

**SECTION 02500
GRAVITY SANITARY SEWERS**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Gravity sanitary sewers and appurtenances, including stacks and service connections.
- B. All connections to existing manholes shall be cored, no exceptions. Resilient connectors shall be supplied and used for all connections to manholes, new or existing.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
 - 1. Payment for gravity sanitary sewers by open-cut or within Potentially Petroleum Contaminated Area (PPCA) is on a linear foot basis, complete in place, including sewer pipe, connections to existing manholes, post-installation television inspection and testing. Measurement shall be taken along centerline of pipe from centerline to centerline of manholes.
 - 2. Payment for television inspection of existing gravity sanitary sewer shall be on a linear foot basis. Measurement shall be taken along centerline of pipe from centerline to centerline of manholes. See Section 02520 – Television Inspection of Sanitary Sewer Lines.
 - 3. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
 - 1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

1.3 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit proposed methods, equipment, materials and sequence of operations for sanitary sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.
- C. Test Reports: Submit test reports and inspection videos as specified in Part III of this Section. DVD's become property of the City.

1.4 QUALITY ASSURANCE

- A. Qualifications: Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections. Perform testing in accordance with Section 02525 – Acceptance Testing for Gravity Sanitary Sewers Lines.
- B. Regulatory Requirements.

1. Install sanitary sewer lines to meet minimum separation distance from potable water line, as scheduled below. Separation distance is defined as the distance between outside of water pipe and outside of sanitary sewer pipe. When possible, install new sanitary sewers no closer to water lines than nine feet (9 Ft) in all directions. Where this separation distance cannot be achieved, new sanitary sewers shall be installed as specified in this Section.
2. Make notification to the Project Manager when water lines are uncovered during sanitary sewer installation where the minimum separation distance cannot be maintained. The Project Manager shall prescribe the method to protect water lines from sanitary sewer lines.
3. Lay gravity sewer lines in straight alignment and grade.

1.5 PRODUCT DELIVERY, STORAGE and HANDLING

- A. Inspect pipe and fittings upon arrival of materials at job site.
- B. Handle and store pipe materials and fittings to protect them from damage due to impact, shock, shear or free fall. Do not drag pipe and fittings along ground. Do not roll pipe unrestrained from delivery trucks.
- C. Use mechanical means to move or handle pipe. Employ acceptable clamps, rope or slings around outside barrel of pipe and fittings. Do not use hooks, bars or other devices in contact with interior surface of pipe to lift or move lined pipe.

1.6 REFERENCES

- A. CTFS – City of Friendswood Technical Specifications.

PART II: PRODUCTS

2.1 PIPE

- A. Provide piping materials for gravity sanitary sewers of sizes and types indicated on the Drawings or as specified.
- B. Unlined reinforced concrete pipe shall not be used for gravity sanitary sewer.

2.2 PIPE MATERIAL SCHEDULE

- A. Unless otherwise shown on the Drawings, use pipe materials that conform to requirements specified in one (1) or more of following Sections:
 1. Section 02215 – Ductile Iron Pipe (DIP) and Fittings.
 2. Section 02220 – High Density Polyethylene Pipe (HDPE).
 3. Section 02235 – Polyvinyl Chloride Pipe (PVC).
- B. Where shown on the Drawings, provide pipe meeting minimum class, dimension ratio or other criteria indicated.
- C. Pipe materials other than those listed above shall not be used for gravity

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sanitary sewers.

2.3 APPURTENANCES

- A. Stacks: Conform to requirements of Section 02505 – Sanitary Sewer Service Stub-outs or Reconnections.
- B. Service Connections: Conform to requirements of Section 02505 – Sanitary Sewer Service Stub-outs or Reconnections.
- C. Roof, street or other type of surface water drains shall not be connected or reconnected into sanitary sewer lines.

2.4 BEDDING, BACKFILL and TOPSOIL MATERIAL

- A. Bedding and Backfill: Conform to requirements of Section 02125 – Excavation and Backfill for Utilities, Section 02140 – Utility Backfill Materials and Section 02145 – Cement-Stabilized Sand.
- B. Topsoil: Conform to requirements of Section 02905 – Topsoil.

PART III: EXECUTION

3.1 PREPARATION

- A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction shall affect traffic. Conform to requirements of Section 01555 – Traffic Control and Regulation.
- B. Provide barricades, flashing warning lights and warning signs for excavations. Conform to requirements of Section 01555 – Traffic Control and Regulation. Maintain barricades and warning lights where work is in progress or where traffic is affected by work.
- C. Perform the Work in accordance with OSHA standards. Employ trench safety system as specified in Section 02280 – Trench Safety System for excavations over five feet (5 Ft) deep.
- D. Immediately notify agency or company owning any utility line which is damaged, broken or disturbed. Obtain approval from the Project Manager and agency or utility company for repairs or relocations, either temporary or permanent.
- E. Remove old pavements and structures including sidewalks and driveways in accordance with requirements of Section 02105 – Removing Existing Pavements and Structures.
- F. Install and operate dewatering and surface water control measures in accordance with Section 01585 – Control of Ground and Surface Water.
- G. Do not allow sand, debris or runoff to enter sanitary sewer system.

3.2 DIVERSION PUMPING

- A. Install and operate required bulkheads, plugs, piping and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. Obtain approval for diversion pumping equipment and procedures from the Project Manager.

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- B. Design piping, joints and accessories to withstand twice the maximum system pressure or fifty pounds per square inch (50 psi), whichever is greater.
- C. No sewage shall be diverted into area outside of sanitary sewer.
- D. In event of accidental spill or overflow, immediately stop overflow and take action to clean up and disinfect spillage. Promptly notify the Project Manager so that required reporting can be made to Texas Commission on Environmental Quality (TCEQ) by the Project Manager or the City.

3.3 EXCAVATION

- A. Earthwork: Conform to requirements of Section 02125 – Excavation and Backfill for Utilities. Use bedding as indicated on the Drawings.
- B. Line and Grade: Establish required uniform line and grade in trench from benchmarks identified by the Project Manager. Maintain this control for minimum of one hundred feet (100 Ft) behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of the Work. Use of appropriately sized grade boards which are substantially supported is also acceptable. Protect boards and location stakes from damage or dislocation.
- C. Trench Excavation: Excavate pipe trenches to depths shown on the Drawings and as specified in Section 02125 – Excavation and Backfill for Utilities.

3.4 PIPE INSTALLATION BY OPEN CUT

- A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.
- B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed and trench has been approved by the Project Manager.
- C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.
- D. Install pipe with spigot ends toward the downstream end of flow such that water flows out of the spigot and into the bell.
- E. Form concentric joint with each section of adjoining pipe so as to prevent offsets.
- F. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe.
- G. Provide lubricant, place and drive home newly laid sections of pipe with come-along winches so as to eliminate damage to pipe. Install pipe to "home" mark where provided. Use of backhoes or similar powered equipment shall not be allowed unless protective measures are provided and approved in advance by the Project Manager.
- H. Keep excavations free of water during construction and until final inspection.

- I. When the Work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.
- J. Where gravity sanitary sewer is to be installed under existing water line with separation distance of at least two feet (2 Ft) and less than nine feet (9 Ft), install new sanitary sewer pipe so that one (1) full eighteen foot (18 Ft) long pipe is centered on water line crossing. Embed sanitary sewer pipe in cement stabilized sand for minimum distance of nine feet (9 Ft) on each side of crossing.
- K. Where gravity sanitary sewer is to be installed under existing water line with separation distance of less than two feet (2 Ft), install new sanitary sewer using pressure-rated pipe as shown on the Drawings. Maintain minimum six inch (6 In) separation distance. Embed sanitary sewer pipe in cement stabilized sand for minimum distance of nine feet (9 Ft) on each side of crossing.
- L. Where the length of a stub-out is not indicated, install the stub-out to the right-of-way line and seal the free end with an approved plug. If stub-out is perpendicular to the right-of-way line then install pipe to the right-of-way-line.
- M. At no time shall any pipe be dropped into the trench or from a height great than twelve inches (12 In). Should a pipe be dropped as noted, the pipe shall be removed and marked with an "X" as defective.

3.5 PIPE INSTALLATION OTHER THAN OPEN CUT

- A. For installation of pipe by augering, jacking or tunneling, conform to requirements of specification sections on tunneling augering, jacking and microtunneling work as appropriate.

3.6 INSTALLATION OF APPURTENANCES

- A. Service Connections: Install service connections to conform to requirements of Section 2505 – Sanitary Sewer Service Stub-outs or Reconnections.
- B. Stacks: Construct stacks to conform to requirements of 02505 – Sanitary Sewer Service Stub-outs or Reconnections.
- C. Construct sanitary sewer manholes to conform to requirements of Section 02300 – Cast-in-Place Concrete Manholes and Section 02305 – Precast Concrete Manholes, as applicable. Install frames, rings and covers to conform to requirements of Section 02315 – Frames, Grates, Rings and Covers.

3.7 INSPECTION AND TESTING

- A. Visual Inspection: Check pipe alignment in accordance with Section 02525 – Acceptance Testing for Gravity Sanitary Sewer Lines.
- B. Mandrel Testing: Use Mandrel Test to test flexible pipe for deflection. Refer to Section 02525 – Acceptance Testing for Gravity Sanitary Sewer Lines.
- C. Pipe Leakage Test: After backfilling line segment and prior to tie-in of

service connections, visually inspect gravity sanitary sewers where feasible and test for leakage in accordance with Section 02525 – Acceptance Testing for Gravity Sanitary Sewer Lines. Maintain piezometer installed to conform with Section 01585 – Control of Ground and Surface Water, until acceptance testing is completed.

3.8 BACKFILL AND SITE CLEANUP

- A. Backfill and compact soil in accordance with Section 02125 – Excavation and Backfill for Utilities.
- B. Backfill trench in specified lifts only after pipe installation is approved by the Project Manager.
- C. Repair and replace removed or damaged pavement, curbs, gutters and sidewalks as specified in Section 02845 – Pavement Repair and Resurfacing.
- D. Provide hydromulch seeding in areas of commercial, industrial or undeveloped land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on the Drawings. Provide minimum of four inches (4 In) of topsoil as specified in Section 02905 – Topsoil and apply hydromulch according to requirements of Section 02910 – Hydromulch Seeding.
- E. Provide sodding in areas of residential land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on the Drawings. Provide minimum of four inches (4 In) of topsoil per Section 02905 – Topsoil. Sod disturbed areas in accordance with Section 02915 – Sodding.

3.9 POST-INSTALLATION TELEVISION INSPECTION

- A. Prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection.
 - 1. Cleaning of sanitary sewer lines and manholes shall conform to Section 02530 – Sanitary Sewer Line Cleaning.
 - 2. Television inspection shall be performed after sanitary sewer line has been cleaned. Television inspection shall conform to Section 02520 – Television Inspection of Sanitary Sewer Lines.
- B. Upon completion of television inspection reviews by the Project Manager, the Contractor shall be notified regarding final acceptance of sanitary sewer segment.

END OF SECTION

**SECTION 02505
SANITARY SEWER SERVICE STUB-OUTS OR RECONNECTIONS**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Installation of service stub-outs in sanitary sewers serving areas where sanitary sewer service did not previously exist.
- B. Reconnection of existing service connections along parallel, replacement or rehabilitated sanitary sewers.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
 - 1. Payment for sanitary sewer service stub-outs or service reconnections with stacks located within five feet (5 Ft) of sanitary sewer main centerline is on a unit price basis for each stub-out or reconnection. Payment shall be made for each service stub-out or reconnection installed complete in place, including service connections, couplings and adapters disconnecting existing services, reconnecting new service, fittings, excavation and backfill.
 - 2. Payment for sanitary sewer service stub-outs or service reconnections without stacks located within five feet (5 Ft) of sanitary sewer main is on a unit price basis for each stub-out or reconnection. Payment shall be made for each service stub-out or reconnection installed complete in place, including service connections, couplings and adapters disconnecting existing services, reconnecting new service, fittings, excavation, backfill and testing.
 - 3. Payment for sanitary sewer service lines more than five feet (5 Ft) laterally from sanitary sewer main is on a linear foot basis. Measurement shall be taken along centerline of pipe from centerline of lateral connection or stack to end of service for service stub-outs laid in open-cut excavation. Payment shall be made for each linear foot of pipe installed, complete in place, including sanitary sewer pipe, excavation, shoring, bedding, backfill and accessories in addition to payment for sanitary sewer stub-outs or service connections with or without stacks. Augered pipe for service stub-outs shall be paid as provided in Section 02275 – Pipe and Casing Augering for Sanitary Sewers.
 - 4. Pay estimates for progress payments shall be made as measured above according to following schedule:
 - a. An estimate for ninety-five percent (95%) payment shall be authorized when stub-out or reconnection is completely installed and backfilled.

- b. An estimate for one hundred percent (100%) payment shall be authorized when stub-out or reconnection has been tested as specified in Section 02525 – Acceptance Testing for Gravity Sanitary Sewer Lines.
 5. One (1) or more connections discharging into a common point are considered one (1) service connection. The Contractor shall not increase the quantity of service reconnections without approval of the Project Manager. The Project Manager may require connections to be relocated to avoid having more than two (2) service connections per reconnection to sanitary sewer.
 6. Protruding service connections which must be removed to allow liner insertion are paid as a service reconnection when connected. If abandoned, they shall be paid as an abandoned connection.
 7. Payment for abandonment of service connections is on a unit price basis for each abandoned service connection. No separate payment shall be made for abandonment of a service connection unless excavation is required. No separate payment shall be made for excavation of sanitary sewer services within new or replacement sanitary sewer trench.
 8. No separate payment shall be made for removal of existing sanitary sewer service stub-outs. Include payment in the unit price for Section 02505 – Sanitary Sewer Service Stub-outs or Reconnections.
 9. No separate payment shall be made for abandoned service connections when service to be abandoned is within four feet (4 Ft) of active connection. Payment for only one (1) abandoned service connection shall be allowed when second (2nd) abandoned connection is within four feet (4 Ft) of first (1st).
 10. If faulty remote cut is later corrected using procedures specified for reconnection by excavation, only one (1) reconnection shall be allowed for payment.
 11. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

1.3 REFERENCES

- A. ASTM – American Society for Testing and Materials.
 1. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 2. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 3. ASTM D3212 – Standard Specification for Joints for Drain and

Sewer Plastic Pipes Using Flexible Elastomeric Seals.

- B. CFTS – City of Friendswood Technical Specifications.

1.4 PERFORMANCE REQUIREMENTS

- A. Accurately locate in field all proposed service stub-outs along new sanitary sewer main.
- B. Accurately locate in field existing service connections and proposed service stub-outs along alignment of new parallel or replacement sanitary sewer main.

1.5 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit product data for each pipe product, fitting, coupling and adapter.
- C. Show reconnected services on record drawings. Give exact distance from each service connection to nearest downstream manhole.

PART II: PRODUCTS

2.1 PVC SERVICE CONNECTION

- A. For stub-outs, use PVC sanitary sewer pipe of four inch (4 In) through ten inch (10 In) diameter, conforming to ASTM D1784 and ASTM D3034, with cell classification of 12454-B. SDR (ratio of diameter to wall thickness) shall be twenty-six (26) for pipe ten inches (10 In) in diameter or less.
- B. PVC pipe shall be gasket jointed with gasket conforming to ASTM D3212.
- C. Provide service connection pipe in sizes shown on the Drawings. For reconnection of existing services, select service connection pipe diameter to match existing service diameter. Reconnections to rehabilitated sanitary sewer mains shall be limited to maximum service connection diameter as specified in TABLE 4.1 – MAXIMUM SERVICE CONNECTION DIAMETER in this Section.
- D. Subject to above limits, provide a six inch (6 In) service connection when more than one (1) service discharges into a single pipe.
- E. Connect service pipes to parallel or replacement sanitary sewer mains with prefabricated, full-bodied tee or wye fittings conforming to the specifications for sanitary sewer main pipe material as specified in other sections for sanitary sewers up to eighteen inches (18 In) in diameter.
- F. Where sanitary sewers are installed using pipe augering or tunneling or where sanitary sewer is greater than eighteen inches (18 In) in diameter, use Fowler "Inserta-Tee" to connect service to sanitary sewer main.

2.2 PIPE SADDLES

- A. Use pipe saddles only on sanitary sewer mains that have been rehabilitated using partial replacement, sliplining, cured in place lining or pipe-bursting methods. Comply with Paragraph 2.1.E for new parallel

and replacement sanitary sewer mains.

- B. Supply one (1) piece prefabricated saddle, either polyethylene or PVC, with neoprene gasket to accomplish complete seal. Use saddle fabricated to fit outside diameter of connecting pipe. Protruding lip of saddle must be at least five-eighths inch (5/8 In) long with grooves or ridges to retain stainless steel band clamps.
- C. Use one-half inch (1/2 In) stainless steel band clamps for securing saddles to sanitary sewer pipe.

2.3 COUPLINGS AND ADAPTERS

- A. For connections between new PVC pipe stub-outs and existing service, four inch (4 In), six inch (6 In) or eight inch (8 In) diameter, use flexible adapter coupling consisting of neoprene gasket and stainless steel shear rings with one-half inch (1/2 In) stainless steel band clamps:
 - 1. Fernco Pipe Connectors, Inc. Series 1055 with shear ring SR-8
 - 2. Band Seal by Mission Rubber Co., Inc.
 - 3. Approved equal.
- B. For connections between new PVC pipe stub-out and new service, use rubber-gasket adapter coupling:
 - 1. GPK Products, Inc.
 - 2. IPS & Sanitary sewer Adapter
 - 3. Approved equal.

2.4 STACKS

- A. Provide stacks for service connections wherever crown of sanitary sewer is eight feet (8 Ft) or more below finished grade.
- B. Construct stacks of same material as sanitary sewer and as shown on the Drawings.
- C. Provide stacks of same nominal diameter at sanitary service line.

2.5 PLUGS AND CAPS

- A. Seal upstream end of unconnected sanitary sewer service stub-outs with rubber gasket plugs or caps of same pipe type and size. Provide plugs or caps by GPK Products, Inc. or approved equal.

PART III: EXECUTION

3.1 PERFORMANCE REQUIREMENTS

- A. Provide minimum of seventy-two hours (72 Hrs) notice to customers whose sanitary sewer service shall potentially be interrupted.
- B. Reconnect service connections, including those that go to unoccupied or abandoned buildings or to vacant lots, unless directed otherwise by the Project Manager.
- C. Reconnection by excavation method shall include stack and fittings and required pipe length to reconnect service line.
- D. Connect services eight inches (8 In) in diameter and larger to sanitary

sewer by construction of manhole. Refer to appropriate section on manholes for construction and payment.

- E. Connections to sanitary sewer lines rehabilitated by either the cured-in-place or sliplining method shall conform to the following:
 - 1. Accurately field locate service connections, whether in service or not, along rehabilitated sanitary sewer line.
 - 2. Properly disconnect existing connections from sanitary sewer and reconnect to rehabilitated sanitary sewer lines, as described in this Section.
 - 3. Complete reconnection of service lines within of twenty-four hours (24 Hrs) after cured-in-place liner installation, and within seventy-two hours (72 Hrs) after disconnection for sliplining of sanitary sewer lines.
 - 4. Reconnect services on `sanitary sewer lines rehabilitated with cured-in-place liner or sliplining at twelve feet (12 In) depth or less by excavation method. The Project Manager reserves right to require service connections by excavation when remote cut service connection damages lines.
- F. Reconnections to new or replacement sanitary sewer lines shall conform to the following:
 - 1. Accurately field locate service connections, whether in service or not, along sanitary sewer line. For new and replacement sanitary sewers, service connections may be located as pipe laying progresses from downstream to upstream.
 - 2. Properly disconnect existing connections from sanitary sewer and reconnect the new or replacement sanitary sewer line, as described in this Section.
 - 3. Complete reconnection of service lines to restore sanitary sewer service in the shortest possible time.
 - 4. Reconnect services on new or replacement sanitary sewer lines at twelve feet (12 In) depth or less by excavation method. The Project Manager reserves right to require service connections by excavation when remote cut service connection damages lines.

3.2 PROTECTION

- A. Provide barricades, warning lights and signs for excavations created for service connections. Conform to requirements of Section 01505 – Temporary Facilities and Control.
- B. Do not allow sand, debris or runoff to enter sanitary sewer system.

3.3 PREPARATION

- A. Rehabilitated, new or replacement of sanitary sewer lines: Determine existing sanitary sewer locations and number of existing service connections from closed-circuit television (CCTV) inspection DVD's or from field survey. Accurately field locate existing service connections,

whether in service or not. Use existing service locations to connect or reconnect service lines or liner.

- B. For rehabilitated sanitary sewer lines, allow sliplining to normalize to ambient temperature and recover from imposed stretch. For cured-in-place liners, verify that liner is completely cured. For sliplining connection procedures, refer to manufacturers recommendations.

3.4 EXCAVATION AND BACKFILL

- A. Excavate in accordance with Section 02125 – Excavation and Backfill for Utilities.
- B. Perform the Work in accordance with OSHA standards. Employ Trench Safety System as specified in Section 02280 – Trench Safety Systems for excavations requiring trench safety.
- C. Install and operate necessary ground water and surface water control measures in accordance with requirements of Section 01585 – Control of Ground and Surface Water.
- D. Determine locations where limited access, buildings or structure preclude use of mechanical excavation equipment. Obtain approval from the Project Manager for hand excavation.

