SECTION 02900
WASTEWATER COLLECTION (SANITARY SEWER) SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work to be performed under these specifications consists of furnishing all materials and performing all work necessary for or incidental to completing and making ready for the operation of the wastewater collection system as indicated on the Contract Drawings.

B. The Work shall include the excavation, trenching and backfilling; furnishing and installing all trench sheeting and bracing; furnishing and installing all pipe, specials, services, manholes, and related appurtenances; storage and protection of materials; testing, cleanup, and all other operations necessary to complete the work in accordance with the detailed plans and project specifications contained herein.

C. Structures shall conform in shape, size, dimensions, materials and other respects to the Contract Drawings or as ordered by the Engineer.

1.02 COORDINATION WITH INTERESTED PARTIES

The Contractor shall duly notify and coordinate any work with interested parties such as the Mississippi Department of Transportation, the Mississippi State Department of Health and the appropriate City or County Officials. No work which affects these interested parties will commence until satisfactory coordination has been achieved.

1.03 SUBMITTALS

A. Shop Drawings:

1. Pipes and Fittings

   a. Submit size, class and other details of the pipe to be used.

   b. Submit information on typical joint and harnessing details.

2. Manholes

   a. Submit design and construction details of all precast concrete manholes.

   b. Submit manufacturer's data on interior lining material, preformed mastic joint material and rubber manhole boots, manhole water stops, and/or lateral connectors.

   c. Submit an affidavit from the coating applicator that each manhole section and special has been coated in accordance with these specifications.

B. Tests: Submit a description of the proposed testing methods, procedures, and apparatus. Submit copies of all test reports.

C. Record Drawings: During progress of the Work, keep an up to date set of drawings showing field modifications. Submit drawings at a scale satisfactory to the Engineer that show the actual in-place installation of all piping and manholes installed under this section. The drawings shall show all piping and manholes on the plans with all reference

dimensions and elevations required for complete record drawings of the piping systems. The drawings shall be furnished no later than 30 days after Substantial Completions of the Work.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery, storage and handling of pipes, fittings and accessories shall be in complete compliance with the manufacturer's recommendations and instructions.

B. Handle all pipes, fittings and accessories carefully with approved handling devices. Do not drop or roll pipes off of trucks. Do not otherwise drop, roll or skid pipes. Materials cracked, gouged, chipped, dented or otherwise damaged will not be approved.

C. Pipes, fittings and accessories shall be unloaded opposite to or as close to the place where they are to be laid as is practicable to avoid unnecessary handling. Interiors shall be kept free from dirt and foreign matter.

1.05 CLEARANCE BETWEEN WATER AND SEWER LINES

A. Sewer lines and manholes shall be laid at least 10 feet horizontally from any water line.

B. Where this 10 feet horizontal separation cannot be maintained, the sewer line shall be ductile iron with the joints located at least 10 feet from the water line or the sewer line shall be totally encased in concrete.

C. Sewer lines crossing water mains shall be laid to provide a minimum vertical distance of 18 inches between the outside of the sewer line and the outside of the water main (water over sewer). The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. Where this separation cannot be met the sewer line shall be constructed to the same specifications as the water line and be water until such a point where the separation can be met.

1.06 CONFLICTS WITH OTHERS UTILITIES

A. Where construction conflicts with underground utilities which are to remain in place, or indicated to be removed and/or relocated by the Contractor, the Contractor shall at his own expense, protect these facilities, restore the portions of those lines which are damaged or severed as a result of his operations, and remove and/or relocate existing facilities as indicated on the Contract Drawings.

B. Where existing lines in conflict are indicated to be removed by others, the Contractor shall cooperate with the Owner of these utilities to the end that these conflicts are removed prior to excavation for the sewer lines.

1.07 RAILROAD AND HIGHWAY CROSSING

All work incidental to the construction of sewer lines under railroads and highways shall be done in strict compliance with the regulations prescribed by the owners of these properties and shall be done with extreme care to safeguard life and property. After the necessary permits and agreements for these crossings have been approved and executed. The Contractor shall confer with the representatives of the Railroad Company, the Mississippi Department of Transportation or the City or County owning these properties and arrange schedules, and the manner for constructing the work in accordance therewith.

1.08 MAINTENANCE

A. The Contractor shall be responsible for, without extra compensation, the maintenance of

all sewer lines and structures, for the stability of all backfills and the finished grades above the sewer lines and around the structures and for the repair, replacement, and restoration of all items which were damaged or removed during construction.

B. The Contractor shall be responsible for, without extra compensation, the restoration of all permanent surfaces and landscaped areas such as pavements, sidewalks, driveways, curbs, gutters, shrubbery, decorative plantings, fences, poles and other property and surface structures removed, disturbed and/or damaged during or as a result of construction operations to a condition which is equal in appearance and quality to the condition that existed before the work began.

C. The Contractor shall take such measures necessary to prevent, control and correct any dust nuisance or muddy conditions developing on roadways as a result of his operation. Direct payment for maintenance of the site shall not be provided as such but shall be considered a subsidiary obligation of the Contractor.

