 HYDRANT INSTALLATION

- A. All fire hydrants shall be installed in strict accordance with the manufacturer's published recommendations, AWWA Standards, and all applicable codes, and the applicable provisions of Section entitled, "Valves, General." All installations shall be to the satisfaction of the local fire and building department.
- B. All hydrant isolating valves with slip joints, friction type, or caulked joint connections shall be harnessed to the main pipe by means of welded steel harness sets, or clamps and steel rods, designed for this purpose. Dry barrel fire hydrants shall be set on a bed of pea gravel not less than 18 inches deep and 3 feet square, for drainage, or as required by local regulations and conditions.

- END OF SECTION -

SECTION 15995

PIPELINE TESTING & DISINFECTION

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall perform flushing and testing of all pipelines and appurtenant piping, complete, including conveyance of test water to point of use and all disposal thereof, all in accordance with the requirements of the Contract Documents. The cost of all testing, including the water shall be borne by the Contractor.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

ANSI/AWWA C600                      Standard for installation of Ductile-Iron Water Mains and their appurtenances.

ANSI/AWWA C651                      Standard for Disinfecting Water Mains

1.03 SUBMITTALS

- A. A testing schedule, including proposed plans for water conveyance, control and disposal shall be submitted in writing for review a minimum of 48 hours before testing is to start.

PART 2 – PRODUCTS

2.01 MATERIALS REQUIREMENTS

- A. All test equipment, temporary valves or bulkheads, or other water control equipment and materials shall be determined and furnished by the Contractor subject to the Owner's review. No materials shall be used which would be injurious to the construction or its future function.

PART 3 – EXECUTION

3.01 GENERAL

- A. All DIP pressure pipelines and PVC pressure pipelines shall be tested in accordance with ANSI/AWWA C600 and ANSI/AWWA C900, respectively. All testing operations shall be performed in the presence of the Owner.

3.02 HYDROSTATIC TESTING OF PIPELINES

- A. Water Service: Prior to hydrostatic testing, all pipelines shall be cleaned with a poly pig cleaning system. The Contractor shall test all pipelines either in sections or as a unit. The

test shall be made by closing valves when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water. The Contractor shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. No section of the pipeline shall be tested until all field-placed concrete or mortar have attained an age of 14 days. Care shall be taken to see that all air vents are open during filling.

- B. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the air valves at a reasonable velocity and all the air within the pipeline shall be properly purged. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb what water it will and to allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the Owner shall be taken.
- C. The hydrostatic test shall consist of holding the test pressure on the pipeline for a period of 2 hours. The pipeline can be tested in 1000-foot sections maximum. The test pressure for water mains shall be at 150 psi and 100 psi for force mains, measured at the lowest point of the pipeline section being tested. All visible leaks shall be repaired in a manner acceptable to the Owner.
- D. The maximum allowable leakage for pipelines shall be 20 U.S. gallons per inch of diameter per mile of pipe per 24 hours for pipe with 20-ft or less joint lengths and with rubber-gasketed joints. The maximum allowable leakage shall be based upon the following formula:

$$L = \frac{(S) (D) [(P)]^{1/2}}{148,000}$$

In which,

- L = Allowable Leakage, Gallons per Hour
- S = Total Length of Pipe Being Tested, In Feet
- D = Nominal Inside Pipe Diameter, In Inches
- P = Average Test Pressure, In PSI Gauge

In the case of pipelines that fail to pass the prescribed leakage test, the Contractor shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines.

- E. Disinfection of Potable Water Lines: Before being placed in service, all new water mains and repaired portions of, or extension to existing mains shall be disinfected. Disinfection shall be done in accordance with the provisions of AWWA Standard C651.
- F. The basic disinfection procedure consists of:
  1. Preliminary flushing according to Section 5.2.2 of AWWA C600.
  2. Chlorine application according to Section 5.2.3 of AWWA C651.

3. Final flushing according to Section 6.1 and 6.2 of AWWA C651.
  4. Bacteriological testing according to Standard Methods for Examination of Water and Wastewater.
  5. Repeat procedure (if necessary).
- G. Disinfection of water mains shall be considered as incidental to the work of constructing the water main and all costs thereof shall be included in the unit contract price per linear foot for pipe installation.
- H. Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the Contractor until satisfactory results are obtained. Failure by the Contractor to get a satisfactory test shall be considered as failure of the Contractor to keep the pipe clean during construction, or to properly chlorinate the main, and no additional payment will be made for reflushing and rechlorinating until a satisfactory test is made.

### 3.03 CONNECTIONS TO EXISTING SYSTEM

- A. Where connections are to be made to an existing potable water system, the interior surfaces of all pipe and fittings used in making the connections shall be swabbed or sprayed with a one percent hypochlorite solution before they are installed. Thorough flushing shall be started as soon as the connection is completed and shall be continued until discolored water is eliminated.
- B. Prior to actual connections to the existing potable water system, record drawings, hydrostatic pressure test results, and bacterial test results shall be submitted to the Owner. Upon approval from the County Public Health Department, the connection can be constructed.

- END OF SECTION -