3.5 RECONNECTION BY EXCAVATION METHOD

- A. Strap on saddle using stainless steel band on each side of saddle. Tighten bands to produce watertight seal of saddle gasket to sanitary sewer pipe. See paragraph 3.6 for additional requirements.
- B. Remove and replace cracked, offset or leaking service line for up to five feet (5 In), measured horizontally, from center of sanitary sewer pipe.
- C. Make up connection between sanitary sewer pipe and service line using PVC sanitary sewer pipe and approved fittings and couplings.
- D. Test service connections before backfilling.
- E. Embed entire service connection in cement stabilized sand as shown on the Drawings. Place and compact trench zone backfill in compliance with Section 02125 – Excavation and Backfill for Utilities.

3.6 RECONNECTION BY REMOTE METHOD FOR CURED-IN-PLACE LINERS OR SLIPLINING

- A. Make service reconnections using remote-operated cutting tools on cured-in-place liners at depth greater than twelve feet (12 Ft).
- B. Employ method and equipment that restore service connection capacity to not less than ninety percent (90%) of original capacity.
- C. For reconnection to sanitary sewer lines that have been sliplined, follow these requirements:
 - 1. Remove portion of existing sanitary sewer pipe or carrier pipe to expose liner pipe. Provide sufficient working space for installing prefabricated pipe saddle.
 - 2. Carefully cut liner pipe to make hole to accept stub-out protruding from the backside of saddle connection.

- D. Immediately open missed connections and repair holes drilled in error using method approved by the Project Manager.
- E. Embed service connection and service line as specified for sanitary sewer main as shown on the Drawings. Place and compact trench zone backfill in compliance with Section 02125 – Excavation and Backfill for Utilities.

3.7 RECONNECTION ON NEW OR REPLACEMENT SEGMENTS

- A. Install service connections on sanitary sewer main.
- B. Remove and replace cracked, offset or leaking service line for up to five feet (5 Ft), measured horizontally, from centerline of sanitary sewer main.
- C. Make up connection between main and existing service line using PVC sanitary sewer pipe and approved couplings, as shown on the Drawings.
- D. Test service connections before backfilling.
- E. Embed service connection and service line as specified for sanitary sewer main as shown on the Drawings. Place and compact trench zone backfill in compliance with Section 02125 – Excavation and Backfill for Utilities.

3.8 INSTALLATION OF NEW SERVICE STUB-OUTS

- A. Install service connections on sanitary sewer pipe for each service connection in accordance with paragraphs 3.5, 3.6 and 3.7. Provide length of stub-out indicated on the Drawings. Install plug or cap on upstream end of service stub-out as needed.
- B. Test service connections before backfilling.
- C. Embed service connection and service line as specified for sanitary sewer main and as shown on the Drawings. Place and compact trench zone backfill in compliance with Section 02125 – Excavation and Backfill for Utilities. Install a minimum two foot (2 Ft) length of magnetic locating tape along axis of service stub-out and nine inches (9 In) to twelve inches (12 In) above crown of pipe, at end of stub-out.

3.9 TESTING

- A. Complete testing and acceptance of downstream sanitary sewers as applicable. Provide for compliance with requirements of this Section.
- B. Test service reconnections and service stub-outs. Follow applicable procedures given in Section 02525 – Acceptance Testing for Gravity Sanitary Sewer Lines to perform smoke testing to confirm reconnection.
- C. Perform post installation CCTV inspection as specified in Section 02520 – Television Inspection of Sanitary Sewer Lines to show locations of service connections.

3.10 CLEANUP

- A. Backfill excavation as specified in Section 02125 – Excavation and Backfill for Utilities.
- B. Replace pavement or sidewalks removed or damaged by excavation in

accordance with Section 02845 – Pavement Repair and Resurfacing. In unpaved areas, bring surface to grade and slope surrounding excavation. Replace minimum of four inches (4 In) of topsoil and seed according to requirements of Section 02910 – Hydromulch Seeding.

PART IV: TABLES

4.1 – MAXIMUM SERVICE CONNECTION DIAMETER

Sanitary Sewer Main Diameter	Maximum Service Connection Diameter
8" or less	4"
10" or greater	6"

END OF SECTION

**SECTION 02510
SANITARY SEWER FORCE MAINS**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Sanitary sewer force mains.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Payment for installation of sanitary sewer force main pipe by open-cut, augered with or without casing, or within limits of Potentially Petroleum Contaminated Area (PPCA) is on a linear foot basis. Measurement shall be taken along center line of pipe from end to end. Payment shall be made for each foot of sanitary sewer force main pipe installed, complete in place including pipe, excavation, bedding, backfill and special backfill, shoring, earthwork, connections to existing manholes, acceptance testing and pipe and accessories.
2. Payment for installation of sanitary sewer force main pipe crossing a stream or other body of water is on a lump sum basis.
3. The Unit Price item identifies line segments between stations as shown on the Drawings.
4. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum):

1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

1.3 REFERENCES

A. ACI – American Concrete Institute.

1. ACI 318 – ACI Building Code and Commentary.

B. ASTM – American Society for Testing and Material.

1. ASTM D696 – Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 C and 30 C with a Vitreous Silica Dilatometer.
2. ASTM D2310 – Standard Classification for Machine-Made “Fiberglass” (Glass-Fiber-Reinforced- Thermosetting-Resin) Pipe.
3. ASTM D2992 – Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for “Fiberglass” (Glass-Fiber Reinforced Thermosetting-Resin) Pipe and Fittings.
4. ASTM D2996 – Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

- C. CFTS – City of Friendswood Technical Specifications.
- D. Uni-Bell UNI-B-3 Polyvinyl Chloride (PVC) Pressure Pipe (complying with AWWA C 900).

1.4 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit proposed methods, equipment, materials and sequence of operations for sanitary sewer force main construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.
- C. Sanitary sewer force mains twenty-four inches (24 In) in diameter and larger: Submit shop drawings and design calculations for joint restraint systems using reinforced concrete encasement of pressure pipe and fittings.
- D. Submit qualifications, proposed methods, equipment, materials and sequence for acceptance testing of sanitary sewer force main. Submit evidence of line proving by pigging for at least three (3) projects of equal or greater scope; project list shall include dates, size and length of pipe, location, owner name, contact person and telephone number. Provide certificate of training by manufacturer of pigging equipment being used.
- E. Submit test reports as specified in Part III of this Section.

PART II: PRODUCTS

2.1 PIPE FITTING MATERIAL SCHEDULE

- A. Unless otherwise shown on the Drawings, use pipe materials that conform to requirements specified in one (1) or more of the following Sections:
 - 1. Section 02215 – Ductile Iron Pipe (DIP) and Fittings.
 - 2. Section 02220 – High Density Polyethylene Pipe (HDPE).
 - 3. Section 02235 – Polyvinyl Chloride Pipe (PVC).

2.2 THRUST RESTRAINT

- A. Unless otherwise shown on the Drawings, provide concrete thrust blocking for sanitary sewer force mains up to twelve inches (12 In) in diameter, to prevent movement of buried lines under pressure at bends, tees, caps, valves and hydrants. Blocking shall be Portland cement concrete, as specified in Section 03300 – Structural Concrete. Place concrete in accordance with details on the Drawings. Place thrust blocks between undisturbed ground and fittings. Anchor fittings to thrust blocks so that pipe and fitting joints are accessible for repairs. Concrete shall extend from six inches (6 In) below pipe or fitting to twelve inches (12 In) above.
- B. For sanitary sewer force mains larger than twelve inches (12 In) in diameter and where indicated on the Drawings, provide restrained joints conforming to requirements of sanitary sewer force main pipe material

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- specifications. Install restrained joints for length of pipe on both sides of each bend or fitting for full length shown on the Drawings.
- C. Horizontal and vertical bends between zero degrees (0°) and ten degrees (10°) deflection angle shall not require thrust blocks or harnessed or restrained joints.
 - D. Horizontal and vertical bends between ten degrees (10°) and ninety degrees (90°) deflection angle shall have thrust restraint as shown on the Drawings.
 - E. Provide thrust restraint at tees, plugs, blowoff drains, valves and caps, or other locations as indicated on the Drawings.
 - F. Reinforced concrete encasement of sanitary sewer force main pipe and fittings may be used in lieu of manufactured joint restraint systems. Alternate joint restraint systems using reinforced concrete encasement shall conform to following design requirements.
 - 1. Design calculations shall be performed and sealed by Professional Engineer licensed in the State of Texas.
 - 2. Base design calculations upon soil parameters quantified in geotechnical report for site where alternative thrust restraint system is to be installed. When data is not available for site, use parameters recommended by geotechnical engineer.
 - 3. The design system pressure shall be the specified test pressure.
 - 4. The following safety factors shall be used in sizing restraint system:
 - a. Apply factor of safety equal to one and one-half (1.5) for passive soil resistance.
 - b. Apply factor of safety equal to two (2.0) for soil friction.
 - 5. Encasement shall remain entirely within standard trench width and terminate on both ends at pipe bell or coupling.
 - 6. Concrete encasement reinforcement steel shall be designed for all loads, including internal pressure and longitudinal forces. Concrete design shall be in accordance with ACI 318.

PART III: EXECUTION

3.1 PIPE INSTALLATION BY OPEN-CUT

- A. Perform excavation, bedding and backfill in accordance with Section 02125 – Excavation and Backfill for Utilities.
- B. Wrap ductile iron pipe (DIP) and fittings with polyethylene wrap in accordance with requirements of Section 02260 – Polyethylene Wrap. Do not install polyethylene wrap on ductile iron pipe protected by cathodic protection system, or fusion bonded or polyurethane coated fittings.
- C. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.
- D. Install pipe only after excavation is completed, bottom of trench is fine graded, bedding material is installed and trench has been approved by

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the Project Manager.

- E. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.
- F. Install pipe with spigot ends toward direction of flow. Form concentric joint with each section of adjoining pipe so as to prevent offsets.
- G. Keep interior of pipe clean as installation progresses. Where cleaning after laying pipe is difficult because of small pipe size, use suitable swab or drag in pipe and pull it forward past each joint immediately after joint has been completed. Remove foreign material and debris from pipe.
- H. Provide lubricant, place and drive home newly-laid pipe with come-along winches so as to eliminate damage to pipe. Install pipe to "home" mark where provided. Use of backhoes or similar powered equipment shall not be allowed unless protective measures are provided and approved in advance by the Project Manager.
- I. Keep excavations free of water during construction and until final inspection.
- J. When the Work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.
- K. Where sanitary sewer force main is to be installed under existing water line with separation distance of less than two feet (2 Ft), install one (1) full joint length of pipe, minimum eighteen foot (18 Ft) length, centered on water line and maintain minimum six inch (6 In) separation distance. Embed sanitary sewer force main in cement-stabilized sand for minimum distance of nine feet (9 Ft) on each side of crossing.

3.2 PIPE INSTALLATION OTHER THAN OPEN-CUT

- A. For installation of pipe by augering, jacking or tunneling, conform to requirements of specification section of augering or tunneling work.

3.3 HYDROSTATIC TESTING

- A. After pipe and appurtenance have been installed, test line and drain. Prevent damage to the Work or adjacent areas. Use clean water to perform tests.
- B. The Project Manager may direct tests of relatively short sections of completed lines to minimize traffic problems or potential public hazards.
- C. Test pipe in presence of the Project Manager.
- D. Test pipe at one hundred fifty pounds per square inch (150 psi) or one and one-half (1.5) times design pressure of pipe, whichever is greater. Design pressure of sanitary sewer force main shall be rated total dynamic head of lift station pump.
- E. Test pipe at required pressure for minimum of four hours (4 Hrs) according to requirements of UNI-B-3.
- F. Maximum allowable leakage shall be as calculated by following formula:

$$L = (S) (D) (P_{0.5}) / 133,200$$

Where: L = Leakage in gallons per hour.
S = Length of pipe in feet.
D = Inside diameter of pipe in inches.
P = Pressure in pounds per square inch.

- G. Correct defects, cracks or leakage by replacement of defective items or by repairs as approved by the Project Manager.
- H. Plug openings in sanitary sewer force main after testing and flushing. Use cast iron plugs or blind flanges to prevent debris from entering tested pipeline.

3.4 PIGGING TEST

- A. After completion of hydrostatic testing and prior to final acceptance, test sanitary sewer force mains longer than two hundred feet (200 Ft) by pigging to ensure pipe is free of obstructions.
- B. Pigs: Provide proving pigs manufactured of open-cell polyurethane foam body, without coating or abrasives which would scratch or otherwise damage interior pipe wall surface or lining. Pigs shall be able to pass through reductions of up to sixty-five percent (65%) of nominal cross-sectional area of pipe. Pigs shall be able to pass through standard fittings such as forty-five degree (45°) and ninety degree (90°) elbows, crosses, tees, wyes, gate valves or plug valves, as applicable to sanitary sewer force main being tested.
- C. Test Execution: Conduct pigging test in presence of the Project Manager. Provide at least forty-eight hours (48 Hrs) notice of scheduled pigging of sanitary sewer force main prior to commencing test.

END OF SECTION

**SECTION 02515
ABANDONMENT OF SANITARY SEWERS**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Abandonment in place of existing sanitary sewers, junction structures, manholes and sanitary sewer force mains.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
 - 1. Payment for grout fill and abandonment of existing sanitary sewers, including boxes and elliptical shaped sanitary sewers, is on linear foot basis for each diameter of sanitary sewer being abandoned. Measurement shall be along centerline of sanitary sewer from centerline to centerline of manholes.
 - 2. Payment for grout fill and abandonment of sanitary sewer manholes or junction structure is by each manhole or junction structure abandoned in conformance with this Section.
 - 3. Payment shall be full compensation for all material, equipment and labor required for complete abandonment grouting, including air venting, testing, temporary plugs, PVC pipes and incidentals.
 - 4. No separate payment shall be made for plugging and abandoning sanitary sewer force mains. Include cost of such abandonment in related work.
 - 5. Refer to Section 01270 – Measurement and Payment for unit price procedures.
 - 6. Acceptability of grout material is based on achieving average strength within range of seventy-five pounds per square inch (75 psi) to one hundred fifty pounds per square inch (150 psi) as defined in Paragraph 2.1.A.1. Grout that is out of range after placement may be accepted with price adjustment of one (1.0 %) percent price deduction for each pound per square inch (psi) average compressive strength below seventy-five pounds per square inch (75 psi) and one-half percent (0.5 %) price deduction for each psi average compressive strength above one hundred fifty pounds per square inch (150 psi), as applicable to material volume represented by test series. Shrinkage in grout material placements shall be remedied by the Contractor according to Paragraph 3.4.H without additional compensation.
- B. Stipulated Price (Lump Sum):
 - 1. If Contract is Stipulated Price Contract, payment for Work in this Section is included in Total Stipulated Price.

1.3 DEFINITIONS

- A. Abandonment: Sanitary sewer abandonment consists of demolition and removal of portions of manholes existing within specified depth of surface and abandonment in place of sanitary sewer lines and manholes as specified in this Section.
- B. Flowable Fill: Flowable fill (abandonment grout) shall be controlled low-strength material consisting of fluid mixture of cement, aggregate, water and with admixtures as necessary to provide workable properties. Placement of flowable fill may be by grouting techniques in sanitary sewers or other restricted areas or as mass placement by chutes or tremie methods in unrestricted locations with open access. Long-term hardened strength shall be within specified range.
- C. Ballast: Large aggregate either placed with voids subsequently filled with flowable fill injected by grouting method; or in areas with open access, placed individually and sequentially at same time as flowable fill placement.
- D. Backgrouting: Secondary stage pressure grouting to ensure that voids have been filled within the abandoned sanitary sewer. Backgrouting shall only be required at critical locations indicated on the Drawings or if there is evidence of incomplete flowable fill placements.

1.4 REFERENCES

- A. ASTM – American Society for Testing and Materials.
 - 1. ASTM C150 – Standard Specification for Portland Cement.
 - 2. ASTM C494 – Standard Specification for Chemical Admixture for Concrete.
 - 3. ASTM C937 – Standard Specification for Grout Fluidifier for Pre-placed Aggregate Concrete.
 - 4. ASTM C940 – Standard Test Method for Expansion and Bleeding of Freshly Mixed Grout for Replaced Aggregate Concrete in the Laboratory.
 - 5. ASTM C1017 – Standard Specification for Chemical Admixture for Use in Producing Flowing Concrete.
 - 6. ASTM C1107 – Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
- B. CFTS – City of Friendswood Technical Standards.

1.5 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Flowable fill mix design report:
 - 1. Flowable fill type and production method. Describe if fill shall be mixed to final proportions and consistency in batch plant or if constituents shall be added in transit mixer at placement location.
 - 2. Use of ballast: Provide percentage of ballast of total placement and size limits for ballast if fill is intended to be used with ballast.

3. Aggregate gradation of fill: Aggregate gradation of mix (excluding ballast) shall be used as pilot curve for quality control during production.
 4. Fill mix constituents and proportions including materials by weight and volume and air content but excluding ballast. Give types and amounts of admixtures including air entrainment or air generating compounds.
 5. Fill densities and viscosities, including wet density at point of placement.
 6. Initial time of set.
 7. Bleeding and shrinkage.
 8. Compressive strength.
- C. Technical information for equipment and operational procedures including projected slurry injection rate, grout pressure, method of controlling grout pressure, bulkhead and vent design and number of stages of grout application.
- D. Experience record for proposed crew, showing minimum of one hundred cubic yards (100 Cy) of flowable fill placed using proposed or similar equipment and methods.
- E. At least sixty days (60 D) prior to commencing abandonment activities, submit plan for abandonment, describing proposed grouting sequence, bypass pumping requirements and plugging, if any and other information pertinent to completion of the Work.

PART II: PRODUCTS

2.1 FLOWABLE FILL

- A. Design Mix Criteria: Provide design of one (1) or more mixes to meet design criteria and conditions for placement. Present information required by Paragraph 1.5.B in mix design report including following:
1. Cement: ASTM C150 Type I or II. Volume and weight per cubic yard of fill. Provide minimum cement content of one hundred pounds per cubic yard (100 Lbs/Cy).
 2. Potable water: Volume and weight per cubic yard of fill. Amount of water determined by mix design testing.
 3. Aggregate gradation: One hundred percent (100%) passing three-eighths inch (3/8 In) sieve and not more than ten percent (10%) passing No. 200 sieve. Mix design report shall define pilot gradation based on following sieve sizes three-eighths inch (3/8 In), Nos. 4, 8, 16, 30, 50, 100 and 200. Do not deviate from pilot gradation by more than plus or minus ten percentage ($\pm 10\%$) points for any sieve for production material.
 4. Aggregate source material: Screened or crushed aggregate, pit or bank run fine gravels or sand or crushed concrete. If crushed concrete is used, add at least thirty percent (30%) of natural

- aggregate to provide workability.
- 5. Admixtures: Use admixtures meeting ASTM C494 and ASTM C1017 as needed to improve pumpability, to control time of set and reduce bleeding.
- 6. Fluidifier: Use fluidifier meeting ASTM C937 as necessary to hold solid constituents in suspension. Add shrinkage compensator if necessary.
- 7. Performance additive: Use flowable fill performance additive, such as Darafill or approved equal, to control fill properties.
- B. Flowable Fill Requirements:
 - 1. Unconfined compressive strength: minimum seventy-five pounds per square inch (75 psi) and maximum one hundred fifty pounds per square inch (150 psi) at fifty-six days (56 D) as determined based on an average of three (3) tests for same placement. Present at least three (3) acceptable strength tests for proposed mix design in mix design report.
 - 2. Placement characteristics: self-leveling.
 - 3. Shrinkage characteristics: non-shrink.
 - 4. Water bleeding for fill to be placed by grouting method in sanitary sewers: not to exceed two percent (2%) according to ASTM C940.
 - 5. Minimum wet density: ninety pounds per cubic foot (90 Lbs/Cf).

2.2 BALLAST

- A. Ballast Material: Natural rock or concrete pieces within the following limits:
 - 1. Minimum size equal to at least ten (10) times maximum aggregate size of flowable fill and;
 - 2. not more than twenty percent (20%) of minimum dimension of space to be filled and;
 - 3. maximum size of twenty-four inches (24 In).
- B. Ballast Composition: Free of regulated waste material.

2.3 PLUGS FOR SANITARY SEWER FORCE MAINS

- A. Grout Plugs: Cement-based dry-pack grout conforming to ASTM C1107, Grade B or C.
- B. Manufactured Plug: Commercially available plug or cap specifically designed and manufactured to be used with pipe being abandoned.

PART III: EXECUTION

3.1 PREPARATION

- A. Have fill mix design reports and other submittals required by Paragraph 1.5 accepted by the Project Manager prior to start of placement. Notify the Project Manager at least twenty-four hours (24 Hrs) in advance of

grouting with flowable fill.

- B. Select fill placement equipment and follow procedures with sufficient safety and care to avoid damage to existing underground utilities and structures. Operate equipment at pressure that shall not distort or imperil portion of the Work, new or existing.
- C. Clean sanitary sewer lines and video with closed circuit television to identify connections, locate obstructions and assess condition of pipe. Locate previously unidentified connections, which have not been redirected and reconnected as part of this project and report them to the Project Manager. During placement of fill, compensate for irregularities in sanitary sewer lines, such as obstructions, open joints or broken pipe to ensure no voids remain unfilled.
- D. Perform demolition work prior to starting placement of fill. Clean placement areas of sanitary sewers and manholes of debris that may hinder fill placement. Remove excessive amounts of sludge and other substances that may degrade performance of fill. Do not leave sludge or other debris in place if filling more than two percent (2%) of placement volume. Dispose of waste material in compliance with Section 01580 – Waste Material Disposal.
- E. Remove free water prior to starting fill placement.