1.09 TRAFFIC CONTROL

Traffic control shall be the responsibility of the Contractor and should be implemented in accordance with the Manual on Uniform Traffic Control Devices.

1.10 TEMPORARY SURFACES OVER TRENCHES

Whenever the sewer lines are constructed under traveled roadways, driveways, sidewalks or other traveled surfaces, a temporary surface shall be placed over the top of the trench as soon as possible after placement and compaction of the backfill has been satisfactorily completed. The temporary surface shall consist of a minimum of six inches (6") of clay gravel. The top of the temporary surface shall be smooth and meet the grade of the adjacent undisturbed surface. The temporary surface shall be maintained at the Contractor's expense until final restoration of the street surface is completed as specified.

1.11 WARRANTY

A. The contractor shall warranty all materials of construction and repair and all workmanship for a period of one year from the date of acceptance of final work.

B. Should defects of failures occur during the period of warranty, the contractor shall promptly take whatever steps are necessary to return the work to first class condition.

PART 2 - MATERIALS & EQUIPMENT

2.01 GENERAL

A. The Contractor shall furnish all materials necessary for or incidental to constructing the wastewater collection system. All materials shall be new and of first quality with certified tests for all pipe and pipe fittings made at the manufacturer's plant to assure conformance with these technical specifications. Two (2) certified copies of each test result shall be furnished to the Engineer.

B. The kinds and classes of materials incorporated into the work shall be as indicated on the Contract Drawings or the Bid Form. The Contractor shall not construe or interpret the several kinds of materials described herein as being equal in their application.

2.02 WATER FOR CONSTRUCTION AND TESTING

A. The Contractor shall be responsible for all water needed in constructing the work, flushing

the completed system, testing and other incidental needs. All water used shall be from an approved source free of pollution and shall be of a satisfactory bacteriological quality.

B. Water used in mixing concrete and mortar shall be fresh, clean and free from injurious amounts of sewage, oil, acid, alkalis, salts or organic matter.

2.03 DUCTILE CAST IRON PIPE AND FITTINGS

A. Ductile iron pipe shall be water pipe manufactured in accordance with AWWA C 151 (ANSI A21.51).

B. All fittings shall be ductile iron and shall conform to the latest edition of AWWA specifications for ductile iron fittings.

C. All ductile iron pipe and fittings shall be factory-coated on the outside with coal tar enamel confirming to the latest edition of AWWA C105 (ANSI A21.5) and lined inside with a minimum of 1/16 inch cement-mortar lining in accordance with the latest edition of AWWA C104 (ANSI A21.4).

D. All pipe and fittings shall be tested for minimum 150 PSI water working pressure laying conditions Type 2 flat bottom trench without blocking, tamped, backfilled and under five (5) feet of cover.

E. All pipe and fittings shall be encased with an 8 mil thick loose polyethylene encasement in accordance with the latest edition of AWWA C-105 (ANSI A21.5).

F. Joints for ductile cast iron pipe shall be slip-on type unless otherwise specified. Slip-on joint shall conform to the latest edition of AWWA C 111 (ANSI A21.11) except that the joints shall be made with a special gasket seal Super-Bel Tite as manufactured by the Clow Corporation or approved equal. Lubricants shall be non-toxic, odorless, tasteless and shall not support bacteria and shall be specifically manufactured for the pipe utilized.

G. Mechanical joint pipes shall conform to the latest edition of AWWA C 111 (ANSI A21.11).

H. All joints for fittings, valves and specials shall be mechanical joints.

I. If flexible joint or river crossing pipe is required and/or indicated in the project plans or specifications the joint shall be designed for a maximum deflection of 15 degrees, and a maximum working pressure rating of 250 psi. The type shall be the USIFLEX joint as manufactured by U.S. Pipe or an approved equal.

2.04 POLYVINYL CHLORIDE (PVC) PIPE

A. PVC sewer pipe and fittings shall be unplasticized polyvinyl chloride meeting the minimum of SDR 26 of the requirements of ASTM Specification D 3034 and with a minimum "pipe stiffness" (F/Y = 115 psi at 5% deflection - maximum allowable for installed pipe for SDR 26) when tested in accordance with ASTM D 2412. All pipe and fittings shall be joined by means of an integral wall bell and spigot joint and sealed with a rubber ring conforming to ASTM D 3212. The pipe and fittings shall be shipped to the job with a solid cross section rubber sealing ring securely locked in place in the bell.

B. The pipe shall be made from white PVC compound having physical properties and chemical resistance of cell classification 12454-B and fittings shall be made from white PVC compound having physical properties and chemical resistance of cell classifications 12454-B, 12454-C or 13343-C as defined in ASTM D 1784.

C. All jointing shall be made in accordance with the manufacturer's recommendations.

D. All pipes shall bear the National Sanitation Foundation (NSF) seal of approval.

2.05 PIPE MARKING

A. Pipe materials are specified under 2.03 & 2.04 of this section.

B. Pipe Marking:

1. General:

a. Each piece of pipe or fitting shall be clearly marked with a designation which shall conform to designations shown on the shop drawings.

b. Class designation shall be cast or painted on each piece of pipe or fitting four inches in diameter or larger.

c. Piping smaller than 4 inches in diameter shall be clearly marked by the manufacturer as to material, type and rating.

2. Magnetic Underground Warning Tape

a. Contractor shall place magnetic warning tape approximately 12 to 18 inches below grade in all pressure pipe trenches.

b. Buried sewer piping warning tape:

1) Message: “CAUTION-BURIED SEWER LINE”

2) Size and Color: 3 inches wide and green background with black lettering

C. See Contract Drawings for required pipe material.

2.06 SERVICE PIPING

A. Service piping shall be PVC service line sized in accordance with the details in the Contract Drawings

1. PVC Service Line: PVC service pipe shall be solvent weld in accordance with the National Sanitary Foundation (NSF), Class 200 pipe, for use with potable water.

2.07 PRECAST CONCRETE MANHOLES

A. Precast manholes shall conform to the details shown. Manhole bases may be precast.

B. Except where otherwise specified, manhole sections shall conform to ASTM C 478.

C. Precast manhole bases shall be of approved design and of sufficient strength to withstand the loads to be imposed upon them. An approved joint shall be provided to receive the riser sections forming the barrel.

D. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.

E. Unless a larger size is required by the Drawings, the barrel of precast manholes shall be constructed of 48-inch diameter standard reinforced concrete manhole sections. The barrel shall be constructed of various lengths in combination to provide the correct height

with the fewest joints. Wall sections shall not be less than five inches thick. For 72-inch and larger manholes, a transition slab, as shown on the Contract Drawings, is required for manholes greater than 12 feet deep.

F. Joints shall be tongue and groove with preformed mastic joint compound. Preformed joint compound shall be Preformed Asphalt and Butyl Gasket Material, a product of the Blue Ridge Rubber Company, or “Ram-Nek” as manufactured by K.T. Snyder Company, Inc. of Houston, Texas, or “Kent-Seal” as manufactured by Hamilton-Kent Manufacturing Company or equal.

G. A precast slab or precast eccentric cone, as shown or approved, shall be provided at the top of the manhole barrel to receive the cast iron frame and cover. The slab or cone shall be of acceptable design and of sufficient strength to safely support an H-20 loading. Concrete slabs shall be not less than 8 inches thick.

H. Manhole sections shall contain manhole steps, uniformly spaced, 12 inches minimum, 16 inches maximum on centers, accurately positioned and embedded in the concrete. Manhole steps shall be M.A. Industries, Model PS1-PF or equal.

I. Rubber gaskets shall be the "0" ring type conforming to the requirements of the latest edition of ASTM Standard Specification A-443. The gaskets shall be as manufactured by the Blue Ridge Company of Flecher, North Carolina, or the Tylox "0" Ring Gasket produced by Hamilton-Kent Manufacturing Company of Kent, Ohio, or approved equal. Lubricants used with the selected gaskets shall be as furnished or recommended by the gasket manufacturer.

2.08 INTERIOR MANHOLE COATINGS

A. Coal Tar Epoxy

1. The interior of all precast manhole sections, slabs and adjusting rings shall be coated with a coal tar epoxy coating unless otherwise specified.

2. Surface Preparation:

   a. Surface to be coated must be clean, dry, properly cured and free from all surface contaminants.

   b. “Brush off Blast” (SSPC-SP7) is to provide an etched surface and to remove contaminants and laitance.

   c. Remove dust before coating.

3. Coating shall be applied in strict accordance with the manufacturer’s requirements.

4. Coating shall be applied at the concrete casting facility.

5. Field touch-up and repair shall be performed in strict accordance with the manufacturer’s requirements.

6. Thickness as recommended by the manufacturer

7. Number of coats as recommended by the manufacturer.

8. Product and Manufacturer:

a. CB-42 by International Oil Company

b. 40-AX-7 Coal Tar Solution by BLP Mobile Paints

c. Or equal

B. 100% Solids Epoxy

1. The interior of all manholes to be coated shall be visually inspected prior to beginning work and areas of hazardous structural damage reported to the engineer.

2. Pressure clean the manhole (minimum 3,500 psi) to remove all dirt, grease, sand and surface contaminants on the wall and floor leaving a clean, wet or dry surface. If a detergent or de-greaser solution is used, the surface shall be thoroughly rinsed and neutralized prior to the installation of the liner system.

3. Coating shall be applied in strict accordance with the manufacturer's requirements.

4. Field touch up and repair shall be performed in strict accordance with the manufacturer's requirements.

5. Thickness as recommended by the manufacturer.

6. Number of coats as recommended by the manufacturer.

7. Product and Manufacturer

a. Warren Environmental System 100% Solids Epoxy by Suncoast Infrastructure

b. Approved equal.