3.2 EQUIPMENT

- A. Mix flowable fill in automated batch plant and deliver it to site in ready-mix trucks. Performance additives may be added at placement site if required by mix design.
- B. Use concrete or grout pumps capable of continuous delivery at planned placement rate.

3.3 DEMOLITION OF SANITARY SEWER MANHOLES, PIPELINE STRUCTURES AND SANITARY SEWER FORCE MAINS PRIOR TO ABANDONMENT

- A. Remove manhole frames and covers and castings from other existing sanitary sewer structures. Deliver castings to the City of Friendswood Public Works Facility for future use. Alternatively, salvaged castings may be used upon approval by the Project Manager for use in construction of new manholes on the project.
- B. Demolish and remove precast concrete adjustment rings and corner section or brick and mortar corbel and chimney or other sanitary sewer structures, to minimum depth of four feet (4 Ft) below finished grade. Structures may be removed to greater depth, but not deeper than eighteen inches (18 In) above crown of abandoned sanitary sewer.
- C. When adjacent sanitary sewer lines are not to be filled, place temporary plugs in each line connecting to manhole, in preparation for filling manhole.
- D. Excavate overburden from sanitary sewer force mains to be abandoned at locations indicated on the Drawings, conforming to Section 02125 –

Excavation and Backfill for Utilities. Cut existing sanitary sewer force main, when necessary, to provide an end surface perpendicular to axis of pipe and suitable for plug to be installed. Remove sanitary sewer force main piping material remaining outside of segment to be abandoned.

3.4 INSTALLATION

- A. Abandon sanitary sewer lines by completely filling sanitary sewer line with flowable fill. Abandon manholes and other structures by filling with flowable fill, together with ballast as applicable, within depth of structures left in place.
- B. Place flowable fill to fill volume between manholes. Continuously place flowable fill from manhole to manhole with no intermediate pour points but in no case exceeding five hundred feet (500 Ft) in length unless approved by the Project Manager.
- C. Have filling operation performed by experienced crews with equipment to monitor density of flowable fill and to control pressure.
- D. Temporarily plug sanitary sewer lines which are to remain in operation during pouring/pumping to keep lines free of flowable fill.
- E. Pump flowable fill through bulkheads constructed for placement of two (2) – two inch (2 In) PVC pipes or use other suitable construction methods to contain flowable fill in lines to be abandoned. These pipes shall act as injection points or vents for placement of flowable fill.
- F. Place flowable fill under pressure flow conditions into properly vented open system until flowable fill emerges from vent pipes. Pump flowable fill with sufficient pressure to overcome friction and to fill sanitary sewer from downstream end, to discharge at upstream end.
- G. Inject flowable fill through replaced ballast using grouting equipment and series of grout pipes discharging at bottom of placement, allowing fill to rise through ballast effectively filling all voids. Alternatively, sequentially place individual pieces of ballast at same time as flowable fill is placed. Do not fill with ballast more than fifty percent (50%) of volume at any level, to prevent nesting and void formation.
- H. Remediate placement of flowable fill which does not fill voids in sanitary sewer, in manholes or in other structures, or where voids develop due to excessive shrinkage or bleeding of fill, by using pressure grouting either from inside sanitary sewer or from surface. Pressure grout shall conform to Section 03105 – Grout.
- I. Plug each end of sanitary sewer force main being abandoned.
- J. Sanitary sewer force main abandonment:
 1. Clean inside surface of sanitary sewer force main at least twelve inches (12 In) from ends to achieve firm bond and seal grout plug or manufactured plug to pipe surface. Similarly, clean and prepare exterior pipe surface if manufactured cap is to be used.
 2. When using grout plug, place temporary plug or bulkhead approximately twelve inches (12 In) inside pipe. Fill pipe end completely with dry-pack grout mixture.

3. When using manufactured plug or cap, install fitting as recommended by manufacture's instructions, to form water tight seal.
 - K. Backfill to surface, above pipe or structures left in place, with:
 1. flowable fill in restricted areas or;
 2. compacted bank run sand in unrestricted areas to be paved or;
 3. select fill in unrestricted areas outside of pavement.
 - L. Place and compact backfill, other than flowable fill, in compliance with Section 02125 – Excavation and Backfill for Utilities.
 - M. Collect and dispose of excess flowable fill material and other debris in accordance with Section 01580 – Waste Material Disposal.
- 3.5 FIELD QUALITY CONTROL
- A. Provide batch plant tickets for each truck delivery of flowable fill. Note on tickets addition of admixtures at site.
 - B. Check flow characteristics and workability of fill as placement proceeds.
 - C. Obtain at least three (3) test cylinders for each placement area for determination of fifty-six day (56 D) compressive strength and bleeding. Acceptance of placement shall be based on average strength of three (3) tests.
 - D. Record volume of ballast together with flowable fill placement for same space to demonstrate that voids have been filled.
- 3.6 PROTECTION OF PERSONS AND PROPERTY
- A. Provide safe working conditions for employees throughout demolition and removal operations. Observe safety requirements for work below grade.
 - B. Maintain safe access to adjacent property and buildings. Do not obstruct roadways, sidewalks or passageways adjacent to the Work.

END OF SECTION

**SECTION 02520
TELEVISION INSPECTION OF SANITARY SEWER LINES**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Post-installation television inspection.
- B. Existing installation television inspection.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices:

- 1. No payment will be made for cleaning and television inspection of new gravity sanitary sewer lines under this Section. Include payment in unit price for work requiring cleaning and television inspection.
- 2. Payment for television inspection of existing gravity sanitary sewer will be on a linear foot basis. Measurement will be taken along centerline of pipe from centerline to centerline of manholes.
- 3. Payment shall be full compensation for all material, equipment and labor required for complete abandonment grouting, including air venting, testing, temporary plugs, PVC pipes and incidentals.
- 4. No separate payment shall be made for television inspection that is required in Section 02525 – Acceptance Testing for Gravity Sanitary Sewer Lines.
- 5. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum):

- 1. If Contract is Stipulated Price Contract, payment for Work in this Section is included in Total Stipulated Price.

1.3 REFERENCES

- A. CFTS – City of Friendswood Technical Standards.

1.4 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. The Contractor shall submit the following:
 - 1. Manufacturers brochures and specifications for TV equipment.
 - 2. Recording media shall be DVD.
 - 3. Test report and project summary.

PART II: PRODUCTS

2.1 RECORDING DEVICE

- A. Recording device shall be high quality color recording device capable of

recording DVD's.

- B. The following information shall be available as follows:
1. Each DVD media shall be permanently labeled with the following information:
 - a. Project Name
 - b. Project Number
 - c. Manhole to Manhole Designation
 - d. Name of the Contractor
 - e. Date Televised
 2. The following information shall be recorded and visible on screen for ten seconds (10 Sec) immediately before the start of televising each line segment:
 - a. Project Name
 - b. Project Number
 - c. Upstream Manhole Designation
 - d. Downstream Manhole Designation
 - e. Pipe Material
 - f. Pipe Size
 - g. Name of the Contractor
 - h. Date Televised
 - i. Street and/or Easement Location
 3. A continuous uninterrupted recording of distance from the insertion manhole shall be visible at the lower left corner of the screen at all times during inspection.
 4. The following information shall be provided in a hard copy report to accompany each DVD media:
 - a. Project Name
 - b. Project Number
 - c. Name of the Contractor
 - d. Date Televised
 - e. Street and/or Easement Location
 - f. Upstream Manhole Designation
 - g. Downstream Manhole Designation
 - h. Pipe Material
 - i. Pipe Diameter
 - j. Location of Service Connections
- C. When the reports and DVD media are complete they shall be given to the Project Manager. DVD media and reports shall become the property of the City of Friendswood.

2.2 CLOSED CIRCUIT TELEVISION CAMERA

- A. Television inspection cameras shall be required to adhere to the following specifications:
1. Camera must be equipped with rotating head capable of ninety degree (90°) rotation from horizontal and three hundred sixty degree (360°) rotation about its centerline.

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2. Minimum Camera Resolution: Four Hundred (400) vertical lines and four hundred sixty (460) horizontal lines.
 3. Camera Lens: Not less than two hundred seventy-five degree (275°) viewing angle with automatic or remote focus and iris controls.
 4. Focal Distance: Adjustable through range of six inches (6 In) to infinity.
 5. Camera shall be intrinsically safe and operative in one hundred percent (100%) humidity conditions.
 6. Lighting Intensity: Remote controlled and adjusted to minimize reflective glare.
 7. Lighting and Camera Quality: Provide clear in-focus picture of the entire inside periphery of line being televised.
 8. Camera must have height adjustment so that the camera lens is always centered at one-half (1/2) the diameter of the pipe.
- B. Footage Counter: Camera shall have an accurate footage counter which displays on the monitor the exact distance from the starting manhole.
- C. Camera shall be self-propelled.

PART III: EXECUTION

3.1 PREPARATION

- A. Pipes to be inspected shall be cleaned as specified in Section 02530 – Sanitary Sewer Line Cleaning. Pipes shall be televised immediately following the cleaning of the pipes done in accordance with Section 02530 – Sanitary Sewer Line Cleaning.
- B. If the depth of flow exceeds the specifications listed in TABLE 4.1 – MAXIMUM DEPTH OF FLOW in this Section, then bypass pumping shall be required at no additional cost to the City.
- C. Move camera through the pipe from upstream manhole to downstream manhole stopping when necessary to permit proper documentation of pipe conditions. Upon entrance and exit of manholes, the camera shall pan to demonstrate that debris has been removed. At no time shall the camera be pulled at a rate faster than thirty feet per minute (30 Ft/Min). Use manual winches, power winches, TV cable and powered rewinds or other devices that do not obstruct the camera view or interfere with the documentation of pipe conditions to move the camera through the pipe. **Under no circumstances shall the camera be tethered to a hydraulically propelled or high-velocity jet cleaning device while the cleaning device is on.**
- D. If the television camera will not pass through an entire section, set up equipment so that inspection can be performed from the opposite manhole. If the camera still cannot pass through the section, then the obstruction shall be cleared by cleaning, removal or point repair as directed by the Project Manager at no additional cost to the City and

reinspected.

- E. Measurement for location of defects shall be aboveground by means of a meter device. Marking the cable, or similar method, which would require the interpolation of the depth of the manhole shall not be allowed. Check accuracy of the distance meter by use of a walking meter, roll-a-tape or other suitable device. The accuracy shall be satisfactory to the Project Manager.
- F. The camera image shall be down the center axis of the pipe when the camera is in motion. The contractor is required to provide a three hundred sixty degree (360°) radial view of the pipe interior using a camera with pan and tilt capabilities for eight inch (8 In) diameter pipe and larger.
- G. Points of interest shall also be digitally recorded and shall include, but not limited to, defective joints, ovality, debris, sediments, cracked pipes, holes, blockages, bellies and service connections.

3.2 DOCUMENTATION AND REPORTING

- A. Television Inspection Logs: Develop and keep printed location records that clearly show the location in relation to an adjacent manhole of each infiltration point observed during inspection. In addition record any other points of significance or concern and other discernible features.
- B. Photographs: Take digital photographs or digital DVD stills of any defect or points of interest recorded on the inspection report.
- C. Each report on each segment shall use the Television Inspection Codes in Tables 4.2 to 4.12. The final report shall also give a total value of the section pipe that has been inspected.
- D. Provide the City with two (2) copies of each DVD and two (2) copies of each report.
- E. The Project Manager shall review the DVD media and documentation to ensure compliance listed in this specification.

PART IV: TABLES

4.1 – MAXIMUM DEPTH OF FLOW

Nominal Pipe Diameter	Maximum Depth of Flow
6" to 10"	1 inch
12" to 14"	2 inches
15" to 24"	3 inches
Over 24"	4 inches

4.2 TELEVISION INSPECTION CODES – LOCATION

LOCATION	CODE
Alley, Good Access	A
Alley, Poor Access	B
Easement, Good Access	C
Easement, Poor Access	D
Open Area, Good Access	E
Open Area, Poor Access	F
Parking Lot, Good Access	G
Parking Lot, Poor Access	H
ROW, Light Traffic	I
ROW, Medium Traffic	J
ROW, Heavy Traffic	K
Street, Light Traffic	L
Street, Medium Traffic	M
Street, Heavy Traffic	N

4.3 TELEVISION INSPECTION CODES – SURFACE COVER

SURFACE COVER	CODE
Asphalt Street	A
Concrete Street	B
Sidewalk	C
Trees/Shrubs	D
Close to Fence	E
Open Area	F
Moveable Structure	G
Unmovable Structure	H
Overhead Utilities	I
Pipe Above Ground	J

4.4 TELEVISION INSPECTION CODES – PIPE TYPE

SURFACE COVER	CODE
Cast Iron Pipe	CIP
Corrugated Metal Pipe	CMP
Concrete Pipe Poured in Place	CON
Cured in Place Pipe	CPP
Ductile Iron Pipe	DIP
Fiberglass Reinforced Pipe	FRP
High Density Polyethylene Pipe	HDP
Plastic Lined Concrete Pipe	PLP
Polyvinylchloride Pipe	PVC
Reinforced Concrete Pipe	RCP
Vitrified Clay Pipe	VCP

4.5 TELEVISION INSPECTION CODES – ALIGNMENT

Description	CODE
Begin 1/4 Pipe of Water	A
Begin 1/2 Pipe of Water	B
Begin Camera Underwater	C
End Camera Underwater	D
End 1/2 Pipe of Water	E
End 1/4 Pipe of Water	F

4.6 TELEVISION INSPECTION CODES – CRACKS

DESCRIPTION ¹	CODE	VALUE
< 1/2" W, < 1/2' L	A	1
< 1/2" W, < 1' – 2' L	B	2
< 1/2" W, > 2' L	C	3
> 1/2" W, < 1/2' L	D	4
> 1/2" W, < 1' – 2' L	E	5
> 1/2" W, > 2' L	F	6
Hole in Pipe – Small	G	7
Pipe Missing < 60°	H	8
Pipe Missing > 60°	I	9

¹Use prefix of RC for Radial Cracks and LC for Longitudinal cracks.

4.7 TELEVISION INSPECTION CODES – JOINTS

DESCRIPTION	CODE	VALUE
Dropped Joint > 90% Clear	A	3
Dropped Joint 80% – 90% Clear	B	6
Dropped Joint < 80% Clear	C	9
Shifted Joint > 90% Clear	D	3
Shifted Joint 80% – 90% Clear	E	6
Shifted < 80% Clear	F	9
Withdrawn Joint 2" – 3"	G	1
Withdrawn Joint 3" – 4"	H	2
Withdrawn Joint > 4"	I	3
Visible Gasket	J	0
Leaking at Joint	K	0
Broken Joint – Light	L	2
Broken Joint – Medium	M	4
Broken Joint – Heavy	N	6

4.8 TELEVISION INSPECTION CODES - LATERALS

DESCRIPTION	CODE	VALUE
Private Service 0" – 1"	A	1
Private Service 1" – 2"	B	2
Private Service 2" – 3"	C	3
Private Service 3" – 4"	D	4
Private Service 0 > 4"	E	5
Defective Service Connection	F	6
Dead/Unused Service	G	7
Factory Service	H	8
Plumber Service	I	0

4.9 TELEVISION INSPECTION CODES - ROOTS

DESCRIPTION	CODE	VALUE
Roots, Light	A	1
Roots, Medium	B	2
Roots, Heavy	C	3

4.10 TELEVISION INSPECTION CODES - DEBRIS

DESCRIPTION	CODE	VALUE
Debris, Light	A	1
Debris, Medium	B	2
Debris, Heavy	C	3
Grease, Light	D	4
Greasy, Medium	E	5
Grease, Heavy	F	6

4.11 TELEVISION INSPECTION CODES – INFLOW/INFILTRATION

DESCRIPTION	CODE	VALUE
I/I – Light (0-1 GPM)	A	3
I/I – Medium (1-5 GPM)	B	6
I/I – Heavy (>5 GPM)	C	9
I/I – Some Evidence	D	2
I/I – Considerable Evidence	E	4
I/I – Great Evidence	F	6
I/I – No Evidence	G	0

4.12 TELEVISION INSPECTION CODES – STRUCTURAL

DESCRIPTION	CODE	VALUE
Line Deterioration, Light	A	3
Line Deterioration, Medium	B	6
Line Deterioration, Heavy	C	9
Line Deterioration, None	D	0
Oval < 5%	E	3
Oval > 5% and <10%	F	6
Oval > 10%	G	9
Collapsed	H	9
Pipe Deterioration, Light	I	0
Pipe Deterioration, Medium	J	0
Pipe Deterioration, Heavy	K	0
Pipe Deterioration, None	L	0
At Manhole	M	0

END OF SECTION

**SECTION 02525
ACCEPTANCE TESTING FOR GRAVITY SANITARY SEWERS**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Acceptance testing of sanitary sewers including:
 - 1. Visual inspection of sewer pipes.
 - 2. Mandrel testing for flexible sewer pipes.
 - 3. Leakage testing of sewer pipes.
 - 4. Leakage testing of manholes.
 - 5. Smoke testing of point repairs.
 - 6. Cleaning of Sanitary Sewer Systems.
 - 7. Television inspection of sewer pipes.
- B. All tests listed in this Section are not necessarily required on this Project. Required tests are named in other Sections which refer to this Section for testing criteria and procedures.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
 - 1. No separate payment shall be made for acceptance testing under this Section. Include payment in the unit price for work requiring acceptance testing.
 - 2. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
 - 1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

1.3 REFERENCES

- A. ASTM – American Society for Testing and Materials.
 - 1. ASTM C924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
 - 2. ASTM D3034 - Standard Specification for Type PSM Polyethylene (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 3. ASTM F794 - Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
 - 4. ASTM F1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air.
- B. CFTS – City of Friendswood Technical Specifications.

1.4 GRAVITY SANITARY SEWER PERFORMANCE REQUIREMENTS

- A. Gravity flow sanitary sewers are required to have straight alignment and uniform grade between manholes.

- B. Flexible pipe, including "semi-rigid" pipe, is required to show no more than five percent (5%) deflection. Test pipe no sooner than thirty days (30 D) after backfilling of line segment but prior to final acceptance using standard mandrel to verify that installed pipe is within specified deflection tolerances.
- C. Maximum allowable leakage for Infiltration or Exfiltration:
 - 1. The total exfiltration, as determined by hydrostatic head test, shall not exceed fifty gallons (50 Gal) per inch diameter per mile of pipe per twenty-four hours (24 Hrs) at minimum test head of two feet (2 Ft) above crown of pipe at upstream manhole or two feet (2 Ft) above groundwater elevation, whichever is greater.
 - 2. When pipes are installed more than two feet (2 Ft) below groundwater level, use infiltration test in lieu of exfiltration test. Total infiltration shall not exceed fifty gallons (50 Gal) per inch diameter per mile of pipe per twenty-four hours (24 Hrs). Groundwater elevation must be at least two feet (2 Ft) above crown of pipe at upstream manhole.
 - 3. Refer to TABLE 4.1 WATER TEST ALLOWABLE LEAKAGE in this Section, for measuring leakage in sewers. Perform leakage testing to verify that leakage criteria are met.
- D. Perform air testing in accordance with requirements of this Section and Texas Commission on Environmental Quality (TCEQ) requirements. Refer to TABLE 4.2 – TIME ALLOWED FOR PRESSURE LOSS FROM 5.0 PSI TO 4.0 PSI and TABLE 4.3 MINIMUM TESTING TIMES FOR LOW PRESSURE AIR TEST in this Section.
- E. Perform vacuum testing of manholes in accordance with requirements of this Section and Texas Commission on Environmental Quality (TCEQ) requirements. Refer to TABLE 4.4 – VACUUM TESTING TIMETABLE in this Section.

1.5 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Test Plan: Before testing begins and in adequate time to obtain approval through submittal process, prepare and submit test plan for approval by the Project Manager. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from the Drawings and the Specifications.
- C. Test Reports: Submit test reports for each test on each segment of sanitary sewer.

1.6 GRAVITY SANITARY SEWER QUALITY ASSURANCE

- A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.
- B. Provide testing reports and DVD media of television inspection as directed by the Project Manager and as specified in Section 02520 – Television Inspection of Sanitary Sewer Lines.

- C. Upon completion of DVD media reviews by the Project Manager, the Contractor shall be notified regarding final acceptance of the gravity sanitary sewer segment.

1.7 SEQUENCING AND SCHEDULING

- A. Perform testing as work progresses. Schedule testing so that no more than one thousand linear feet (1000 Lf) of installed gravity sanitary sewer remains untested at one (1) time.
- B. Coordinate testing schedules with the Project Manager. Perform testing under observation of the Project Manager.