2.09 MANHOLE FRAMES AND COVERS

Provide manhole frames with covers as manufactured by one of the following:

A. "Paved Areas" Manholes:

1. C. L. Dews, Model DF-25(7).

2. Or equal.

B. "Non-Paved Areas" Manholes:

1. C. L. Dews, Model DF-25(7).

2. Or equal.

2.10 DROP INLET CONNECTIONS

Drop inlet connections for manholes shall be constructed where shown and shall conform to the design and details shown. Pipes and fittings shall be the same as the inlet pipe except where noted on the details or described herein. Concrete shall be bonded to manhole in a manner shown or otherwise approved by Engineer.

2.11 RUBBER MANHOLE BOOTS

A. Rubber manhole boots complying with ASTM C923 shall be employed in the connection of each sewer pipe with outside diameter less than 59 inches to precast manholes.

B. Connector will consist of rubber EPDM and elastomers designed to resist ozone, acids, alkalis, oils and petroleum products.

C. Banding mechanism shall be totally non-magnetic 304 stainless steel and torqued for 60-70 inch/lbs.

D. Manufacturer:

1. Kor-N-Seal.

2. Or equal.

2.12 LATERAL CONNECTIONS

A. Lateral connectors can be employed in the connection of sewer pipe 15" in diameter or less in lieu of rubber manhole boots.

B. Lateral connectors shall consist of a PVC hub, rubber sleeve, and stainless steel band.

C. PVC hub shall meet ASTM D3034 and be SDR 26 and gasket in hub shall meet ASTM F477. Rubber sleeve shall meet ASTM C443. Band and housing shall be type 301 stainless steel and screw shall be type 305 stainless steel.

D. Model and Manufacturer:

1. Inserta Tee by Inserta Fittings Company.

2. Or equal.

2.13 SPECIALS

Specials shall be of the same material as the pipe material being used or as approved by the Engineer. The term specials shall include plugs, caps, and other items as needed. Specials shall conform to the applicable AWWA/ASTM/ANSI Standards.

2.14 OTHER MATERIAL

A. Concrete: Concrete shall be in accordance with Section 0300, Concrete, and shall develop a compressive strength of 3,000 pounds per square inch at twenty-eight (28) days.

B. Steel Casing: The steel casing pipe shall conform to ASTM designation A-53 and have an A.S.A. Standard thickness.

C. Select Embedment Material: Select embedment material for pipe embedment shall be Class I, II or III conforming to the requirements of ASTM Standard Specification D 2321 (Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications).

D. Select Backfill Material: Select material for backfilling trenches and other designated excavations shall be composed of a natural or artificial mixture of sand silt and clay or soil binder or shall be a select well-graded sand-gravel material as specified and approved by

the Engineer. The following limits shall apply to the sand-clay material passing the number 40 sieve:

Liquid Limit (LL)----------Not more than 25
Plasticity Index (PI)----------Not more than 6

The fraction passing the number 200 sieve shall not be greater than two-thirds (2/3) the fraction passing the number 40 sieve.

PART 3 – EXECUTION

3.01 GENERAL

A. The Contractor shall duly notify and coordinate any work with interested parties such as the Mississippi Department of Transportation, the Mississippi State Department of Health and the appropriate City or County Officials. No work which affects these interested parties will commence until satisfactory coordination has been achieved.

B. The work required shall consist of excavation and trenching for open cut construction, installation of pipe, manholes and appurtenances, backfilling, testing, repair and restoration of property, and final cleanup.

3.02 EXCAVATION FOR PIPING

A. The Contractor shall perform all excavation of every description and of whatever substances encountered to the depth specified in the Contract Drawings or as directed by the Engineer. All trenches shall be excavated along the lines and to the grades established in the Contract Drawings.

B. The bottom of all trenches shall be carefully shaped, graded and aligned. Care shall be taken not to excavate below the depth specified; however, in the event this should occur, the bottom of the trench shall be filled back to grade with approved material and thoroughly compacted in a manner satisfactory to the Engineer.

C. The bed for each piece of pipe is to be shaped either by trimming the bottom of the trench or by placing excavated earth therein and tamping so that each piece of pipe will have uniform bearing and be in continuous contact with the supporting ground for its entire length. The trench shall be further excavated around each bell or hub, if necessary, so that it will entirely be clear of the ground and leave ample room for making up joints.

D. When rock is encountered, the Contractor shall excavate to a depth at least 4 inches below the required grade and a minimum clearance of 12 inches on each side of pipe and backfilled to grade with 4 inches of sand cushion.

E. Water will not be permitted in the trenches while the pipe is being laid. The Contractor shall not open up more trench than the available pumping facilities are able to dewater to the satisfaction of the Engineer.

F. Should conflicts in grade occur with other utilities, the sewer line grade shall be changed to avoid the conflict as directed by the Engineer.

G. All material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Contractor to pile material so that free access is provided at all times to all fire hydrants

and water valves in the vicinity of the Work and to cause as little inconvenience as possible to public travel and the abutting property. All excavated materials not required or not suitable for backfill shall be removed and wasted as indicated or as directed by the Engineer. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations and any water accumulating therein shall be removed by pumping or by other approved methods.

H. The disposal of all surplus and unsuitable excavation shall be the responsibility of the contractor at his own expense. The surplus and unsuitable material not to be used in the construction of the project shall not be left on the right-of-way or easement of the project or adjacent thereto.

3.03 EXCAVATION FOR MANHOLES

A. Excavation for manholes shall be sufficient to permit the carrying out of the construction as required by these specifications and Contract Drawings.

B. Care shall be taken not to excavate for the manholes below the depths specified on the plans in correspondence with the detail sheet. If extra depth of excavation is necessitated by the nature of the soil and is ordered by the engineer, the contractor will be paid for the selected fill material as provided elsewhere in these Contract Documents for “Extra Work”, unless the contract contains unit prices for the materials used.

3.04 SHEETING, SHORING AND BRACING

A. The Contractor shall furnish and place such sheeting and bracing as may be required to support the sides of the trench and to protect the workmen and pipe or adjacent structures from injury by the sloughing off or caving in of the trenches.

B. When using movable trench support, care shall be exercised not to disturb the pipe location, jointing or embedment.

C. Any voids left in the embedment material by support removal shall be carefully filled with granular material and adequately compacted.

D. The sheeting and bracing may be removed as the trench is backfilled, or may be left in place where necessary to prevent damage. In the event the sheeting or bracing is left in place, it shall not extend nearer than one foot (1') to the surface of the ground.

E. In no case will extra compensation be allowed for furnishing, placing or removing any sheeting and bracing, but the cost of this work shall be included in the unit price bid for installing the pipe.

3.05 PIPE EMBEDMENT

A. Select embedment material used around and under pipes is as specified in 2.14 of this section.

B. Select Embedment Installation:

1. Foundation: If required, as recommended for material class in Table 2 of ASTM D 2321

2. Bedding: As recommended for material class in Table 2 of ASTM D 2321

3. Haunching: As recommended for material class in Table 2 of ASTM D 2321

4. Initial Backfill: As recommended for material class in Table 2 of ASTM D 2321

C. No pipe shall be brought into position until the preceding length has been embedded and secured in its final position.

D. Place embedment materials so that the pipe after installation will be true to line and to grade.

3.06 PIPE LAYING

A. Pipes, specials and fittings shall be carefully laid to the line and grade established on the Contract Drawings or as directed by the Engineer. All pipes shall be laid in compliance with the manufacturer's instructions, technical specifications and details on contract drawings and at such depths that a minimum cover is maintained as specified previously. Extra depth will not be measured unless noted on the Bid Form.

B. Install all pipes accurately to the line and grade shown unless otherwise approved by the Engineer. Remove and relay pipes that are not laid correctly.

C. Pipe laying will not be permitted when trench contains water.

D. Slope piping uniformly between elevations given.

E. Start laying pipes at lowest point and proceed towards higher elevations, unless otherwise approved by Engineer.

F. Place bell and spigot so that bells face the direction of laying, unless otherwise approved by the Engineer.

G. Excavate around the joints in bedding and lay pipes so that only the barrel receives bearing pressure from the trench bottom.

H. Blocking is not allowed to bring pipe to grade.

I. Permissible deflections at joints shall not exceed the amount allowed by the manufacturer.

J. Take every precaution that no foreign material enters the piping prior to and during installation.

K. All pipes and fittings shall be carefully examined for cracks, damage or other defects while suspended above the trench before installation. Defective materials shall be immediately removed from site.

L. Interior of all pipes and fittings shall be inspected and all dirt, gravel, sand, debris or other foreign materials shall be completely removed from pipe interior before it is moved into the trench.

M. Bell and spigot mating surfaces shall be thoroughly wire brushed and wiped clean and dry immediately before pipe is laid.

O. Every time that pipe laying is not actively in progress the open ends of pipe shall be closed by a watertight plug.

P. Field cutting pipe, where required, shall be made with a machine specially designed for cutting piping. Cuts shall be carefully done, without damage to pipe or lining, so as to leave a smooth end at right angles to the axis of pipe. Cut ends shall be tapered and sharp edges filed off smooth. Flame cutting will not be allowed.

Q. Touch up protective coatings in a satisfactory manner prior to backfilling.

3.07 HORIZONTAL AND VERTICLE ALIGNMENT OF PIPES

A. The Contractor shall utilize a commercial grade laser beam specifically manufactured to aid in maintaining grade and alignment of pipelines during installation. The primary unit shall be mounted on a heavy duty base and firmly anchored in the downstream manhole of the reach under construction. The maximum distance shall not exceed 400 feet per setup.

B. Each joint of pipe will be installed using an approved target to align the pipe with the projected laser beam. The methods and procedures shall be in strict accordance with the manufacturer's recommendations and instructions.

C. Proper ventilation shall be maintained at all times and care shall be exercised to avoid bumping or misalignment of the projected beam.

D. Sewer pipe shall be laid so that the installation variation of invert elevations when compared with the construction plans does not exceed 0.10 feet. If the variation exceeds 0.10 feet the line shall be rejected.