PART II: PRODUCTS

2.1 DEFLECTION MANDREL

- A. Mandrel Sizing: Rigid mandrel shall have outside diameter (O.D.) equal to ninety-five percent (95%) of inside diameter (I.D.) of pipe. Inside diameter of pipe, for purpose of determining outside diameter of mandrel, shall be average outside diameter minus two (2) minimum wall thicknesses for O.D. controlled pipe and average inside diameter for I.D. controlled pipe, dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.
- B. Mandrel Design: Rigid mandrel shall be constructed of metal or rigid plastic material that can withstand two hundred pounds per square inch (200 psi) without being deformed. Mandrel shall have nine (9) or more "runners" or "legs" as long as total number of legs is odd number. Barrel section of mandrel shall have length of at least seventy-five percent (75%) of inside diameter of pipe. Rigid mandrel shall not have adjustable or collapsible legs which would allow reduction in mandrel diameter during testing. Provide and use proving ring for verifying each size of mandrel.
- C. Proving Ring: Furnish "proving ring" with each mandrel. Fabricate ring of one-half inch (1/2 In) thick, three inch (3 In) wide bar steel to diameter 0.02 inches larger than approved mandrel diameter.
- D. Mandrel Dimensions [five percent (5%) allowance]: Average inside diameter and minimum mandrel diameter are specified in TABLE 4.5 – PIPE VS. MANDREL DIAMETER in this Section. Mandrels for higher strength, thicker wall pipe or other pipe not listed in table may be used when approved by the Project Manager.

2.2 EXFILTRATION TEST

- A. Water Meter: Obtain transient water meter from the City for use when water for testing shall be taken from the City system. Conform to the City requirements for water meter use.
- B. Test Equipment:
 - 1. Pipe plugs.

2. Pipe risers where manhole cone is less than two feet (2 Ft) above highest point in pipe or service lead.

2.3 INFILTRATION TEST

A. Test Equipment:

1. Calibrated ninety degree (90°) V-notch weir.
2. Pipe plugs.

2.4 LOW PRESSURE AIR TEST

A. Minimum Requirement for Equipment:

1. Control panel.
2. Low-pressure air supply connected to control panel.
3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested; capable of withstanding internal test pressure without leaking or requiring external bracing.
4. Air hoses from control panel to:
 - a. Air supply.
 - b. Pneumatic plugs.
 - c. Sealed line for pressuring.
 - d. Sealed line for monitoring internal pressure.

- #### B. Testing Pneumatic Plugs:
- Place pneumatic plug in each end of length of pipe on ground. Pressurize plugs to a minimum of twenty-five pounds per square inch (25 psi); then pressurize sealed pipe to five pounds per square inch (5 psi). Plugs are acceptable when they remain in place against test pressure without external aids.

2.5 GROUND WATER DETERMINATION

- #### A. Equipment:
- Pipe probe or small diameter casing for ground water elevation determination.

2.6 SMOKE TESTING

A. Equipment:

1. Pneumatic plugs.
2. Smoke generator as supplied by Superior Signal Company, or approved equal.
3. Blowers producing two thousand five hundred Standard Cubic Feet per Minute (2500 Scfm) minimum.

PART III: EXECUTION

3.1 PREPARATION

- #### A.
- Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.
- #### B.
- Determine selection of test methods and pressures for gravity sanitary

sewers based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Section 01585 - Control of Ground and Surface Water.

3.2 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS

- A. Check pipe alignment visually by flashing light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and relay or replace pipe segment.

3.3 MANDREL TESTING FOR GRAVITY SANITARY SEWERS

- A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than five percent (5%) deflection. Mandrel testing shall conform to ASTM D3034. Perform testing no sooner than thirty days (30 D) after backfilling of line segment, but prior to final acceptance testing of line segment.
- B. Pull approved mandrel by hand through gravity sanitary sewer sections. Replace any section of gravity sanitary sewer not passing mandrel. Mandrel testing is not required for stub-outs.
- C. Retest repaired or replaced gravity sanitary sewer sections.

3.4 LEAKAGE TESTING FOR GRAVITY SANITARY SEWERS

- A. Test Options:
 - 1. Test gravity sanitary sewer pipes for leakage by either exfiltration or infiltration methods, as appropriate, or with low pressure air testing.
 - 2. Test new, replacement or rehabilitated gravity sanitary sewer manholes with water or low-pressure air. Manholes tested with low pressure air shall undergo physical inspection prior to testing.
 - 3. Perform leakage testing after backfilling of line segment, and prior to tie-in of service connections.
 - 4. If no installed piezometer is within 500 feet of gravity sanitary sewer segment, provide temporary piezometer for this purpose.
- B. Compensating for Ground Water Pressure:
 - 1. Where ground water exists, install pipe nipple at same time gravity sanitary sewer line is placed. Use one-half inch (1/2 In) capped pipe nipple approximately ten inches (10 In) long. Make installation through manhole wall on top of gravity sanitary sewer line where line enters manhole.
 - 2. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect clear plastic tube to nipple. Support tube vertically and allow water to rise in tube. After water stops rising, measure height in feet of water over invert of pipe. Divide this height by two and three-tenths feet/pounds per square inch (2.3 Ft/psi) to determine ground water pressure to be used in line testing.

- C. Exfiltration test:
1. Determine ground water elevation.
 2. Plug sewer in downstream manhole.
 3. Plug incoming pipes in upstream manhole.
 4. Install riser pipe in outgoing pipe of upstream manhole when highest point in service lead (house service) is less than two feet (2 Ft) below bottom of manhole cone.
 5. Fill gravity sanitary sewer pipe and manhole or pipe riser, when used, with water to point two and one-half feet (2-1/2 Ft) above highest point in gravity sanitary sewer pipe, house lead, or ground water table, whichever is highest.
 6. Allow water to stabilize for one hour (1 Hr) to two hours (2 Hrs). Take water level reading to determine drop of water surface, in inches, over one hour (1 Hr) period, and calculate water loss [one inch (1 In) of water in four feet (4 Ft) diameter manhole equals eight and twenty-two hundredths gallons (8.22 Gal)] or measure quantity of water required to keep water at same level. Loss shall not exceed that calculated from allowable leakage according to TABLE 4.1 WATER TEST ALLOWABLE LEAKAGE in this Section.
- D. Infiltration test: Ground water elevation must be not less than two feet (2 Ft) above highest point of gravity sanitary sewer pipe or service lead (house service).
1. Determine ground water elevation.
 2. Plug incoming pipes in upstream manhole.
 3. Insert calibrated ninety-degree (90°) V-notch weir in pipe on downstream manhole.
 4. Allow water to rise and flow over weir until it stabilizes.
 5. Take five (5) readings of accumulated volume over period of two hours (2 Hrs) and use average for infiltration. Average must not exceed that calculated for two hours (2 Hrs) from allowable leakage according to TABLE 4.1 WATER TEST ALLOWABLE LEAKAGE in this Section.
- E. Low Air Pressure Test: When using this test conform to ASTM C924 or ASTM F1417, as applicable, with holding time not less than that listed in TABLE 4.2 – TIME ALLOWED FOR PRESSURE LOSS FROM 5.0 PSI TO 4.0 PSI.
1. Air testing for sections of pipe shall be limited to lines less than thirty-six inch (36 In) average inside diameter.
 2. Lines thirty-six inch (36 In) average inside diameter and larger shall be tested at each joint. Minimum time allowable for pressure to drop from five pounds per square inch (5.0 psi) to four pounds per square inch (4.0 psi) during joint test shall be ten seconds (10 Sec), regardless of pipe size.
 3. For pipe sections less than thirty-six inch (36 In) average inside diameter:

- a. Determine ground water level.
 - b. Plug both ends of pipe.
 - c. After manhole-to-manhole section of gravity sanitary sewer main has been sliplined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.
 - d. Pressurize pipe to five pounds per square inch (5.0 psi). See TABLE 4.2 – TIME ALLOWED FOR PRESSURE LOSS FROM 5.0 TO 4.0 PSI in this Section.
 - e. To determine air loss, measure time interval for pressure to drop to four pounds per square inch (4.0 psi). Time must exceed that listed in TABLE 4.2 – TIME ALLOWED FOR PRESSURE LOSS FROM 5.0 TO 4.0 PSI in this Section for pipe diameter and length. For sliplining, use diameter of carrier pipe.
- F. Retest: Repair and retest any section of pipe which fails to meet requirements.

3.5 TEST CRITERIA TABLES

- A. Exfiltration and Infiltration Water Tests: Refer to TABLE 4.1 WATER TEST ALLOWABLE LEAKAGE in this Section.
- B. Low Pressure Air Test:
 - 1. TABLE 4.2 – TIME ALLOWED FOR PRESSURE LOSS FROM 5.0 TO 4.0 PSI in this Section, are based on equation from Texas Commission on Environmental Quality (TCEQ) Design Criteria 317.2(a)(4)(B).

$$T = 0.0850(D)(K)/(Q)$$

- Where:
- T = time for pressure to drop one (1.0) pound per square inch gauge in seconds
 - K = 0.000419 DL, but not less than one (1.0)
 - D = average inside diameter in inches
 - L = length of line of same size pipe
 - Q = rate of loss, 0.0015 ft³/min./sq. ft. internal surface

- 2. Since K value of less than one (1.0) shall not be used, there are minimum testing times for each pipe diameter as given in TABLE 4.3 – MINIMUM TESTING TIMES FOR LOW PRESSURE AIR TEST in this Section.

Notes:

- 1. When two (2) sizes of pipe are involved, compute time by ratio of lengths involved.
- 2. Lines with twenty-seven inch (27 In) average inside diameter and larger may be air tested at each joint.
- 3. Lines with average inside diameter greater than thirty-six inches (36 In) shall be air tested for leakage at each joint.
- 4. If joint test is used, perform visual inspection of joint

immediately after testing.

5. For joint test, pipe is to be pressurized to four (4.0) psi greater than pressure exerted by groundwater above pipe. Once pressure has stabilized, minimum times allowable for pressure to drop from five (5.0) pounds per square inch to four (4.0) pounds per square inch shall be ten (10) seconds.

3.6 LEAKAGE TESTING FOR MANHOLES

- A. After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.
- B. Plug influent and effluent lines, including service lines, with suitably sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs minimum of six inches (6 In) outside of manhole walls. Brace inverts to prevent lines from being dislodged when lines entering manhole have not been backfilled.
- C. Vacuum testing:
 1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.
 2. Evacuate manhole with vacuum pump to ten inches (10 In) of mercury (Hg), disconnect pump, and monitor vacuum for time period specified in Table 4.3 VACUUM TESTING TIMETABLE in this Section.
 3. If drop in vacuum exceeds one inch of mercury(1 In/Hg) over specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.
- D. Perform hydrostatic exfiltration testing as follows:
 1. Seal wastewater lines coming into manhole with internal pipe plug. Then fill manhole with water and maintain it full for at least one hour (1 Hr).
 2. The maximum leakage for hydrostatic testing shall be twenty-five thousandths gallons (0.025 Gal) per foot diameter per foot of manhole depth per hour.
 3. If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

3.7 SMOKE TEST PROCEDURE FOR POINT REPAIRS

- A. Application: Perform smoke test to:
 1. Locate points of line failure for point repair.

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2. Determine when point repairs are properly made.
 3. Determine when service connections have been reconnected to rehabilitated sewer.
 4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.
- B. Limitations: Do not backfill service taps until completion of this test. Test only those taps in single manhole-to-manhole section at one (1) time. Keep number of open excavations to minimum.
- C. Preparation: Prior to smoke testing, give written notices to area residents no fewer than two days (2 D), nor more than seven days (7 D), prior to proposed testing. Also give notice to the City of Friendswood Police, Fire Departments and Public Works twenty-four hours (24 Hrs) prior to actual smoke testing.
- D. Isolate Section: Isolate manhole section to be tested from adjacent manhole sections to keep smoke localized. Temporarily seal annular space at manhole for sliplined sections.
- E. Smoke Introduction:
1. Operate equipment according to manufacturer's recommendation and as approved by the Project Manager.
 2. Conduct test by forcing smoke from smoke generators through gravity sanitary sewer main and service connections. Operate smoke generators for minimum of five minutes (5 Min).
 3. Introduce smoke into upstream and downstream manhole as appropriate. Monitor taps/connections for smoke leaks. Note sources of leaks.
- F. Repair and Retest: Repair and replace taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one (1) manhole-to-manhole section at time. When repair or replacement, testing or retesting, and backfilling of excavation is not completed within one (1) workday, properly barricade, and cover each excavation as approved by the Project Manager.
- G. Service Connections: On houses where smoke does not escape from plumbing vent stacks to confirm reconnection of sewer service to newly installed liner pipe, perform dye test to confirm reconnection has been made. Introduce dye into service line through plumbing fixture inside structure or sewer cleanout immediately outside structure and flush with water. Observe flow at service reconnection or downstream manhole. Detection of dye confirms reconnection.

PART IV: TABLES

4.1 – WATER TEST ALLOWABLE LEAKAGE

Diameter of Riser or Stack in Inches	Volume per Inch of Depth		Allowance Leakage*	
	Inch	Gallons	Pipe Size in Inches	Gal./Min. per 100 ft.
1	0.7854	0.0034	6	0.0039
2	3.1416	0.0136	8	0.0053
2.5	4.9087	0.0212	10	0.0066
3	7.0686	0.0306	12	0.0079
4	12.5664	0.0306	15	0.0099
5	19.6350	0.0544	18	0.0118
6	28.2743	0.1224	21	0.0138
8	50.2655	0.2176	24	0.0158
			27	0.0177
			30	0.0197
			36	0.0237
			42	0.0276
For other diameters, multiply square of diameters by value for 1" diameter.			Equivalent to 50 gallons per inch of inside diameter per mile per 24 hours.	
* Allowable leakage rate shall be reduced to ten gallons (10 Gal) per inch of inside diameter per mile per twenty-four hours (24 Hrs) when sewer is identified as located above twenty-five year (25 Yr) flood plain.				

4.2 TIME ALLOWED FOR PRESSURE LOSS FROM 5.0 PSI TO 4.0 PSI

Pipe Dia. In.	Min. Time mm:ss	Length for Min. Time	Time for Longer Length	Specification Time for Length (L) shown in MM:SS					
				100'	150'	200'	250'	300'	
6	5:40	398	0.8548	5:40	5:40	5:40	5:40	5:40	
8	7:33	298	1.5196	7:33	7:33	7:33	7:33	7:36	
10	9:27	239	2.3743	9:27	9:27	9:27	9:54	11:52	
12	11:20	199	3.4190	11:20	11:20	11:20	14:15	17:06	
15	14:10	159	5.3423	14:10	14:10	17:48	22:16	26:43	
18	17:00	133	7.6928	17:00	19:14	25:39	32:03	38:28	
21	19:50	114	10.4708	19:50	26:11	34:54	43:38	52:21	
24	22:40	99	13.6762	22:48	34:11	45:35	56:59	68:23	
27	25:30	88	17.3089	28:51	43:16	57:42	72:07	86:33	
30	28:20	80	21.3690	35:37	53:25	71:14	89:02	106:51	
33	31:10	72	25.8565	43:06	64:38	86:11	107:44	129:17	
Pipe Dia. In.	Min. Time mm:ss	Length for Min. Time	Time for Longer Length	Specification Time for Length (L) shown in MM:SS					
				350'	400'	450'	500'	550'	600'
6	5:40	398	0.8548	5:40	5:42	6:25	7:07	7:50	8:33
8	7:33	298	1.5196	8:52	10:08	11:24	12:08	13:56	15:12
10	9:27	239	2.3743	13:51	15:50	17:48	19:47	21:46	23:45
12	11:20	199	3.4190	19:57	22:48	25:39	28:30	31:20	34:11
15	14:10	159	5.3423	31:10	35:37	40:04	44:31	48:58	53:25
18	17:00	133	7.6928	44:52	51:17	57:42	64:06	70:31	76:56
21	19:50	114	10.4708	61:05	69:48	78:32	87:15	95:59	104:42
24	22:40	99	13.6762	79:47	91:10	102:34	113:58	125:22	136:46
27	25:30	88	17.3089	100:58	115:24	129:49	144:14	158:40	173:05
30	28:20	80	21.3690	124:39	142:28	160:16	178:05	195:53	213:41
33	31:10	72	25.8565	150:50	172:23	193:55	215:28	237:01	258:34

4.3 MINIMUM TESTING TIMES FOR LOW PRESSURE AIR TEST

Pipe Diameter (Inches)	Minimum Time (seconds)	Length of Pipe for Minimum Time (feet)	Time for Longer Length (seconds)
6	340	398	0.855 (L)
8	454	298	1.520 (L)
10	567	239	2.374 (L)
12	680	199	3.419 (L)
15	850	159	5.342 (L)
18	1020	133	7.693 (L)
21	1190	114	10.471 (L)
24	1360	99	13.676 (L)
27	1530	88	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	258.856 (L)

4.4 – VACUUM TESTING TIME TABLE

TIME ALLOWED FOR VACUUM LOSS FROM 10.0 Hg TO 9.0 Hg			
TIME IN SECONDS BY DIAMETER OF MANHOLES			
Manhole Depth in Feet	48" Diameter	60" Diameter	72" Diameter
8' and less	14	18	23
10	17	23	28
12	21	28	34
14	25	32	40
16	28	37	45
18	23	41	51
20	35	46	57
22	39	51	62
24	42	55	68
26	46	60	74
28	49	64	80
30	53	69	85

4.5 – PIPE VS. MANDREL DIAMETER

PIPE VERSUS MANDREL DIAMETER			
Material and Wall Construction	Nominal Size (Inches)	Average I.D. (Inches)	Minimum Mandrel Diameter (Inches)
PVC - Solid (SDR 26)6	6	5.764	5.476
	8	7.715	7.329
	10	9.646	9.162
PVC – Solid (SDR 35)12	12	11.737	11.150
	15	14.374	13.655
	18	17.629	16.748
	21	20.783	19.744
	24	23.381	22.120
	27	26.351	25.033
PVC – Truss	8	7.750	7.363
	10	9.750	9.263
	12	11.790	11.201
	15	14.770	14.032
PVC – Profile (ASTM F794)	12	11.470	11.153
	15	14.370	13.652
	18	17.650	16.768
	21	20.750	19.713
	24	23.500	22.325
	27	26.500	25.175
	30	29.500	28.025
	36	35.500	33.725
	42	41.500	39.425
HDPE – Profile	48	47.500	45.125
	18	18.000	17.100
	21	21.000	19.950
	24	24.000	22.800
	27	27.000	25.650
	30	30.000	28.500
	36	36.000	34.200
	42	42.000	39.900
	48	48.000	45.600
Fiberglass (Class SN-46)	54	54.000	51.300
	60	60.000	57.00
	12	12.85	11.822
	18	18.66	17.727
	20	20.68	19.646
	24	24.72	23.484
	30	30.68	29.146
	36	36.74	34.903
	42	42.70	40.565
48	48.76	46.322	
54	54.82	52.079	
60	60.38	57.361	

END OF SECTION

**SECTION 02530
SANITARY SEWER LINE CLEANING**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Cleaning of Sanitary Sewer Lines to include all the equipment, labor and materials necessary to perform all work for sewer line cleaning.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
 - 1. No separate payment shall be made for acceptance testing under this Section. Include payment in the unit price for work requiring acceptance testing.
 - 2. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
 - 1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

1.3 REFERENCES

- A. CFTS – City of Friendswood Technical Specifications.
- B. TCEQ – Texas Commission on Environmental Quality.

1.4 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. The Contractor shall submit all manufacturer's brochures and specifications for the cleaning equipment.
- C. Methods of cleaning and clearing lines shall submit for review and approval by the Project Manager.

1.5 QUALITY ASSURANCE

- A. The Contractor shall comply with all codes, laws, ordinances and regulations of the governmental authorities having jurisdiction over this work.
- B. The Contractor shall comply with the latest revision of the Occupational Safety and Health Administration manuals for construction and confined spaces.
- C. The Contractor shall comply with all rules and regulations of the Texas Commission on Environmental Quality.
- D. The sanitary sewer line cleaning shall remove foreign materials from the lines and restore the sanitary sewer to a minimum of ninety-five percent (95%) of the original carrying capacity or as required for proper seating of an internal pipe line. 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 shall immediately notify the Project Manager and the Contractor shall not be required to clean that section of pipe.

1.6 COORDINATION

- A. The Contractor shall completely remove and dispose of all dirt, rubbish and surplus, and unsuitable materials at the end of each work day at no additional cost to the City and in accordance of Section 01580 – Waste Material Disposal.
- B. The Contractor shall be allowed to use the City water supply for filling the tanks. The Contractor shall go to the Public Works Department and obtain, by leaving a deposit, a meter for fire hydrants. There shall be no charge for the water used during this operation. There shall be either an RPZ or and an air gap for filling of the tanks. All filling operations are to be reviewed by the Project Manager.

PART II: PRODUCTS

2.1 HIGH VELOCITY JET (HYDRO CLEANING) EQUIPMENT

- A. All high-velocity sanitary sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two (2) or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from fifteen degrees (15°) to forty-five degrees (45°) in all sizes of pipe designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floors. 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, hydraulically driven hose reel and recovery tank.
 - 1. The equipment shall have a minimum of six hundred feet (600 Ft) of one inch (1 In) I.D. high pressure hose.
 - 2. The nozzles shall have a capacity of sixty gallons per minute (60 GPM).
 - 3. The minimum working pressure shall be one thousand pounds per square inch (1000 psi).