3.08 MAKING JOINTS

A. Joints shall be constructed in accordance with the recommendations of the manufacturer.

B. Clean completely all jointing surfaces and adjacent areas immediately before matting joint.

C. After gaskets are compressed and before pipe is brought fully home, each gasket shall be checked for proper position around full circumference of the joint.

3.09 TRANSITION FROM ONE TYPE OF PIPE TO ANOTHER

Provide all necessary adapters, specials and connection pieces required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.

3.10 SERVICE ASSEMBLES AND SERVICE LINE INSTALLATION

A. Assemblies shall consist of appurtenances needed to complete the assembly in accordance with the Contract Drawings. They shall be installed in a good and workmanlike manner in the places designated on the Plans or as directed by the Engineer.

B. Service line shall be as specified herein and will be measured and paid for separately as detailed herein.

C. Service lines to be marked as shown in the Contract Drawings.

3.11 CONNECTION TO EXISTING MANHOLES

A. Where indicated on the Contract Drawings, the Contractor will be required to make a water tight connection to an existing wastewater collection system. The Contractor shall furnish all labor and materials and service required for the excavating, removal and relocation of sections of old pipe, de-watering the trench, connecting of the sewer line with the existing lift station or manhole and the setting of necessary fittings, specials and required replacement of manhole coatings as shown on the Contract Drawings.

B. The size of the opening cut in the existing manhole wall shall be restricted to a normal diameter sufficient only to insert the sewer pipe. After insertion of the pipe, the void

between the outside of the pipe and the manhole shall be dry packed with a Portland cement-sand mix. The moisture content of the cement-sand mixture shall be minimized in order to avoid undue shrinkage after drying.

3.12 MANHOLE BASES

Precast bases shall be set on a concrete foundation or compacted granular material as shown in the Contract Drawings. Precast bases shall be set at the proper grade and carefully leveled and aligned.

3.13 PRECAST MANHOLE SECTIONS

A. Set sections vertical with sections true to alignment.

B. Install sections in accordance with manufacturer's recommendations.

C. Lifting holes shall be sealed water tight with non-shrink grout inside and out.

3.14 MANHOLE CHANNELS

A. For straight through flow, inverts shall be formed of concrete and shall be given a hard trowel finish.

B. Where side channels occur, the channels within the manholes shall be formed of concrete and shall be given a hard trowel finish.

3.15 GRADING RINGS

A. Grading rings shall be used on all concrete manholes where required. Stacks shall be a maximum of 12 inches in height. The height of the stack shall be such as is necessary to bring the manhole frame to the proper grade.

B. The outside of the grading rings shall be neatly plastered with 1/2 inch of cement mortar as the work progresses.

C. Each grading ring shall be laid in a full bed of mortar and shall be thoroughly bonded.

3.16 MANHOLES WATER TIGHNESS

A. All manholes shall be free of visible leaks.

B. All leaks shall be repaired in a manner subject to the Engineer's approval.

C. All lift holes to be sealed water tight inside and out with non-shrink grout.

3.17 FLEXIBLE PIPE CONNECTOR AND WATERSTOP AT MANHOLE BASES

An approved flexible connector shall be provided between each pipe entering and exiting manhole. The joint into the manhole base shall be completely watertight.

3.18 DROP MANHOLES

A. In manholes where the free fall inside the manhole exceeds 2 feet measured from the invert of the pipe to the top of the manhole floor, drop manholes shall be constructed in the same manner as specified for standard manholes except that the bottom shall be extended to support the drop line.

B. One joint of ductile iron pipe shall be extended upstream from the drop manhole and secured on the undisturbed bedding of the adjacent pipe trench.

3.19 BACKFILLING TRENCHES

A Backfilling shall be carefully performed and the original surface restored, to the full satisfaction of the Engineer. The trenches shall be backfilled with fine, loose earth, free form large clods, stones or rocks, frozen material or debris.

B. Proper compaction procedures should be exercised to provide the required soil densities. The backfill procedures shall be as follows:

1. Open areas or cross-country: Backfill material suitable for this method shall be machine-placed in successive layers and compacted until a density of at least the adjacent undisturbed ground is obtained. This operation will continue until all settlement has occurred and to the full satisfaction of the Engineer.

2. Across driveways, parking lots, paved areas, yards and within all road rights--of-way: The trenches shall be backfilled carefully and rammed until enough has been placed to provide a cover of not less than one foot (1') above the pipe. The remainder of the backfill material shall be placed in successive layers, not to exceed six inches (6"). Each lift shall be thoroughly compacted with mechanical tampers in paved area as well as road shoulder, so that at least 95% of the density determined by the Proctor Method, ASTM D-698, shall be obtained before the next lift is placed.

3. Backfill in unpaved areas shall be made as above specified, except the backfill lifts above the pipes may be deposited in layers not to exceed 6 inches and thoroughly tamped until a density of at least that of the adjacent soil is obtained.

C. Each lift of the backfill material shall have the proper moisture content to permit compaction to the required density.