PART III: EXECUTION

3.1 CLEANING PRECAUTIONS

- A. During sanitary sewer cleaning operations, satisfactory precautions shall be taken in the use of the cleaning equipment to insure that the water pressure does not create damage or cause flooding of property or buildings being served by the sewer. Extraordinary care shall be taken to prevent the nozzle from causing damage to people, vehicles or other

property that are in the vicinity of or around the equipment.

3.2 SEWER LINE CLEANING

- A. The designated sanitary sewer sections shall be cleaned using high-velocity jet equipment. The equipment shall be capable of removing roots, dirt, grease, sand, rocks and other materials and obstructions from sanitary sewer lines and manholes. There shall be a debris catcher on the downstream manhole if the system is currently tied into the City's existing sanitary sewer system. If cleaning of an entire section cannot be successfully performed from one (1) 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 transverse the entire section, it shall be assumed that a major blockage exists and the cleaning effort shall be abandoned after notification to and approval by the Project Manager.

3.3 ROOT REMOVAL

- A. Roots shall be removed in the sections where root intrusion is a problem. Special attention shall be used during the cleaning operation to assure almost complete removal of roots from the joints. Roots which could prevent installation of a pipe liner 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.

3.4 MATERIAL REMOVAL

- A. Sludge, dirt, rocks, sand, grease, roots and other solid or semi-solid material resulting from cleaning operation shall be captured and removed at the downstream manhole of the section being cleaned, loaded in a suitable container, transported to the nearest wastewater treatment facility and disposed of at that facility in accordance with all requirements and charges and as specified in Section 01580 – Waste Material Disposal.
- B. **UNDER NO CIRCUMSTANCES SHALL SEWAGE OR SOLIDS OR ANY OTHER TYPE OF WASTE MATERIAL FROM THIS OPERATION THAT HAS BEEN REMOVED FROM THE CITY SEWER SYSTEM, BE DUMPED ONTO STREETS OR INTO DITCHES, CATCH BASINS, STORM DRAINS, EXISTING SANITARY SEWER MANHOLES, ON THE GROUND OR INTO STREAMS.**

3.5 CLEANING WATER DISPOSAL

- A. Water used to clean the sewer lines shall be discharged into the sanitary sewer system downstream of the cleaning operation or as otherwise directed by the Project Manager.
- B. **UNDER NO CIRCUMSTANCES SHALL THE CONTRACTOR DISCHARGE WATER USED TO CLEAN THE SEWER LINES ONTO**

**STREETS OR INTO DITCHES, CATCH BASINS, STORM DRAINS,
EXISTING SANITARY SEWER MANHOLES, ON THE GROUND OR
INTO STREAMS.**

3.7 FINAL ACCEPTANCE

- A. Acceptance of sanitary sewer line cleaning shall be made upon completion of the television inspection as specified in Section 02520 – Television Inspection of Sanitary Sewer Lines. The DVD media and reports shall be reviewed and approved by the Project Manager. Any television inspection that shows the cleaning to be unsatisfactory shall require the process of re-cleaning and re-inspecting to be repeated until the sanitary sewer line cleaning is satisfactory to the Project Manager. Re-cleaning and re-inspection shall be done at no additional cost to the City.

END OF SECTION

**SECTION 02535
SANITARY SEWER LIFT STATIONS**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Installation of permanent, replacement and temporary sanitary sewer lift stations and equipment.
- B. This Technical Specification is intended as a general description of sanitary sewer lift station requirements and does not purport to describe all details of the equipment to be furnished. See the individual Sections for detailed specifications on equipment.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
 - 1. Payment for sanitary sewer lift station components shall be broken down into a schedule of values and shall be paid according to the percentage finished of each value.
 - 2. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
 - 1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

1.3 REFERENCES

- A. ASTM – American Society for Testing and Materials.
 - 1. ASTM C443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
 - 2. ASTM C478 Standard Specification for Precast Reinforced Concrete Manhole Sections.
 - 3. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 4. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 5. ASTM D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- B. AWWA – American Water Works Association.
 - 1. AWWA C151 – Standard Pressure Classes – Wall thickness and nominal wall thickness.
 - 2. AWWA C500 – Metal-seated Gate Valves for Water Service.
 - 3. AWWA C508 – Swing-Check Valves for Waterworks Service, 2 in. through 24 in. NPS
 - 4. AWWA C509 – Resilient-Seated Gate Valves for Water Service.
 - 5. AWWA C550 – ERTA Protective Interior Coatings for Valves and

Hydrants.

- C. CFTS – City of Friendswood Technical Specifications.
- D. NEC – National Electrical Code.

1.4 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit product data for each type of pipe and equipment that shall be incorporated in the Work.

1.5 QUALITY ASSURANCE

- A. The Project Manager shall be responsible for the day to day inspection of the Work and overall quality inspection. The City's Building Division shall be responsible for verifying the Contractor has complied with all Federal, State and City Codes, Regulations and Ordinances.
- B. In matters of building codes, the Building Inspector shall govern over all aspects. The Chief Building Official shall be the final determining authority over matters or questions on codes, ordinances and regulations.
- C. The Contractor shall comply with the start up procedure as stated in paragraph 3.11 in this Section.

PART II: PRODUCTS

2.1 WET WELLS

- A. The wet well shall consist of a circular basin a minimum of seven feet (7 Ft) in diameter and a minimum of ten feet (10 Ft) in depth. The wet well shall be constructed of reinforced concrete meeting the requirements of Section 03300 – Structural Concrete. The wet well walls shall be designed to withstand the external earth loadings when wet well is empty.
 - 1. Precast wet wells shall be installed according to Section 02305 – Precast Concrete Manholes. Materials for Precast sections shall conform to ASTM C478 and cylinders shall be joined by watertight gasketed joints per ASTM C443.
 - 2. The base wet well shall consist of a minimum of twelve inches (12 In) of reinforced concrete. The base shall be installed on top of a seal slab with the thickness as shown on the Drawings.
 - 3. All pipe openings shall be core drilled into the wet well walls.
 - 4. All openings and base slab shall be sealed with a non-shrink grout meeting the specifications of Section 03105 – Grout.
 - 5. All wet wells shall be coated with Raven or Spectrashield.
- B. Air Vent: The wet well shall have a minimum three inch (3 In) diameter ductile iron or stainless steel air vent extending through the top slab with a one hundred eighty degree (180°) turn sealed by an approved insect screen.
- C. Guide Rails: Provide type 304 stainless steel pump guide rails, two (2) per pump, in the wet well securely fastened to the top opening of the wet

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well to allow the pumps to accurately mate with the pump bases which shall be secured to the bottom with stainless steel bolts.

- D. Pump Bases: Pump bases shall be as specified by the manufacturer and approved by the Project Manager. Bases shall have a minimum four inch (4 In) ductile iron (Class 200) discharge pipe. Pumps shall be provided with a stainless steel lifting chain capable of raising the pumps to the top slab.
- E. Floats: Floats for control of the pumps and alarms shall be provided by the pump manufacturer and shall be installed so as that they are not affected by incoming flow.
- F. Access Hatch: Access to the wet well shall be through a rectangular aluminum hatch with 316 stainless steel hardware and rated for a three hundred pound (300 Lb) load, and of a size which provides the maximum size opening required for work in the wet well. The top of the hatch shall be a minimum of twelve inches (12 In) higher than the surrounding area. The finish shall be either checkered, diamond plate or other approved non-slip surface. Hatch shall open and lock automatically with stainless steel "hold open" arm with aluminum release handles.
- G. Ladder: Human access to the wet well will not normally be required but steps shall be provided and embedded in the wet well. Rungs shall have sixteen inch (16 In) spacing. Ladder and all hardware shall be stainless steel.
- H. Discharge connection elbows shall be permanently installed in the wet well.

2.2 PUMPS AND MOTORS

- A. Pumps for installation in sanitary sewer lift stations shall be Flygt or ABS compatible with Flygt dual guide rail systems. **No exceptions.**
- B. The pump and motor units shall be the submersible type designed to pump raw sewage through a minimum four inch (4 In) discharge force main. All nuts, bolts, washers and other fastening devices coming into contact with raw sewage shall be constructed of Type 304 stainless steel.
- C. Pumps shall have single or double shrouded, balanced, non-clogging impellers and shall be capable of handling solids, fibrous materials heavy sludge and shall be capable of passing three inch (3 In) diameter spheres. Pumps shall be driven by three phase (3 Ø), four hundred sixty volt (460V), sixty hertz (60 Hz) motors.
- D. Pump motors shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled or oil field watertight chamber, NEMA B type. The pump power cable shall be sized according to the NEC standards and shall be oil resistant chloroprene rubber. Motor and cable shall be capable of continuous submergence without loss of watertight integrity to a dept of sixty-five feet (65 Ft).
- E. Hydraulic Sealing Flange: Pumps shall be supplied with a universal coupling which bolts to the pump discharge and shall accept the discharge elbow provided by the manufacturer. Seal of the pump

discharge flange shall be accomplished by a simple downward motion of the pump with the entire weight of the pump guided to and pressing against the discharge connection; no part of the pump shall bear directly on the sump floor and no rotary motion of the be shall be required for sealing. Sealing at discharge shall be affected directly by a rubber lip to ensure a positive leak proof system and for ease of removal.

2.3 PIPING AND VALVING

- A. All piping and fittings in the wet well shall be ductile iron, class 260 in accordance with AWWA C151. The connection outside shall be made with a ductile iron mechanical joint solid sleeve.
- B. Gate Valves: Gate valves shall be in accordance with AWWA C500 and AWWA C509 and have hand wheel operators. All valves shall be open left (counter-clockwise)
- C. Swing Check Valves: Check valves shall have exterior weighted arms and conform to AWWA C508. Valves shall be cast iron body with bronze mounted, single disc, one hundred seventy-five pounds per square inch (175 psi) working pressure, and cushioned closing type. Valve shall be coated in accordance of AWWA C550. Check valves shall be air cushioned, horizontal swing bolted bonnet, removable seat and disc flanged. A stainless steel pressure gauge shall be installed on the upstream side of the check valve.
- D. Surge Relief Valves: Force mains with a total dynamic head greater than eighty feet (80 Ft) shall be required to have a surge relief valve.

2.4 STORAGE CAPACITY

- A. The sanitary sewer lift station shall have additional storage capacity to handle flows at peak demand period, during a power failure or other malfunction, of at least two hours (2 Hrs).

2.5 PAVING

- A. All paving and areas around the lift station shall have a minimum of eight inches (8 In) stabilized subgrade and seven inches (7 In) of concrete. Driveway shall have a minimum width of fourteen feet (14 Ft).
 - 1. Subgrade: Excavate and proof roll natural ground and remove any soft spots. Install eight inches (8 In) of stabilized subgrade and compact to ninety-five percent (95%) Standard Proctor.
 - 2. Place seven inches (7 In) of concrete in accordance with Section 03300 – Structural Concrete.

2.6 FENCING

- A. Install eight foot (8 Ft) high opaque wood fence around perimeter of the sanitary sewer lift station with a mow strip. This fence shall be level across the top for the perimeter of the lift station and/or property line. Refer to Section 02930 - Cedar Fence for more details.

2.7 ELECTRICAL COMPONENTS AND CONTROLS

- A. The electrical, control and alarm system shall be as specified in the Division sixteen (16) of these specifications and installed in accordance with the National Electrical Code. The complete system shall be furnished and installed by one (1) supplier. The Contractor shall call the local power distribution company and install all lines to the control panel and meter in accordance of their requirements. The electric meter shall be installed as close to the lift station as allowed by the local power distribution company. Electrical equipment as listed below are the basics, and all details would need to be reviewed on the Drawings and Division sixteen (16) – ELECTRICAL.
1. Enclosures, Power Distribution Blocks, Surge suppression, Circuit Breakers, Contactors, Relays, Transformers, time delays, and Fuses.
 2. Alarm light, Alarm system and SCADA Monitoring System.
 3. SCADA system shall conform and be compatible with current City of Friendswood SCADA system.

PART III: EXECUTION

3.1 GENERAL

- A. The work covered by this Section of the Technical Specifications shall consist of furnishing all specified materials with all necessary equipment, machinery, tools and labor and performing all work required to install and/or construct the sanitary sewer lift stations, incorporating all change orders, directives and modifications, all to shall be complete, in place, accepted and ready for use. Failure to comply with these Technical Specifications will result in the rejection of the Work by the Project Manager.

3.2 STRUCTURES

- A. All structures such as the wet well and the control panel base shall be constructed as detailed on the Drawings and as directed in these Technical Specifications. All access frames and covers shall be properly set and installed as recommended by the manufacturer.

3.3 PUMP AND MOTOR INSTALLATION

- A. The pump and motor units shall be carefully installed as recommended by the manufacturer and the seals between pumps and pump bases must mate as intended. The pump and motor shall be properly wired and field checked to see that it can easily be removed and replaced by means of lifting the chains and do not bind on the guardrails. Actual pump tests shall be required by placing water in the wet well and timing the withdrawal rates.

3.4 ELECTRICAL AND CONTROLS

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- A. Permanent power shall be installed and all systems operating checked and verified. All electrical equipment, wiring and devices shall be installed in accordance with the National Electrical Code and shall be inspected by the City of Friendswood Building Division.
- 3.5 PIPING
- A. Piping shall be installed as shown on the Drawings and in accordance with all relevant Technical Specifications.
- 3.6 PAVING
- A. Paving shall be provided for the access road and for all areas inside the fence and shall consist of materials as specified in this Section. Paving shall be smooth grade and sloped to provide proper drainage, especially away from the lift station facilities. All paving shall have a light to medium broom finish and shall have been treated with curing compound.
- 3.7 FENCING
- A. Fencing and access gates shall be installed as shown on the Drawings and as approved by the Project Manager using the materials stated in this Section.
- 3.8 TESTING
- A. Testing shall consist of verification on all piping and wet wells that there is no infiltration. All backfill and subgrade shall be tested as required. Independent Testing Laboratory shall be contracted by the City.
- 3.9 SITE CLEANUP, RESTORATION AND GRADING
- A. After the Work has been completed, the Contractor shall clear the site of all construction materials and other debris. Grading shall consist of providing proper drainage and all sites shall be left in a neat, clean and acceptable condition. All property that has been disturbed by or during the Work, shall be restored to a condition that is equal to, or better than, the condition before the Work was started. In any existing or proposed lawn areas, the final restoration shall include sodding.
- 3.10 OPERATION AND MAINTENANCE MANUALS AND RECORD DRAWINGS
- A. The Contractor shall supply two (2) sets each of Operation Manuals and Maintenance Manuals. Only one (1) copy of the original manufacturers' data sheets for miscellaneous components shall be required. City staff shall be instructed on the operation and maintenance of all equipment installed at the lift station.
 - B. Record Drawings and documents shall consist of all revised Drawings, all Contract Documents and the As-Builts for the Work. The as-builts shall be rendered to the City on a CD in an acceptable AutoCAD format to be verified by the Project Manager. All Mylars used for the production of the Drawings shall become the property of the City.

3.11 START UP PROCEDURE

- A. After the verification of completed substantial completion punch items, a final walkthrough shall be scheduled to include the Director of Public Works, the Water/Wastewater Superintendent, the Project Manager, the Contractor and all Subcontractors necessary for the startup procedures. The Contractor shall perform the following start up procedure in the presence of the City personnel.
 - 1. Have wet well filled with water and a tank standing by. Simulate all conditions so that the floats can control the normal operations of the pumps.
 - 2. Pumps shall be tested for flow rate by attaching a flow test meter to the discharge pipe, and cycling the pump. Flow rate shall have a tolerance of plus or minus ten percent ($\pm 10\%$).
 - 3. Simulate all conditions likely to be encountered during normal operations including, but not limited to, running pumps in manual, setting off causes for alarm and verifying the dialer program is working.
 - 4. Verify that SCADA system is online and working. This also includes communications with current SCADA system.
- B. If any of the tests fails or does not perform to specifications or expectations the Project Manager shall reject the Work as being unacceptable and incomplete for final acceptance. The Contractor shall make any and all necessary repairs to bring the lift station to final completion. The Contractor shall schedule and perform a new start-up procedure at no extra cost to the City.

END OF SECTION

**SECTION 02540
SANITARY SEWER POINT REPAIRS**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Repair and replacement of sanitary sewer line failures.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices:

- 1. Payment for point repairs shall be on a unit price basis for each repair. Payment shall be made for each repair complete in place, including all materials equipment, labor and excavation and backfill.
- 2. Payment for point repairs shall be on a unit price basis per linear foot of repair as measured along the centerline of the sanitary sewer line. Payment shall be made for each repair complete in place, including all materials equipment, labor and excavation and backfill.
- 3. No separate payment shall be made for Television Inspection of repaired sanitary sewer lines.
- 4. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum):

- 1. If contract is Stipulated Price Contract, payment for work in this Section is included in the Total Stipulated Price.

1.3 REFERENCES

- A. ASTM – American Society for Testing and Materials.
 - 1. ASTM C150 – Standard Specification for Portland Cement.
 - 2. ASTM D698 – Standard Test Methods for Laboratory Characteristics of Soil Using Standard Effort.
- B. CFSD – City of Friendswood Standard Details.
- C. CFTS – City of Friendswood Technical Specifications.

1.4 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit product data for each pipe product, fitting, coupling and adapter.

1.5 QUALITY ASSURANCE

- A. Provide manufacturer's affidavits that pipes, fittings, couplings and adapters were manufactured in compliance with standards and Technical Specifications referenced in this Section.

PART II: PRODUCTS

2.1 MATERIALS

- A. Use only soils that are in compliance with the specifications in Section 02140 – Utility Backfill Materials.
- B. Use cement-stabilized backfill for bedding and backfill to above the pipe as required. Repairs under paving shall have cement-stabilized backfill to the top of the subgrade of the paving that shall conform to Section 02145 – Cement-Stabilized Sand.
 - 1. Cement shall consist of Type I Portland Cement conforming to ASTM C150.
 - 2. Sand and cement shall be mixed in a pug mill or obtained from an approved supplier using not less than one and one-half (1-1/2) sacks of cement per one ton (1 Tn) of mixture and sufficient water to hydrate the cement.
- C. All pipe and materials for repair shall conform to the appropriate section, Section 02200 to Section 02280, for the type of pipe being repaired.

PART III: EXECUTION

3.1 PREPARATION

- A. All line materials (pipe and fittings) shall be on-site prior to any excavation.
- B. Bedding material shall be on-site or delivery arrangements definitely made with a reliable source.
- C. Trench Safety Systems shall be on-site and shall comply with all rules, regulations and laws as specified in Section 02280 – Trench Safety Systems.
- D. Provide bypass pumping as required. Bypass pumping shall be incidental to the work in this Section. All bypass pumping shall conform to Section 02555 – Sanitary Sewer Bypass Pumping.

3.2 EXCAVATION

- A. Trenching and Excavations shall comply with Section 02125 – Excavation and Back Fill for Utilities.
- B. Trench sides shall be as near vertical as practical considering wall stability and safety. Remove and dispose of defective pipe. Correct trench grade as required and stabilize trench with cement-stabilized sand. Backfill to above top of new pipe as specified in the City of Friendswood Standard Details.
- C. Excavated material suitable for backfilling, and meeting specifications of Section 02140 – Utility Backfill Material, shall be piled as far as practical from edge of trench, to increase soil stability and allow working room for pipe removal and pipe laying operations. Excess material is to be removed from the trench bank as soon as possible. Excess material becomes the Contractor's property and it is the Contractor's responsibility to dispose off waste material as specified in Section 01580

– Waste Material Disposal.

- D. It is the Contractor’s responsibility to maintain safe conditions and follow all local, state and federal guidelines for trench safety and Section 02280 – Trench Safety Systems. The Contractor shall have a person competent in trench safety or safety officer on site at all times during excavation.

3.3 TRENCH WATER

- A. Where practical, ground surfaces shall be graded or diked to prevent the entry of surface water into the open trench.
- B. Groundwater entering the open trench from the walls and from a firm bottom in small quantities shall be promptly removed by trench pumps. Multiple pumps in good operating order shall be kept on the excavation site for such purposes at all times. Under such trench conditions, the rough excavation of grades is required to drain water to the pumps prior to under-bedding placement, and with suitable screening to exclude sand from pump suction.

Other methods may be employed by the Contractor to achieve the required results only after such methods submitted to and approved by the Project Manager. The water level shall be maintained below the pipe invert until full compaction of the pipe bedding has been accomplished.

- C. In the event that trench pumps are unable to maintain the required level of water, or, if the water entry is from the bottom of the excavation in such quantities as to make the bottom unstable, or, from the sides in such quantities to make the walls unstable, then the Contractor shall provide and operate an effective well point system to dewater the trench for the required pipe laying conditions.
- D. Water removed from trenches, from drainage ditches and well points shall be conveyed to the City’s drainage system, upstream of erosion control devices. Pumped water shall not be discharged onto the streets, sidewalks or private property.
- E. Dewatering or well pointing systems shall be installed and operated so as to minimize inconvenience and annoyance to the public. Mechanical equipment shall be housed or shielded to minimize noise; engines are to be provided with efficient noise mufflers. Points and headers shall not block pedestrian and vehicular traffic. Location of pumping units shall be chosen for minimum disturbance. Site to be promptly restored to its original or better condition after well point removal.