D. Whenever the trenches have not been properly filled, or if settlement occurs they shall be refilled, smoothed off, and finally made to conform to the surface of the ground. Surplus material shall be disposed of as directed by the Engineer.

3.20 WORK AFFECTING EXISTING PIPING

A. Location of Existing Piping:

1. Locations of existing piping shown should be considered approximate.

2. Contractor is responsible for determining exact location of existing piping to which connections are to be made, or which may become disturbed during earth moving operations, or which may be affected by the work in anyway.

B. Work on Existing Pipelines:

1. Cut pipes as shown or required with machines specifically designed for this work.

2. Install temporary plugs to keep out all mud, dirt, water and debris.

3. Provide all necessary adapters, fittings, pipes and appurtenances required.

3.21 TESTING OF GRAVITY SEWER LINES

A. General:

1. Contractor shall conduct a low-pressure air test and a deflection test for all gravity sewer piping. For gravity sewer pipe 30" and larger, an infiltration/exfiltration test shall be performed.

2. Notify Engineer 48 hours in advance of testing.

3. Provide all testing apparatus.

4. Pipelines which fail to hold specified test pressure or which exceed the allowable leakage rate shall be repaired and retested.

5. Test pressures required are at the lowest elevation of the pipeline section being tested unless otherwise specified.

6. Unless otherwise approved, conduct all tests in the presence of the Engineer.

B. Installed Low Pressure Air Test: UNI-Bell's UNI-B-6.

1. Installed gravity sewer pipe 24" and smaller shall be air-tested prior to acceptance.

2. Specified pressure drop of 0.5 psig shall be used to determine the required time the pipe is tested.

3. Sections of installed pipe shall be tested from manhole to manhole.

C. Deflection Test:

1. Deflection tests shall be performed on all PVC and ductile iron gravity sewer pipe. The test shall be conducted after the final backfill has been in place at least 30 days.

2. No pipe shall exceed a deflection of 5%.

3. If the deflection test is to be run using a rigid ball or mandrel, it shall have a diameter equal to 95% of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices.

4. The mandrel shall be drawn through the pipe by hand. Irregularities or obstructions encountered in the line shall be corrected by the Contractor.

5. If a section of pipe with excessive deflection is found, the Contractor shall uncover the pipe for inspection. Damaged pipe will be replaced. If the pipe is undamaged, the Contractor may reinstall the bedding and backfill and retest the pipe. Retesting shall include mandrel and low-pressure air testing.

D. Infiltration/Exfiltration Test:

1. Infiltration/Exfiltration Test shall be performed in those sections of sewer pipe that lie under the groundwater table.

2. Contractor shall supply needed equipment and personnel to perform the infiltration/exfiltration test on installed gravity sewer pipe 30" and larger.

3. Allowable infiltration/exfiltration shall not exceed 50 gallons per inch of nominal diameter per mile of sewer per day.

4. An exfiltration test shall be performed where the crown of the entire reach of sewer being tested lies less than five feet under the existing water table. Minimum upstream testing head shall be five feet above existing water table.

5. An infiltration test shall be performed where the crown of the entire reach of sewer being tested lies five feet or more under the existing water table.

6. Sections of installed piping shall be tested from manhole to manhole.

7. The Contractor shall install a calibrated weir at lower end of section being tested and shall measure leakage for a minimum of four hours if infiltration test is performed. Provide bulkhead at upper end of pipe section being tested.

8. The Contractor shall measure required water to maintain minimum upstream testing head if exfiltration test is performed.

3.22 TESTING OF FORCE MAIN SEWER LINES

Leakage Test for Force Main Sewer Lines:

1. A leakage test shall be conducted by the Contractor at his expense and in the presence of the Engineer or his representative for installed force main line. The duration of each leakage test shall be 2 hours. During the test, the main shall be subjected to a pressure of not less than 100 psi measured at the average elevation of the pipe to be tested.

2. There shall be no visible leakage at any point and the total amount of leakage shall not exceed 20 gallons per 24 hours per inch diameter per mile as measured over a period of two hours.

3. Water which is introduced into the force main line to determine leakage may be measured by pumping water from a vessel of known volume or by using a calibrated water meter. If a meter is used it must have the capability of accurately measuring the low flows which may be required to maintain the test pressure on the line. A displacement type meter with sweep hand dial is recommended. One complete revolution of the sweep hand should represent not more than ten gallons.

3.23 FLUSHING

A. All piping shall be thoroughly cleaned and flushed in a manner approved by the Engineer prior to placing in service. Piping 48 inches in diameter and larger shall be inspected from the inside and all debris, dirt and foreign matter removed.

B. Water for flushing and testing shall be furnished and paid for by the Contractor. Contractor shall provide all temporary piping, hose, valves, appurtenances and services required.

C. The completed gravity flow system shall be clean of all muck, siltation and other foreign matter deposited or collected during construction. Flushing shall continue downstream manhole to manhole.

D. Flushing shall be accomplished prior to testing should the collected matter be sufficient in quantity to obstruct or effect the testing. Flushing will not be required in those sections of

the installed pipes and manholes where the exfiltration test has adequately cleaned the mains.

3.24 CLEAN-UP

A. In areas where the wastewater collection system has been backfilled, the Contractor shall clear the right-of-way and surrounding ground, and shall dispose of all waste materials and debris resulting from his operations. He shall fill and smooth holes and ruts and shall repair all miscellaneous and unclassified ground damage done by him and shall restore the ground to such a stable and suitable condition as may be reasonably required, consistent with the condition of the ground prior to construction.

B. Clean-up, including grading, disposal, dress work and other incidentals shall be completed by the Contractor at no additional cost to the Owner to the extent directed by the Engineer.

PART 4 - COMPENSATION

4.01 GENERAL

No separate payment shall be made for any item necessary for the completion of the work indicated on the Contract Drawings and in the Specifications but not shown as a pay item on the proposal form; therefore, full compensation for these items shall be considered absorbed in the Contract Lump Sum or related pay items.

4-02 MEASUREMENT AND PAYMENT

A. Gravity Mains

1. General: Gravity mains will be measured and paid for in linear feet along the centerline of the pipe from the center to center of manholes and from center of manhole to center of junction with existing main or plugged end. The total length of pipe thus measured will be separated into the various kinds and sizes for each increment of depth to establish the quantities of each Pay Item. Depth zones will be measured from existing ground line or the finished ground to the invert of pipe, whichever is less.

2. No deduction in length of main will be made for diameter of manholes 60" and smaller, or for space occupied by other specials installed.

3. Gravity mains installed in cased or tunneled openings will be measured along the centerline of the pipe from end to end of the casing.

4. Gravity mains designated to be jacked or bored through open cut barriers or restrictions shall be measured for payment along the centerline of the pipe from trench end to trench end. Trench end shall be defined as the vertical face of the trench that is perpendicular to the centerline of the jacked or bored pipe and is adjacent to the open cut barrier or restrictive area.

B. Force Mains

1. General: Force mains will be measured and paid for in linear feet along the centerline of the pipe from the center of the valve pit to center of junction with existing main or plugged end.

2. Force mains installed in cased or tunneled openings will be measured along the centerline of the pipe from end to end of the casing.

3. Gravity mains designated to be jacked or bored through open cut barriers or restrictions shall be measured for payment along the centerline of the pipe from trench end to trench end. Trench end shall be defined as the vertical face of the trench that is perpendicular to the centerline of the jacked or bored pipe and is adjacent to the open cut barrier or restrictive area.

C. Manholes: Manholes will be measured and paid for as the type, size and number of completed and accepted units in place and of incremental depths indicated in the Proposal. Incremental depths shall be determined from the finished elevation of the top of the completed unit to the invert of the outlet pipe. Manholes constructed over existing sewer mains will include a separate, additional measurement item per each for installation of the manhole and connection to the existing sewer main. Manholes floatation straps installed at the locations shown on the plans shall be measured per each installed and accepted.

D. Pipe Connections: Pipe connections to existing manholes or structures will be measured and paid for in units of each, with no allowance of incremental depths of bury.

E. Removal and Restoration of Permanent Surfaces

1. General: No separate measurement for payment purposes will be made for removal of permanent surfaces. This shall be considered an absorbed cost item unless otherwise specified on the Proposal.

2. No separate measurement for payment for restoration of concrete pavements, sidewalks, driveways, curb and gutter or for clay gravel will be made. These shall be considered as absorbed cost items unless otherwise specified on the Proposal.

3. No separate measurement for payment for restoration of asphalt pavements will be made. This shall be considered an absorbed cost item unless otherwise specified on the Proposal.

F. Removal and Restoration of Landscaping: Items designated to be removed and restored shall not be measured for payment, unless otherwise indicated on the Proposal.

G. Timber Sheeting or Sheet Piling Left in Place: Timber sheeting or sheet piling left in place will not be measured for payment but shall be considered an absorbed cost item.

H. Supplementary Items: If provided for in the Proposal, work performed in support of the gravity main construction shall be measured for payment in the manner prescribed in the respective Sections of the SPECIFICATIONS covering new construction of these items. Otherwise, these items will be absorbed costs.

I. Select backfill and select bedding hauled in from off-site areas shall not be measured for separate payment but shall be considered an absorbed cost item unless otherwise specified on the Proposal.

J. Pipe on Piers: Sewer pipe installed on piers across creeks, sloughs and low areas shall be measured along the centerline of the pipe from the point at which the top of the pipe leaves the natural ground to the point where the top of the pipe re-enters the natural ground. Measurement will not be made of excavation, grading or other items incidental to completion of the work. Measurement of piers and related appurtenances shall be per each installed.

K. Sanitary sewer service lines shall be measured along the centerline of the pipe per linear foot of each type installed with no allowance for cut depth differentials. No separate measurement for payment shall be made of specials, fittings, plugs, marker posts or other incidentals. Service assemblies including wye, bend and post shall be measured per each installed.

L. Sewer Main Bores and Service Line Bores shall be measured in the units specified in the Proposal.

--END OF SECTION 02900--