3.4 PIPE EMBEDMENT

- A. After defective pipe is removed, cut or fill trench to rough grade. All fill shall be cement-stabilized sand per Part II – Products, of this Section. Place embedment across the width of the trench and approximately to the grade of the bottom of the pipe, with bell hole left open and additional material on the sides. Additional dry, loose material is to be placed in uniformly spaced piles along the pipe (clearing sling points, if any, and

bell holes) sufficient to support the lower quadrant of the pipe barrel for thirty percent (30%) or more of its length. The spigot end of pipe is to be set into the receiving bell and lowered against sand. It is to be checked for vertical alignment of spigot vs. bell and for grade. The length is to be worked into true alignment and grade by "bumping", and/or adding or removing underbedment material, so pipe piece is uniformly supported, under its own weight, for the lower quadrant for not less than eighty percent (80%) of its length. The pipe piece is then moved horizontally (axially) to make up the joint and additional underbedment material promptly worked under the pipe and tamped to provide full support for its lower one-third (1/3) for its entire length. Joint is to be checked for make-up and exterior protection placement commenced. Pipe bedding material placement shall continue and pipe shall be solidly anchored against axial movement before the next joint is made-up. Remaining bedding and backfill placing shall continue until complete. Trench water shall not rise appreciably until the bedding level is above spring line of pipe.

3.5 BACKFILL

- A. Where excavation has resulted in clods not larger than ten inches (10 In) in the largest dimension, the surface excavated material shall be pushed into the trench in layers not thicker than twelve inches (12 In) and compacted. Where excavation has resulted in clods larger than ten inches (10 In) in the largest dimension, then follow this procedure as approved by the Project Manager:
 - 1. The clods are to be removed from the trench area and select imported fill material substituted therefore, or
 - 2. The clods are to be reduced to not greater than allowed above and adequate finer materials sufficient to fill voids between large clods provided. Highly-organic excavated material shall be considered "unsuitable" and excluded from backfill.
- B. Each layer of the backfill is to be mechanically compacted, to densities per ASTM D698 (standard proctor) within plus or minus three percent ($\pm 3\%$) optimum moistures content. Reopen trenches and backfill that does not meet specifications and recompact.
- C. Backfill shall be hand-placed and compacted under lines crossing the trench, steep slopes, valves, valve boxes, service connections, manholes, inlets and other appurtenances and structures.
- D. Any trench settlement shall be promptly filled, all trenches to be given final dressing immediately after settlement.
- E. Final clean-up to follow backfill operation within forty-eight hours (48 Hrs) of construction or earlier if directed by the Project Manager.

3.6 Miscellaneous Precautions and Restoration of Damages.

- A. The Contractor shall at all times be vigilant in observing overhead electric power and communication equipment.
- B. Damage to overhanging tree limbs shall also be avoided. Damage limbs

- should be pruned accordingly.
- C. All existing facilities (fences, structures, pavements, driveways, sidewalks, trees, gardens, etc.) damaged or removed to facilitate the point repairs shall be restored to as good as or better condition. All cost shall be borne by the Contractor.

END OF SECTION

**SECTION 02545
SANITARY SEWER PIPE LINING**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Rehabilitation of sanitary sewer lines by manhole entry method. Excavations shall not be allowed; rather trenchless methods shall be used. Reline finished, rehabilitated sanitary sewer line with continuous tight-fitting, watertight liner extending over entire length of line between manhole sections.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
 - 1. Payment for pipe lining shall be on a unit price basis per linear foot of sanitary sewer lined as measured along the centerline of the sanitary sewer line. Payment shall be made for each sanitary sewer line, from manhole to manhole, complete in place, including all materials equipment, and labor.
 - 2. No separate payment shall be made for Television Inspection of repaired sanitary sewer lines.
 - 3. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
 - 1. If contract is Stipulated Price Contract, payment for work in this Section is included in the Total Stipulated Price.

1.3 REFERENCES

- A. ASTM – American Society for Testing and Materials.
 - 1. ASTM D543 – Resistance of Plastics to Chemical Reagents.
 - 2. ASTM D638 – Tensile Properties of Plastic.
 - 3. ASTM D790 – Flexural Properties of Un-reinforced and Reinforced Plastic and Insulating Materials.
 - 4. ASTM D1693- Environmental Stress Cracking of Ethylene Plastics.
 - 5. ASTM D1784 – Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CVPC) Compounds.
 - 6. ASTM D2412 – Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
 - 7. ASTM D2444 – Impact Resistances of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).
 - 8. ASTM D2990 – Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics.
 - 9. ASTM D3034 – Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.

- 10. ASTM D3350 – Polyethylene Plastics Pipe and Fittings Materials.
 - 11. ASTM D5813 – Cured-In-Place Thermosetting Resin Sewer Pipe.
 - 12. ASTM F1216 – Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.
 - 13. ASTM F1504 – Folded Poly Vinyl Chloride (PVC) Pipe for Existing Sewer and Conduit Rehabilitation.
 - 14. ASTM F1533 – Deformed Polyethylene (PE) liner.
 - 15. ASTM F1606 – Rehabilitation of Existing Sewers and Conduits with Deformed Polyethylene (PE) liner.
- B. CFTS – City of Friendswood Technical Specifications.

1.4 DEFINITIONS

- A. Deformed Polyethylene Liner: Polyethylene pipe manufactured in deformed shape that reduces cross-sectional area for insertion and rehabilitation of non-pressure pipelines, conduits and ducts.
- B. Folded Poly Vinyl Chloride (PVC) Pipe: Pipe that has been manufactured in folded shape for use in existing sanitary sewer and conduit.
- C. Cured-In-Place Pipe (CIPP): Hollow cylinder containing non-woven or woven material or combination of non-woven and woven material surrounded by cured thermo-setting resin. Plastic coatings may be included. This pipe is formed within existing pipe, and takes the shape of and fits tightly to existing pipe.
- D. Inversion: Process of turning resin-impregnated tube inside out by use of water pressure or air pressure for CIPP.

1.5 SYSTEM DESCRIPTION

- A. Design Requirements: Design newly installed liner for a minimum fifty years (50 Yrs) continuous loading condition.
 - 1. Design thickness of liner system for fully deteriorated host pipe condition.
 - 2. For solid-walled liner, determine the minimum thickness in accordance with modified AWWA formula listed below.
$$t = 0.712 D * [(N * q_t / C)^2 / E_L * R_W * B' * E'_s]^{1/3}$$
where:
 - t = Required minimum installed liner wall thickness in inches.
 - D = Inside diameter of host pipe in inches.
 - N = Safety factor, use 2.0
 - $q_t = \text{Total external pressure on pipe in psi.}$
 $= 0.433 * H_W + [w * H_S * R_W / 144] + W_S$
 - $H_W = \text{Height of water table above host pipe in feet, use zero (0).}$
 - $W = \text{Soil density, pounds per cubic foot, use one hundred twenty pounds per cubic foot (120 pcf).}$

H_s = Height of soil cover over host pipe in feet. Determine cover heights from manhole depths and line sizes given in the Contract Documents.

R_w = Water buoyancy factor.
= $1 - 0.33 (H_w / H_s)$, minimum value = 0.67

W_s = Live load, psi. Use H-20 highway loading with a 1.0 impact factor.

C = Ovality factor. Use host pipe which is five percent (5%) out-of-round, unless otherwise indicated in the Contract Documents.

E_L = Long-term flexural modulus of elasticity, in psi.
PVC Liner: Two hundred forty thousand pounds per square inch (240,000 psi).
High-Density Polyethylene Liner: Ninety-one thousand pounds per square inch (91,000 psi).
Resin-impregnated Tube System: One hundred twenty-five thousand pounds per square inch (125,000 psi).

B' = Coefficient of elastic support
= $1 / [1 + 4e^{(-0.65H_s)}]$

E'_s = Modulus of soil reaction. Use one thousand pounds per square inch (1,000 psi).

This calculation yields an in-place wall thickness requirement. Provide allowances for any circumferential stretching, polymerization shrinkage and resin migration that may occur.

B. Performance Requirements.

1. Proposed rehabilitation liner system shall minimize the loss of flow-carrying capacity of the existing sanitary sewer, but in no case shall the lining reduce capacity by more than sixteen percent (16%).
 - a. Manning "n" value used for host pipe shall be 0.015 and rehabilitated line shall be 0.013.
 - b. Diameter and wall thickness of new trenchless liner shall be manufactured to size such that when installed it shall provide a minimum wall thickness determined in paragraph 1.5.A.
2. Proposed liner material shall be inert to attack by sanitary sewage and suitable for use in underground sanitary sewer environment.
3. Liner material shall be manufactured in such manner as to result in tight-fitting liner after installation. There shall be no measurable continuous annular space between outside diameter of new liner and existing host pipe.

1.6 SUBMITTALS

- A. Shop drawings: Submit shop drawings that identify locations and methods of liner insertion, liner size, thickness calculations and

assumptions used as basis for calculations.

1. Submit for review by the Project Manager as least ten working days (10 Wd) prior to start of the Work.
 2. Assume liner shall provide full structural support, without considering structural support from existing pipe except during construction.
 3. Submit bypass pumping plans and locations with sufficient detail to assure that the Work can be accomplished without sanitary sewage spill.
 - a. Bypass pumping plan shall be in accordance with the Drawings and the requirements of Section 02555 – Sanitary Sewer Bypass Pumping.
 - b. Include emergency response action plan to be followed in event of failure of bypass pumping system.
- B. Product Data: Provide manufacturer's data for lining materials and resins, and the following:
1. Manufacturer's certification that the liner materials are in compliance with the specifications, codes and standards referenced herein.
 2. Installation instructions and details of component materials and construction details, including complete manufacturer's recommendations for storage procedures and temperature control, handling and inserting liner, curing details, trimming and finishing.
 3. Manufacturer's certification, field measurements and pipe-sizing calculations which demonstrate that the liner has been properly sized to avoid creation of wrinkles or folds.
 4. Resin manufacturer's heating requirements.
- C. Pre-liner: Provide sample and material test data, if pre-liner is used.
- D. Quality control.
1. Design Data: Submit liner wall thickness calculations for approval by the Project Manager prior to installation.
 2. Certificates: Certificates of compliance with design and test reports in accordance with ASTM test methods.
 3. Submit evidence acceptable to the City, such as certified copy of license or agreement, that the Contractor has authority from patent owner to use and/or install patented materials or use patented equipment or methods.

1.7 QUALITY ASSURANCE

- A. Comply with this specification and specific product manufacturer recommendations. Conflict between product manufacturer's recommendations and any portion of Contract Documents shall be resolved by the City prior to proceeding with the Work.
- B. Manufacturer Qualifications: Products used in the Work shall be produced by manufacturers regularly engaged in manufacture of similar

products and with a history of successful production acceptable to the City.

- C. Installer Qualifications: Licensed or certified by the lining system manufacturer, and must have the following qualifications:
 - 1. Thoroughly trained and experienced in the necessary crafts to complete the Work.
 - 2. Completely familiar with the specified requirements and methods needed for proper performance of the Work.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Exercise adequate care during transportation, handling and installation to ensure liner material is not torn, cut, exposed to direct sunlight or otherwise damaged.
- B. If any part or parts of liner material becomes torn, cut or otherwise damaged before or during insertion, repair or replace the liner at the Contractors cost before proceeding any further.

PART II: PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. CSR Hydro Conduit: Deformed polyethylene liners marketed under the trade name "U-liner."
 - 2. Inituform – USA: Folded Poly Vinyl Chloride (PVS) liners marketed under the trade name "NuPipe."
 - 3. Inituform – USA: Cured-in-place resin-impregnated tube liners marketed under the trade name "Inituform."
 - 4. In-Liner – USA: Cured-in-place resin-impregnated tube liners marketed under the trade name "InLiner USA."

2.2 MATERIALS

- A. Liner material: Provide light-colored or white liner to facilitate closed-circuit television inspection that shall conform to the requirements in Section 02520 – Television Inspection of Sanitary Sewer Lines.
 - 1. Deformed Polyethylene (PE) Liner: Comply with ASTM F1533 and minimum material requirements of ASTM D3350, Cell Class 345434-D.
 - 2. Folded PVC Pipe Liner: Comply with ASTM F1504, and minimum material requirements of ASTM D1784, Cell Class 13223-B or 12344-B.
 - 3. Cured-In-Place Liner: Comply with ASTM D5813 and ASTM F1216.
 - a. Resin-impregnated tube liner material shall consist of

- one (1) or more layers of flexible needled felt, or equivalent woven or non-woven material.
 - b. Capable of carrying resin, and withstanding installation pressures and curing temperatures.
 - c. Able to stretch to fit irregular pipe sections and negotiate bends.
 - d. Resins shall be styrene-based, thermo-set resin and catalyst system, or epoxy resin and hardener system that is compatible with the installation process.
 - e. Outside layer of tube should be plastic-coated with material compatible with resin system to be used.
- B. Liners fabricated from PVC, PE or resin-impregnated tubes shall comply with the physical specifications in TABLE 4.1 – LINER MATERIAL PHYSICAL REQUIREMENTS in this Section.
- C. Pre-Liner Material: If used, pre-liner material shall be manufactured from material capable of withstanding temperatures and pressures encountered during installation.

PART III: EXECUTION

3.1 EXAMINATION

- A. Take field measurements of pipe inside diameter of sanitary sewer lines to be rehabilitated.
- B. In conjunction with review of color closed-circuit television (CCTV) DVDs, provide correct liner diameter and wall thickness to ensure a tight fit with existing pipe to be restored.
- C. Confirm lengths of liner to be installed.
- D. Locate live sanitary sewer services prior to rehabilitation activities. Each service connection shall be noted by size, position from reference manhole and orientation with respect to circumference of pipe.
 - 1. Live Service: Inactive sanitary sewer service lines to vacant lots or vacant buildings to be occupied later or to occupied buildings with more than one (1) sanitary sewer service line serving the property.

3.2 PREPARATION

- A. Successfully complete the following items before installation of the Work.
 - 1. Control sanitary sewer flow as specified in Section 02555 – Sanitary Sewer Bypass Pumping.
 - 2. Clean sanitary sewer lines prior to television inspection and installation of liners in compliance with Section 02530 – Sanitary Sewer Line Cleaning.
 - 3. Perform closed-circuit television inspection as specified in Section 02520 – Television Inspection of Sanitary Sewer Lines.
- B. Take precautions to protect new liner, existing pipe, and manholes from

damage that might result during insertion process.

3.3 SEQUENCE OF WORK

- A. Divert sanitary sewer flow to comply with the requirements of Section 02555 – Sanitary Sewer Bypass Pumping.
- B. Clean sanitary sewer lines and perform pre-insertion CCTV inspection in compliance with Section 02530 – Sanitary Sewer Line Cleaning and Section 02520 – Television Inspection of Sanitary Sewer Lines. Complete cleaning and television inspection a minimum of twenty-four hours (24 Hrs) and a maximum of sixty hours (60 Hrs) prior to rehabilitation lining for Cured-In-Place Pipe (CIPP).
- C. Perform any point repairs that are needed in compliance with Section 02540 – Sanitary Sewer Point Repairs.
- D. Install liner within all requirements of this Technical Specification.
- E. Leak-test liner to comply with requirements of Section 02500 – Gravity Sanitary Sewers and Section 02525 – Acceptance Testing for Gravity Sanitary Sewer Lines.
- F. Reconnect sanitary sewer service connections to newly rehabilitated pipe.
- G. Perform post-insertion CCTV inspection in compliance with Section 02520 – Television Inspection of Sanitary Sewer Lines. If the Project Manager, after seeing the DVD's, concludes that the liner has not been installed properly and to the specifications, the Contractor shall reinstall liner and CCTV inspection until liner is in compliance, and at no additional cost to the City.

3.4 PIPE POINT REPAIR

- A. Repair sanitary sewer pipe where point repairs are identified on the Drawings.
- B. Sanitary sewer pipe and repair materials shall be the same as the host sanitary sewer line, unless otherwise indicated on the Drawings.
- C. Trenching and Excavation shall conform to Section 02125 – Excavation and Backfill for Utilities and Section 02280 – Trench Safety Systems.
- D. When required for completion of the Work bypass pumping shall be in conformance of Section 02555 – Sanitary Sewer Bypass Pumping.
- E. Notify the Project Manger a minimum of forty-eight hours (48 Hrs) in advance of planned time to begin sanitary sewer line point repair work at a particular location.
- F. Installation and Field Inspection: Installation of replacement pipe and/or repair work shall conform to Section 02500 – Gravity Sanitary Sewers. All sanitary sewer point repairs shall be inspected by the Project Manager prior to back filling and compaction.

3.5 GENERAL REQUIREMENTS FOR LINER INSTALLATION

- A. Perform operations in strict accordance with Occupational Health and Safety Administration (OSHA) and manufacturer safety requirements.

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Particular attention shall be given to safety requirements involving confined spaces, work on elevated platforms and working with pressurized equipment.

- B. To ensure proper heat distribution for rehabilitation systems using heat exchange methods, and to prevent creation of flat bottoms in liner profile, takes steps to isolate new liner system from inflow, infiltration or standing water.

Isolate new liner system by temporarily stopping the inflow and infiltration and remove standing water, or by using reinforced, flexible pre-liner to isolate new liner.

- C. Install liner through existing or new manholes. Excavation for liner insertion shall not be permitted, unless warranted by extraordinary circumstances and with the approval of the Project Manager.
- D. For cured-in-place pipe (CIPP) processes, designate location and notify the Project Manager where resin impregnation shall take place. Use vacuum impregnation process with roller system designed to uniformly distribute resin throughout tube.
- E. Equipment used to supply heat and pressure shall be capable of providing necessary heat and pressure required for installation condition. Heat sources shall be fitted with suitable monitors to gage temperatures and pressures.
- F. Cut and trim new liner at each end to conform to inside manhole wall. If liner fails to make tight seat at manhole wall, apply sealant to annular space. Sealant material shall be approved by the Project Manager.

3.6 LINER INSTALLATION OF DEFORMED POLYETHYLENE AND FOLD POLY VINYL CHLORIDE (PVC) SYTEMS

- A. Install liner for deformed polyethylene pipe in accordance with ASTM F1606, as amended below.
- B. Rounding devices or other approved methods may be used to reform liner to circular shape conforming to inside of host pipe.
- C. Round out deformed liner systems when necessary temperature has been achieved.
- D. After new liner is completely rounded, cool to temperature specified by manufacturer prior to relieving pressure in liner. In no case shall this temperature be in excess of one hundred degrees Fahrenheit (100° F).

3.7 LINER INSTALLATION – CURED-IN-PLACE PIPE (CIPP)

- A. Install liner for cured-in-place pipe in accordance with ASTM F1216.
- B. Resin impregnation: Designate location where uncured resin in original containers and non-impregnated liner tube shall be impregnated prior to installation.
 - 1. Impregnate liner tube by vacuum or other approved means.
 - 2. The Project Manager shall inspect materials and “wetting” procedure.
 - 3. Use resin and catalyst system compatible with requirements of

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this method.

- C. Liner Insertion: Ensure that the pressure in the liner exceeds both the pressure due to groundwater head and any pressure due to sanitary sewage in lateral sanitary sewers.
 1. Insert impregnated tube through existing or new manholes by means of installation process, and application of hydrostatic head, compressed air or other means sufficient to fully extend it to next designated manhole or termination point.
 - a. Inflate and firmly adhere liner to pipe wall.
 - b. Install liner at a rate greater than three feet (3 Ft) per minute and less than ten feet (10 Ft) per minute.
 2. Mark exterior of manufactured tube along its entire length at regular intervals not to exceed five feet (5 Ft) as a gage to measure elongation during installation.
 - a. During insertion of resin impregnated tube into sanitary sewer pipe, a maximum allowable longitudinal elongation or stretch of material shall not exceed five percent (5%).
 - b. Longitudinal stretch of tube shall be gauged by comparing markers on fully inserted tube to actual length of pipe being rehabilitated.
 3. Insertion by Inversion: Insert “wetted” liner through existing or new manholes by means of the inversion process, and application of hydrostatic head or air pressure sufficient to fully extend liner to next designated manhole.
 - a. At lower end of standpipe or guide chute, turn liner inside out and attach to standpipe (or chute) so that leakproof seal is created.
 - b. Adjust inversion head or air pressure to be of a sufficient magnitude to cause impregnated liner to invert from manhole to manhole, hold tube tight to pipe wall, and produce dimples at service lateral connections and flared ends at manholes.
 - c. Use lubricant if needed.
 4. Insertion by Winching: The City shall accept winched-in applications as alternate to inversion process, provided that the liner tube and resin conform to materials and curing requirements of ASTM F1216 and this specification.
 - a. Insert “wetted” liner through upstream manhole, and pull through section with power winch and steel cable attached to the end of the liner with appropriate pulling head.
 - b. Provide monitoring device on cable to measure pulling force. Should the pulling force exceed manufacturer recommendations, the liner tube shall be rejected and replaced.

- c. Install rollers in upstream and downstream manholes to guide liner into and out of the host pipe, and to guard against chafing of crowns at entry and exit from winch cable.
 - d. Cover sanitary sewer invert throughout section to be lined, with polyethylene foil or other suitable material to facilitate threading of liner and reduce risk of damage to the liner material. Form CIPP with polyethylene coating on its way to interior surface.
 - e. Use flexible and impermeable calibration hose to inflate the liner tube. Calibration hose may or may not remain in the completed installation.
 - 1) Dry tube or inflation hose material that enters existing pipe that has not been previously vacuum impregnated with resin under controlled conditions cannot be included in structural wall of CIPP. Nominal thickness of this material shall be deducted from field sample thickness in order to verify that the minimum specified wall thickness is achieved.
 - 2) Hose material remaining in installation shall be compatible with resin system used, bond permanently with liner tube, and be translucent to facilitate post-installation inspection.
 - 3) Hose material to be removed after curing shall be non-bondable material.
 - f. Introduce water, air and/or steam into the liner tube. Pressure shall inflate and press liner material in tight fit against inner walls of host pipe, producing dimples at lateral and side connections and flared ends.
- D. Curing: After insertion of the liner tube is completed, provide suitable heat source and distribution system to distribute and recirculate hot water, air and/or steam throughout host pipe as recommended by the manufacturer.
- 1. Equipment shall be capable of delivering hot water, air, and/or steam throughout section by means of pre-strung hose to uniformly raise temperature above temperature required to effect cure of resin.
 - a. Temperature shall be determined by manufacturer based on resin/catalyst system employed.
 - b. Perforate hose in accordance with manufacturer's recommendations, or other methods acceptable to the City.
 - 2. Fit heat source piping with suitable continuous monitoring thermocouples to gage temperature of incoming and outgoing curing medium.

3. Temperature of curing medium shall meet requirements of resin manufacturer as measured at heat source inflow and outflow return lines.
4. Place additional continuous monitoring thermocouples between impregnated felt tube and pipe invert at manholes.
5. Curing medium temperature in line during cure period shall be as recommended by resin manufacturer.
6. Take care during elevated curing temperature so as not to over-stress liner materials.
7. Initial cure shall be deemed to be complete when inspection of exposed portions of liner appear to be hard and sound, and remote temperature sensor indicates that the temperature is of magnitude to realize exotherm.
 - a. Cure temperature shall be held for period recommended by resin manufacturer, during which time distribution and control of curing medium shall continue.
 - b. Curing of CIPP shall consider host pipe material, resin/catalyst system, ambient temperature, moisture level, and thermal conductivity of soil.
- E. Cool-Down: Cool hardened liner to temperature below one hundred degrees Fahrenheit (100° F) before relieving pressure in section.
 1. Cool-down may be accomplished by introduction of cool water or air into lined pipe to replace water or steam and water being drained.
 2. Drain water from small hole made in downstream end.
 3. Take care in release of static head or air pressure to prevent development of vacuum that could damage pipe or newly installed lining.
 4. After tube has cured, use cool-down period prior to opening downstream plug and returning normal flow back into system.
- F. Sealing at Manholes: If CIPP fails to make tight seal at manhole walls, apply seal consisting of resin mixture compatible with liner/resin system, in accordance with manufacturer specifications and approved by the City.

3.8 REINSTATEMENT OF SERVICES

- A. Immediately reinstate live services after leak testing is complete and acceptance of sanitary sewer line, in conformance with Section 02525 – Acceptance Testing for Gravity Sanitary Sewer Lines is achieved.
 1. Reconnect from interior of sanitary sewer line by means of television camera and remote-controlled cutting device.
 2. Excavation shall not be allowed.
 3. Holes cut through rehabilitation liner shall be neat and smooth, and match bottom of reinstated service line.
 4. Reinstate live service opening to a minimum of ninety-five percent (95%) and a maximum of one hundred percent (100%) of service lateral pipe area.

5. New edge shall be crack-free with no loose or abraded material
 6. Seam between host pipe and new liner at reinstated live service shall be free of gaps, voids, or cavities. Grout gaps, voids, or cavities at this joint with packer and grouting system approved by the Project Manager.
 7. Post-construction television inspection shall show focused close-up of entire perimeter of each service reconnection and shall conform to all requirements in Section 02520 – Television Inspection of Sanitary Sewer Lines.
- B. Provide fully-operational backup device for reinstating live service laterals. If for any reason remote cutting device fails during reinstatement of service lateral, a standby device shall be immediately deployed to complete reinstatement.

3.9 FIELD QUALITY CONTROL

- A. Inspection: After completion of liner insertions, reinstatement of live service laterals, and finish work at manhole, sanitary sewer shall be televised in color DVD format, as specified in Section 02520 – Television Inspection of Sanitary Sewer Lines. Provide two (2) original disks to the Project Manager.
1. Finished liner shall be continuous over entire length of liner insertion run between manholes, and free from visual defects such as foreign inclusions, dry spots, pinholes, and delamination.
 2. Wrinkles in finished liner pipe which cause backwater of one inch (1 In) or more, or reduce hydraulic capacity of pipe [wrinkles which exceed five percent (5%) of pipe diameter] are unacceptable.
 - a. Remove and repair at no additional cost to the City.
 - b. Wrinkles in finished liner pipe that reduce structural stability of pipe are unacceptable.
 3. In the event the Project Manager, based on review of post-installation Television Inspection DVDs, has reasonable cause to suspect that annular space exists between liner and host pipe, the Contractor shall be directed to excavate and expose existing sanitary sewer and remove existing host pipe such that confirmation of suspected annular space can be made.
 - a. If annular space is determined to exist, repair in a manner approved by the Project Manager.
 - b. If it is determined that no annular space exists, the Contractor shall be reimbursed in accordance with the "Changes" clause of the Contract Documents.
- B. Leak Testing: After completion of liner installation but prior to reinstatement of live service lines, pressure-test rehabilitated sanitary sewer line for leakage in accordance with Section 02500 – Gravity Sanitary Sewers and Section 02525 – Acceptance Testing for Gravity

Sanitary Sewer Lines.

3.10 CLEANING

- A. Keep premises free from accumulations of waste materials, rubbish and other debris resulting from the Work.
- B. Remove waste materials, rubbish, and debris from and about premises.
- C. Remove tools, construction equipment and machinery, and surplus materials.
- D. Restore to original condition portions of site not designated for alterations by the Contract Documents.

PART IV: TABLES

4.1 – LINER MATERIAL PHYSICAL REQUIREMENTS

PROPERTY	TEST METHOD	MINIMUM VALUES		
		Thermoplastic Systems	Polyester Resin Systems	Epoxy and Vinylester Resins
Corrosion Resistance			ASTM F1216 Section X2	Green Book Sec. 210-2.3.3
Flexural Modulus (Initial)	ASTM D790	136,000 psi (940 MPa)	250,000 psi (1,720 MPa)	300,000 psi (2,070 MPa)
Flexural Modulus (Long Term)	ASTM D2990	-	125,000 psi (860 MPa)	150,000 psi (1,030 MPa)
Flexural Strength	ASTM D790	-	4,500 psi (31 MPa)	5,000 psi (34 MPa)
Tensile Strength (Yield)	ASTM D638	3,200 psi (22 MPa)	3,000 psi (21 MPa)	4,000 psi (28 MPa)
Tensile Modulus (Initial)	ASTM D638	-	300,000 psi (2,070 MPa)	250,000 psi (1,720 MPa)
Tensile Strength (Long Term)	ASTM D638	-	150,000 psi (1,030 MPa)	125,000 psi (860 MPa)
Impact Resistance	ASTM D2444 ⁽¹⁾	210 ft-lb (29 m-kg)	-	-
Pipe Flattening	ASTM D3034 ⁽²⁾	60% Deflection	-	-
Pipe Stiffness	ASTM D2412	15 psi (103 kPa)	-	-
Environmental	ASTM D1693 Condition C	2000 hours	-	-
⁽¹⁾ Impact testing performed with twenty pound (20 Lb) Tup A and flat plat holder B. ⁽²⁾ Without cracking, breaking or splitting.				

END OF SECTION

SECTION 02550 SANITARY SEWER PIPE-BURSTING

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Procedure employed for the reconstruction of existing sanitary sewer lines by the pipe-bursting method, followed by replacement with an approved pipe material and appropriate diameter. This Item covers the furnishing of all material, equipment, labor, supervision and all appurtenances necessary to provide for the complete reconstruction of deteriorated sanitary sewer lines.
- B. The pipe-bursting method is defined as the reconstruction of sanitary sewer pipe by displacing the existing pipe and installing an approved pipe material. The process involves the use of a static, hydraulic or pneumatic hammer "moling" device, suitably sized to break out the old pipe. Forward progress of the "mole" may be aided by the use of hydraulic equipment or other apparatus. The replacement pipe is either pushed or pulled into the bore. The method allows for replacement pipe of sizes from eight inches (8 In) through eighteen inches (18 In).

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
 - 1. Payment for pipe-bursting shall be paid on a per linear foot basis as measured along the centerline of the sanitary sewer line. Payment shall be for complete in-place installation, including all materials, equipment, labor and excavation and backfill.
 - 2. No separate payment shall be made for Television Inspection of pipe-bursted sanitary sewer line.
 - 3. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
 - 1. If contract is Stipulated Price Contract, payment for all work in this Section is included in the Total Stipulated Price.

1.3 REFERENCES

- A. ASTM – American Society for Testing and Materials.
 - 1. ASTM D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.
 - 2. ASTM D2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
 - 3. ASTM D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
 - 4. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl

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- Chloride) (PVC) Sewer Pipe and Fittings.
- 5. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
 - 6. ASTM F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- B. CFTS – City of Friendswood Technical Specifications.

1.4 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit proposed methods, equipment, materials and sequence of operations for sanitary sewer pipe-bursting construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.
- C. Submit qualifications, proposed methods, equipment, materials and sequence for acceptance testing of sanitary sewer pipe-bursting.
- D. Submit test reports as specified in Part III of this Section.

1.5 QUALITY ASSURANCE

- A. Provide manufacturer's affidavits that replacement pipe was manufactured in compliance with standards and Technical Specifications referenced in this Section.

PART II: PRODUCTS

2.1 SOLID WALL POLYETHYLENE PIPE

- A. The replacement pipe shall be manufactured from a high density, high molecular weight polyethylene compound (HDPE) which conforms to ASTM D1248 and meets the requirements for Type III, Class C, Grade P-34, Category 5, and has a PPI rating of PE 3408. No exceptions to this requirement.
- B. The pipe produced from this resin shall have a minimum cell classification of 335434C under ASTM D3350-80. A higher numbered cell classification limit which gives desirable higher primary property, per ASTM D3350-80, may be approved by the Project Manager. The higher classification limit pipe shall be provided at no additional cost to the City. The value for the Hydrostatic Design Basis shall not be less than one thousand six hundred pounds per square inch (1,600 psi) per ASTM D2837.
- C. Before beginning the Work, the Contractor shall submit for approval the vendor's specific technical data with complete information on resin, physical properties of pipe, and pipe dimensions pertinent to this job. A certificate of "Compliance With Specification" shall also be furnished for all materials to be supplied.
- D. The Contractor shall be responsible for all damage caused by, and the replacement of, failed, unspecified, or unapproved materials.

2.2 STANDARD DIMENSION RATIO

- A. The Standard Dimension Ratio (SDR), which is the ratio of the outside diameter of the liner pipe to its minimum wall thickness, shall be as specified in TABLE 4.1 – POLYETHYLENE REPLACEMENT PIPE DIMENSIONS in this Section. Dimensions and workmanship shall be in accordance with ASTM F714-81 and D2122. Minimum wall thickness (inches) = O.D./SDR.

2.3 PIPE CLASSIFICATION

- A. The SDR Classification for various depths shall be as specified in TABLE 4.2 – POLYETHYLENE REPLACEMENT PIPE SDR in this Section. Depth shall be measured from the upstream and downstream rim of the manhole to the invert of the existing sanitary sewer in the pipe segment to be replaced. The SDR shall be selected for the deeper of the two (2) manholes for a given pipe segment.

2.4 QUALITY CONTROL

- A. The physical appearance of the replacement pipe revealing deformities such as concentrated ridges, discoloration, excessive spot roughness, pitting, varying wall thickness, etc., shall constitute sufficient basis for rejection by the Project Manager. The replacement pipe shall be homogeneous throughout, free from visible cracks, foreign inclusions, and other injurious defects. Pipe with gashes, nicks, abrasions, or any such physical damage which may have occurred during storage and/or handling, and which are larger/deeper than ten percent (10%) of the wall thickness, shall not be used and must be removed from the construction site.
- B. In the case of any conflict with, or deviation from, these specifications, the Contractor shall either discuss the matter in the Pre-Bid Conference or report such in writing to the Project Manager during construction for clarification, explanation, and/or approval. The Project Manager's decision shall be final and all costs, if any, incurred due to the Contractor's use of an unapproved replacement pipe and the subsequent work to remove and replace this replacement pipe with an acceptable pipe as specified shall be borne by the Contractor.

2.5 Clamps

- A. Where excavations for the insertion of the replacement pipe are made between two (2) manholes, the ends of the replacement pipe shall be joined with an all-stainless steel (including bolts and lugs), full circle, Universal Clamp Coupling with a one-quarter inch (1/4 In) thick grid gasket similar to JCM Industries Type 108 or an approved equal. Clamps shall be selected to fit the outside diameter of the liner pipe. Minimum clamp lengths shall be as specified in TABLE 4.3 – MINIMUM CLAMP LENGTHS in this Section.

PART III: EXECUTION

3.1 PRE-INSTALLATION PREPARATIONS

- A. The following procedures shall be adhered to unless otherwise approved by the Project Manager.
 - 1. Safety: The Contractor shall carry out his operations in strict accordance with all applicable OSHA Standards.
 - 2. Bypass Pumping: It shall be the Contractor's responsibility to provide all pumps, piping, and personnel to bypass wastewater around the section of sanitary sewer to be replaced by plugging an upstream manhole and pumping to a downstream manhole if site conditions require bypass pumping. Pumps shall be of adequate capacity to handle expected flow. All bypass pumping shall conform to Section 02555 – Sanitary Sewer Bypass Pumping.
 - 3. Pre-Installation Cleaning: The Contractor shall remove all debris, roots, etc. from the existing sanitary sewer before pipe-bursting and replacement. Cleaning shall be by the use of swabs, pigs, washing or other methods as determined by the Contractor and approved by the Project Manager. All pre-installation cleaning shall conform to Section 02530 – Sanitary Sewer Line Cleaning.
 - 4. Pre-Installation Inspection: The Contractor shall review existing video media and logs of the sanitary sewer lines designated for replacement. It shall be the responsibility of the Contractor to conduct a television inspection of the sanitary sewer pipe not previously televised, immediately before the pipe-bursting to assure that the pipe conditions are acceptable for pipe-bursting. Location of all service connections shall be verified from video media and logs for reconnection following replacement operations. All televising of sanitary sewer lines shall conform to Section 02520 – Television Inspection of Sanitary Sewer Lines.
 - 5. Line Obstructions: If inspection reveals an obstruction that cannot be removed by conventional sanitary sewer cleaning equipment, such as heavy solids, severely dropped joints, collapsed pipe that prevents completion of the installation process or reinstallation of a service connection, then a point repair shall be made by the Contractor as approved by the Project Manager. Protruding sanitary sewer service connections are not considered line obstructions and removal is incidental to the Work. See separate specifications for details. All point repairs shall conform to Sections 02540 – Sanitary Sewer Point Repairs and 02560 – Sanitary Sewer Obstruction Removal.
 - 6. Sags In Line: If pre-installation video (TV) inspection reveals a sag in the existing sanitary sewer that is greater than one-half (1/2) the diameter of the existing pipe, it shall be the Contractor's

responsibility to install the replacement pipe in a manner that results in an acceptable grade without the sag. The Contractor shall take the necessary measures to eliminate these sags either:

- a. pipe replacement;
- b. digging a sag elimination pit and bringing the bottom of the pipe trench to a uniform grade in line with the existing pipe invert;
- c. or by other means that shall be acceptable to the Project Manager.

3.2 INSTALLATION

A. The Contractor shall submit information, in detail, of the procedure and the steps to be followed for the installation of the pipe-bursting method. All such instructions and procedures submitted shall be carefully followed during installation. Any proposed changes in installation procedures shall require submittal of revised procedures and acceptance by the Project Manager.

- 1. Process Limitations
 - a. Though the installation process may be licensed or proprietary in nature, the Contractor SHALL NOT change any material, thickness, design values or procedural matters stated or approved in the submittals, without the Project Manager's prior knowledge and pre-approval. The Contractor shall submit, in writing, full details about component materials, their properties and installation procedures and abide by them fully during the entire course of the project.
 - b. All sanitary sewer rehabilitation by pipe-bursting systems are considered structurally equal processes as far as "end product" required by the City. The minimum required performance criteria, and/or standards, physical/structural properties, chemicals resistance tests, and the replacement pipe thicknesses as given in this specification shall be strictly complied with. It shall be the responsibility of the Contractor to comply with the specifications in full without any request for any change after the award of the Contract. The City reserves the right to accept, reject, or modify any later requests for changes, which would be at no additional cost to the City or credit for the City.
- 2. Finished Pipe
 - a. The installed replacement pipe shall be continuous over the entire length of each pipe segment from manhole to manhole and shall remain free from visual defects as specified in Paragraph 2.4 of this Specification. The

replacement pipe passing through or terminating in a manhole shall be carefully cut out in a shape and manner approved by the Project Manager. The invert and benches shall be streamlined and improved for smooth flow. The installed pipe shall meet the leakage requirements of the pressure test in Paragraph 3.3.

- 3. Insertion or Access Pits
 - a. The location and number or insertion, or access, pits shall be determined by the Contractor and approved by the Project Manager prior to excavation. The pits shall be located such that their total number shall be minimized, and the footage of replacement pipe installed in a single pull shall be maximized to the limit of Paragraph 3.2.A.4.b.
 - b. Before any excavation is done for any purpose, it shall be the responsibility of the Contractor to locate water lines and taps and check with the various utility companies and determine the location of their facilities. Any necessary temporary construction easements and/or right-of-way areas shall be arranged for by the Contractor at no cost to the City.
 - c. Any damage done to any utilities and the resulting repair, temporary service, cost, etc. and restoration of temporary easements and right-of-way areas shall be borne by the Contractor. Access pits shall be backfilled in accordance with Section 02125 – Excavation and Backfilling for Utilities. Excavation shall comply with provisions of Sections 02280 – Trench Safety Systems and 02125 – Excavation and Backfilling for Utilities.
 - d. Existing clean-outs may be removed as required for pit excavation. After completion of pipe replacement and testing, clean-out shall be reinstalled and pit backfilled.
 - e. All existing facilities (fencing, structures, drives, sidewalks, trees, gardens, etc.) damaged or removed to facilitate pipe-bursting and pipe replacement shall be restored to, or better than, their condition prior to the start of the Work. All cost shall be borne by the Contractor.
- 4. Pipe Jointing
 - a. Sections of replacement pipe shall be assembled and joined on the job site above ground. Jointing shall be accomplished by the heating and butt-fusion method in strict conformance with the manufacturer's recommendation.
 - b. The butt-fusion method for pipe jointing shall be carried out in the field by operators with at least two years (2

Yrs) prior experience of fusing replacement pipe with similar equipment using proper jigs and tools per standard procedures outlined by the pipe manufacturer. These joints shall have the acceptable appearance of a smooth, uniform, double roll back bead made while applying the proper melt, pressure and alignment. It shall be the sole responsibility of the Contractor to provide an acceptable butt-fusion joint in the field. All joints shall be inspected by the Project Manager before insertion. The replacement pipe shall be joined on the job site in appropriate working lengths near the insertion pits. The maximum length of continuous replacement pipe which shall be assembled above ground and pulled on the jobsite at any one (1) time shall be six hundred linear feet (600 Lf) unless approved by the Project Manager.

- 5. Use of Clamp and Encasement
 - a. Where excavations for the insertion of the replacement pipe are made between two (2) manholes, the ends of the replacement pipe shall be cut smooth and square to the axis, so that it can be joined in a workman like manner such that both ends meet and touch uniformly and continuously. An all stainless steel (including bolts and lugs) clamp with gasket as described in paragraph 3.2.A.5.b shall be used.
 - b. In all excavations where the replacement pipe is exposed (i.e. insertion pits, sag elimination pits), an encasement shall be placed under (bedding) around and above the replacement pipe using cement-stabilized sand. The compacted thickness of this encasement shall be a minimum of six inches (6 In) below the pipe and twelve inches (12 In) above and on the sides of the pipe. It shall not be backfilled without the Project Manager's approval.
- 6. House or Building Service Connections
 - a. The exact location and number of house or building sanitary sewer service connections shall be determined from TV inspection tapes and/or in the field. Any and all such locations shown on the Plans and/or Exhibits are only approximate, as are the number of said connections in the bid proposal. It shall be the Contractor's responsibility to field locate all existing sanitary sewer service connections, whether in service or not, along the sanitary sewer line which has been rehabilitated. The Contractor shall disconnect all such connections prior to pipe-bursting and reconnect all such connections,

- including those that go to unoccupied or abandoned buildings or houses or vacant lots, as directed by the Project Manager. Accordingly, each vacant lot shall have at least one (1) existing sanitary sewer service connection left in service. All services which are reconnected to the rehabilitated sanitary sewer shall be properly shown on the "As Rehabilitated" Plans and/or Exhibits with the exact distances from the nearest downstream manhole. All existing sanitary sewer connections shall be properly disconnected from the existing sanitary sewer and then reconnected to the replacement pipe per instructions and procedures as outlined below or as approved by the Project Manager.
- b. After the replacement pipe has been pulled into place and allowed to normalize to ambient temperature as well as recover from any imposed stretch, each existing sanitary sewer service connection, as directed by the Project Manager, shall be reconnected to the replacement pipe with a prefabricated polyethylene saddle or an approved alternate. The polyethylene saddle shall be a one (1) piece saddle equipped with a neoprene gasket so that a complete seal is accomplished when the strap-on saddle is tightened with two (2) stainless steel bands, one (1) on each end. The stub-out attached to the saddle must protrude into the replacement pipe a distance equal to the wall thickness of the installed replacement pipe. The new four inch (4 In) stub-out, or lateral, shall be connected to the existing sanitary sewer service line with a flexible PVC coupling, "Fernco" or an approved equal.
 - c. The flexible coupling shall be secured to the existing sanitary sewer service lateral and new stub-out and/or stack with stainless steel bands. All such connections shall be completely encased in cement-stabilized sand a minimum of six inches (6 In) below, and twelve inches (12 In) above and on the sides of the pipe at a cost incidental to such sanitary sewer service connections. All such connections shall be tested and approved by the Project Manager before backfilling. A remote tap shall not be allowed.
 - d. Service connections on an existing sanitary sewer shall have a minimum diameter four inches (4 In). Gasketed PVC sanitary sewer pipe (ASTM D-3034, SDR 26) may be used for all stubs. PVC saddles with neoprene gaskets may be used in lieu of polyethylene saddles.
 - e. The Contractor shall utilize existing taps/service

connections to reconnect the service lines to the replacement pipe unless approved otherwise by the Project Manager.

7. Sealing and Benches in Manholes

- a. The replacement pipe shall be installed with a tight fitting seal with the existing or new manhole. Half-inch (1/2) diameter activated oakum band soaked in Scotch seal 5600 or equal shall be applied circumferentially on the replacement pipe and encased with a cementitious mortar to prevent inflow at the manhole. The top one-half (1/2) of the pipe within the manhole shall be neatly cut off and not broken or sheared off, at least four inches (4 In) away from the manhole walls. The channel in the manhole shall be a smooth continuation of the pipe(s) and shall be merged with other lines or channels if any. Channel cross-section shall be U-shaped with a minimum height of one-half (1/2) pipe diameter to three-quarters (3/4) of the pipe diameter for fifteen inches (15 In) and larger. The side of the channels shall be built up with mortar/concrete, as specified, to provide benches at a maximum of one (1) in twelve (12) pitch towards the channel.
- b. The replacement pipe in the manhole shall be sealed as specified above before proceeding on to the next manhole section and all manholes shall be individually inspected for replacement pipe cut-offs, benches and sealing work.
- c. The replacement pipe shall be allowed to normalize to ambient temperatures as well as recover from any imposed stretch, usually eight hours (8 Hrs) to ten hours (10 Hrs) in the case of polyethylene, before being cut to fit between manholes and proceeding with reshaping and/or smoothing the manhole invert.

3.3 TESTING OF REPLACEMENT PIPE

- A. All costs for testing the replacement pipe by a pressure method shall be incidental to the installation. All testing shall conform to Section 02525 – Acceptance Testing for Gravity Sanitary Sewer Lines.

PART IV: TABLES

4.1 POLYETHYLENE REPLACEMENT PIPE DIMENSIONS

IPS NOMINAL O. D. (inches)	MINIMUM O. D. (inches)	MINIMUM WALL THICKNESS (inches)			
		SDR 26	SDR 21	SDR 19	SDR 17
7	7.125	.274	.339	.375	.419
8	8.625	.332	.411	.454	.507
10	10.750	.413	.512	.566	.632
12	12.750	.490	.607	.671	.750
14	14	.538	.667	.737	.824
16	16	.615	.762	.842	.941

4.2 POLYETHYLENE REPLACEMENT PIPE SDR

HDPE PIPE SDR	MAXIMUM DEPTH (Feet)
26	8.0
21	14.0
19	19.0
17	26.0

4.3 MINIMUM CLAMP LENGTHS

OUTSIDE DIAMETER OF THE LINER PIPE (Inches)	MINIMUM LENGTH OF CLAMP (Inches)
4.500	12
6.625	12
8.625	18
10.750 and larger	30

END OF SECTION

**SECTION 02555
SANITARY SEWER BYPASS PUMPING**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Bypass pumping of sanitary sewer lines for the purpose of construction, repair, cleaning and television inspection.
- B. Provide full redundancy for the bypass system.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices:

- 1. No separate measurement or payment shall be made for bypass pumping for any cleaning, CCTV, or rehabilitation/replacement operations in sanitary sewers with an estimated daily flow of less than two million gallons per day (2 mgd). Estimated daily flows shall be provided by the City to the Contractor prior to initiating a specific project.
- 2. For sanitary sewers with estimated daily flows of greater than two million gallons per day (2 mgd), the Contractor shall be paid for bypass pumping on a per hour basis. Payment shall include all labor, materials, equipment, tools and incidentals for pump setup, plugging, pumping and diversion of sewage flow, development of the flow control and bypassing plan, setup, pumps, piping, gasoline/diesel fuel, maintenance, transportation and storage, temporary bypass and service piping, confined space entry and equipment, inserting and removing pipe plugs, constructing bulkheads, pumping flows, monitoring water levels, installing bypass/diversion piping, trenching, jacking and boring, abandoning the jacked casing, plating for diversion piping, backfill, compaction, placing temporary pavement, traffic control, and surface restoration. Estimated daily flows shall be provided by the City to the Contractor prior to initiating a specific project.
- 3. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum):

- 1. If Contract is Stipulated Price Contract, payment for Work in this Section is included in the Total Stipulated Price.

1.3 REFERENCES

- A. ASTM – American Standards for Testing and Materials.
 - 1. All materials are to comply with the latest STM Standard Specifications for Materials and Equipment.
- B. CFTS – City of Friendswood Technical Specifications.

- C. OSHA – Occupational Health and Safety Administration.
 - 1. All operations, material, equipment and safety plans shall be in full compliance with all OSHA Standards. It is the Contractors Responsibility to adhere to all these regulations.
- D. TCEQ – Texas Commission on Environmental Quality.
 - 1. The Contractor shall adhere to all rules and regulations of the Texas Commission on Environmental Quality for Sanitary Sewer Systems.

1.4 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. The Contractor shall submit the following:
 - 1. The Contractor shall submit to the Project Manager a detailed plan and description outlining all provisions and precautions that the Contractor shall take regarding the handling of wastewater flows during sanitary sewer rehabilitation or other operations. The plan shall be submitted to the Project Manager for review and approval at least seven working days (7 Wd) prior to commencing work on each portion of the system to be rehabilitated. The plan must be specific and shall include, but not be limited to, the following details:
 - a. Schedule for installation and maintenance of bypass pumping system.
 - b. Staging areas for pumps.
 - c. Bypass pump sizes, capacity, number of each size to be on site and power requirements.
 - d. Calculations of static lift, friction losses, and flow velocity.
 - e. Pump curves showing pump operating range.
 - f. Road crossing details.
 - g. Protection against main breaks.
 - h. Sanitary sewer plugging methods and bypass time duration for each sanitary sewer section.
 - i. Size, length, material, location and method of installation for suction and discharge piping. This shall include any wet tap or hot tap procedures.
 - j. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill.
 - k. Method of noise control for each pump and/or generator.
 - l. Standby power generator size and location.
 - m. Downstream discharging plan.
 - n. Methods of protecting discharge manholes or structures from erosion and damage.
 - o. Restraining lengths for piping. Thrust blocks shall not be allowed as a method of restraint for bypass pumping systems.

1.5 QUALITY CONTROL

- A. It is the Contractor’s responsibility to have verification from the manufacturers that all equipment and materials being used are in compliance with this Technical Specification.
- B. No spillage of sanitary sewage shall be allowed at anytime. All waste materials shall be removed in conformance of Section 01580 – Waste Material Disposal.
- C. Violations due to sanitary sewage spills shall be the sole responsibility of the Contractor.
- D. The bypass system shall meet the requirements of all codes and of all regulatory agencies having jurisdiction.

1.6 COORDINATION

- A. The estimated daily flow rates for dry weather and wet weather flows shall be provided by the City for specific projects identified in need of Bypass Pumping.
- B. If the depth of flow in the sanitary sewer line being televised or repaired is above the maximum allowable for the proposed work, then the Contractor shall reduce the flow to the levels shown in Section 02520 – Television Inspection of Sanitary Sewer Lines, by manual operation of pump stations, plugging or blocking of the flow or by pumping and bypassing of the flow, as acceptable to the Project Manager. Plugging or blocking of the flow shall only be allowed when the Contractor can demonstrate that the upstream gravity collection system can accommodate the surcharging without any adverse impact. Operation of sanitary sewer lift stations must be performed by the City’s personnel and scheduled by the Project Manager.

PART II: PRODUCTS

2.1 EQUIPMENT

- A. The Contractor shall select pumping/bypassing equipment that shall not have excessive noise levels from pumping/bypassing equipment and shall be restricted to the following conditions in accordance with the City’s Ordinances:
 - 1. Residential Properties:
 - a. Daytime hours (7 a.m. to 10 p.m.) – maximum sixty-five decibels (65 dB).
 - b. Nighttime Hours (10 p.m. to 7 a.m.) – maximum fifty-eight decibels (58 dB).
 - 2. Non-residential Properties – maximum seventy decibels (70 dB).
 - 3. Measurement shall be taken at the nearest right-of-way line or property line.
- B. All pumps shall be capable of handling peak flows for the duration of operations.

- C. All pipes and fittings shall be able to handle peak flow volumes and pressures plus ten percent (10%).
- D. All materials shall be suitable for contact with domestic sanitary sewage. Under no circumstances shall aluminum "irrigation" type piping or glued PVC pipe be allowed. Discharge hose shall only be allowed in short sections and by specific permission from the Project Manager. The bypass pumping system shall be one hundred percent (100%) watertight.

PART III: EXECUTION

3.1 GENERAL

- A. The Contractor shall provide the necessary operating controls for each pump.
- B. The Contractor shall provide redundancy within the pumping system. Back-up pumps shall be online and isolated from the primary system by a valve.
- C. In order to prevent the accidental spillage of flows, all discharge systems shall be temporarily constructed of rigid pipe with positive, restrained joints. Only materials that withstand pressures greater than the peak bypass system pressures shall be used.

3.2 CONSTRUCTION REQUIREMENTS

- A. Preparation:
 - 1. The Contractor is responsible for locating any existing utilities in the area where the Contractor selects to locate the bypass pipelines. The Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the Project Manager. All cost associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.
 - 2. When working inside a manhole or force main, the Contractor shall exercise caution and comply with OSHA requirements when working in the presence of sanitary sewer gases, combustible or oxygen-deficient atmospheres, and confined spaces.
 - 3. The City shall be responsible for obtaining any approvals for placement of the temporary pipeline within Texas Department of Transportation highways or county roads rights-of-way
- B. Plugging and Blocking:
 - 1. A sanitary sewer line plug shall be inserted into the line upstream of the section being televised or repaired. The plug shall be so designed that all or any portion of the upstream flow can be released. During the television inspections and repair operations, the flow through the line being worked shall be reduced to within the maximum limits established in Section

02520 – Television Inspection of Sanitary Sewer Lines. After the work has been completed, the flow shall be restored to normal.

- C. Pumping and Bypassing.
 - 1. When pumping and bypass pumping is required, the Contractor shall supply all necessary pumps, conduits and other equipment to divert the flow around the pipe section or manhole in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing dry-weather flow plus additional flow that may occur during wet-weather (i.e. rainfall or snowmelt events). The Contractor shall be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. Pumps and equipment shall be continuously monitored by the Contractor during the periods that pumping and bypassing are required.

- D. Flow Control Precautions
 - 1. When flow in a sanitary sewer line is plugged, blocked or bypassed by the Contractor, the Contractor shall take sufficient precautions to protect the public health and to protect the sanitary sewer lines from damage that might result from sanitary sewer surcharging. Further, the Contractor shall take precautions to ensure that sanitary sewer flow control operations do not cause flooding or damage to public or private property being served by the sanitary Sewer Lines involved. The Contractor shall be responsible for any damage resulting from his flow control operations.
 - 2. When flow in a sanitary sewer line is plugged or blocked by the Contractor, he shall monitor the conditions upstream of the plug and shall be prepared to immediately start bypass pumping, if needed. Any liquid or solid matter which is bypass pumped from the sanitary sewer collection system shall be discharged to another sanitary sewer manhole or appropriate vehicle or container only. No such liquid or solid matter shall be allowed to be discharged, stored or deposited to the open environment. The Contractor shall protect all pumps, conduit and other equipment used for bypass from traffic.
 - 3. Should any liquid or solid matter from the sanitary sewer collection system be spilled, discharged, leaked or otherwise deposited to the open environment as a result of the Contractor’s flow control operations, he shall be responsible for all cleanup and disinfection of the affected area and all associated costs. The Contractor shall also be responsible for notifying the Project manager, sanitary sewer system operating personnel and appropriate regulatory agencies and performing all required cleanup operations at no additional cost to the City.

**END OF SECTION
02555-5**

**SECTION 02560
SANITARY SEWER OBSTRUCTION REMOVAL**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. The purpose of an obstruction removal is to clear a sanitary sewer line of obstructions so as to allow for rehabilitation by any method.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Payment for an obstruction removal shall be paid on a per each basis, for all necessary material, equipment and labor to accomplish the removal of obstructions in sanitary sewer lines by excavation or remote cleaning.
2. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum):

1. If Contract is Stipulated Price Contract, payment for Work in this Section is included in Total Stipulated Price.

1.3 REFERENCES

- A. CFTS – City of Friendswood Technical Specifications.

1.4 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
B. Submit product data for each pipe product, fitting, coupling and adapter.

1.5 QUALITY ASSURANCE

- A. Provide manufacturer's affidavits that pipes, fittings, couplings and adapters were manufactured in compliance with standards and Technical Specifications referenced in this Section.

PART II: PRODUCTS

2.1 MATERIALS

- A. Use only soils that are in compliance with the Specifications in Section 02140 – Utility Backfill materials.
B. Use cement-stabilized backfill for bedding and backfill that shall conform to Section 02145 – Cement-Stabilized Sand.
 1. Cement shall consist of Type I Portland cement conforming to ASTM C150.
 2. Sand and cement shall be mixed in a pug mill or obtained from

an approved supplier using not less than one and one-half (1-1/2) sacks of cement per one ton (1 Tn) of mixture and sufficient water to hydrate the cement.

- C. All pipe and materials for repair shall conform to the appropriate section, Sections 02200 through 02280, for the type of pipe being repaired.

PART III: EXECUTION

3.1 PREPERATION

- A. All line replacement materials (pipe and fittings) shall be on-site prior to any excavation.
- B. Bedding material shall be on-site or prior delivery arrangements made with a reliable source.
- C. Trench Safety Systems shall be on-site and shall comply with all rules, regulations and laws as specified in Section 02280 – Trench Safety Systems.
- D. Provide bypass pumping as required. Bypass pumping shall be incidental to the work in this Section. All bypass pumping shall conform to Section 02555 – Sanitary Sewer Bypass Pumping.
- E. Remote obstruction removal device, if used, shall be on-site prior to the start of work.

3.2 OBSTRUCTION REMOVAL

- A. **Obstruction Removal by Remote Device:** This method of obstruction removal shall be performed prior to rehabilitation. During television inspection, or if video media is available from a previous televising of the sanitary sewer line and identifies heavy roots, protruding taps and hard material deposits, which could cause a non-uniform liner pipe or obstruction during installation of the liner, the Contractor shall ask the Project Manager for approval for obstruction removal by remote device. The obstruction removal by remote device shall consist of solid steel mandrel, or porcupines winched from one manhole to another manhole. They shall be sized to remove the obstructions to the satisfaction of the Project Manager. The Contractor may use bucket machine to break obstruction by this method without damaging sanitary sewer pipe.
- B. **Obstruction Removal by Excavation:** This method of obstruction removal shall be performed while installing a liner in the sanitary sewer, or the repair or removal of obstructions to the flow within a sanitary sewer. If during the liner insertion operation, a collapsed sewer, off-set joint, or other obstruction is encountered which prevents or blocks the passage or insertion of the liner involved in the rehabilitation process, or an obstruction is known or found in any sanitary sewer line, the Contractor shall notify the Project Manager for approval to make an excavation to uncover and remove the obstruction in the following manner:

1. Excavate at the point where there is an obstruction. A trench safety system shall be required for all excavations over five feet (5 Ft) deep.
2. Break out the existing sanitary sewer pipe, carrier pipe, etc., as directed by the Project Manager. Remove only that amount of material which is causing the obstruction. The amount of carrier pipe, if any to be removed shall be minimized.
3. When the liner is completely in place, it shall be encased with Cement Stabilized sand bedding. Under such conditions, replacement of the carrier pipe is not required. The existing sanitary sewer bedding should not be disturbed by the excavation work. However, if said bedding is disturbed during the obstruction removal procedure, the Contractor shall place cement-stabilized sand beneath the liner to a minimum compacted thickness of twelve inches (12 In) and to above the pipe as required. Repairs under paving shall have cement-stabilized backfill to the top of the subgrade of the paving.

END OF SECTION

SECTION 02565 LIFT STATION CLEANING

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. The purpose of Lift Station Cleaning is to remove all debris, grit, and bio-solids from the designated facilities. The contractor may de-water the solid material, and the contractor shall be responsible for the disposal of the wastewater/solid in an approved and regulated manner.
- B. All cleaning operations shall be required to meet OSHA standards, especially if considered a confined space.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
 - 1. Payment for lift station cleaning shall be paid on a per hour basis, for all necessary labor, material, equipment, supervision, and performing all work necessary to clean the wet well, to remove all debris, grit, and grease to provide final wash down of walls and ceilings and fixtures, to dispose of all removed water and solids.
 - 2. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
 - 1. If Contract is Stipulated Price Contract, payment for Work in this Section is included in Total Stipulated Price.

1.3 REFERENCES

- A. ANSI/ASSE – American National Standards Institute/American Society of Safety Engineers.
 - 1. ANSI/ASSE Z117.1-2009 – Safety Requirements for Confined Spaces.
 - 2. ANSI/ASSE Z359.1-2007 – Safety Requirements for Personal Fall Arrest Systems, Subsystems, and Components.
- B. CFTS – City of Friendswood Technical Specifications.
- C. OSHA – Occupational Safety and Health Administration CFR-29 Standards.
 - 1. 1910.23 – Guarding Floor and Wall Openings and Holes.
 - 2. 1910.146 – Permit Required Confined Spaces.
 - 3. 1926, Subpart E – Personal Protective and Life Saving Equipment.
 - 4. 1926, Subpart M – Fall Protection.
- D. TCEQ – Texas Commission on Environmental Quality.

PART II: PRODUCTS – NOT USED

PART III: EXECUTION

3.1 CLEANING, MINOR

- A. Skimming of all debris, trash, sludge and other materials floating on top of the liquids in the wet well.
- B. All material removed from the wet well shall be disposed of in accordance with TCEQ rules and regulations, latest edition.

3.2 CLEANING, MAJOR

- A. The wet well shall be pumped down as far as possible with existing pumps. Cleaning of facilities shall include cleaning of sloped floor, walls, connected piping, and channels.
- B. Remove all grease from wet well surfaces, including flow level floats and monitors. Contractor shall also remove all grease floating or in mats.
- C. All sludge, grit, grease, scum, and other debris shall be completely removed and disposed of in accordance with TCEQ specifications.
- D. All existing concrete, piping, and equipment shall be cleaned with high-pressure water.
- E. There are no claims as to the condition, hardness, or type of material to be removed.
- F. After the removal of the grit and sludge, the wet well shall be inspected.
- G. Contractor shall take precautions not to damage (further) the existing equipment in the lift stations wet well. Contractor shall be responsible for any careless damage and shall be responsible for any repairs to damaged facilities.

3.3 DEWATERING AND DISPOSAL

- A. Existing material may be taken from the wet well and hauled directly for disposal, or solids and debris may be dewatered onsite. The dewatering process shall not create odors or vector problems. Grease shall be removed directly and not dewatered. Dissolved grease may not be put back into the bypass pumping. All dewatering and disposal operations shall be done in compliance with the latest TCEQ Regulations.

3.4 SOLIDS DISPOSAL

- A. Disposal of grit and sludge shall be in accordance with State, Federal, and Local regulations and is the responsibility of the Contractor. Contractor shall be responsible for cleaning up any material spills in accordance with State, Federal, and local regulations. The contractor shall submit information on the disposal of material. The landfill shall be

identified on the manifest for official records. The vendor shall not stockpile any removed material on site. Contractor shall be required to meet State and City regulations for sludge/liquid transportation.

- B. Compensation for transportation and disposal of waste material resulting from cleaning and inspection operations is considered subsidiary to the cost of cleaning and inspection. Additional compensation shall not be allowed.

3.5 CONFINED SPACES

- A. The work contemplated under this project involves activities in and around confined spaces. The contractor and/or contractors independently retained employee or safety consultant shall implement a confined space entry program in accordance with OSHA Standards governing the presence and activities associated with working in and around confined spaces. The contractor shall, as a function of the Health and Safety plan implement a confined space entry program. The contractor shall maintain a copy of the Confined Space Entry Program on site at all times. The contractor shall take all necessary actions to ensure that his employees and employees of any sub contractor have read and understand and follow the plan.
- B. The contractor shall implement OSHA Fall Protection around any openings.

END OF SECTION