SECTION 33 31 00

SANITARY SEWERS

PART 1 - GENERAL

1.01 Pipe material for sewer lines 10 inches and smaller shall be PVC unless otherwise shown on the drawings.

1.02 Shop drawings are required for all products specified in this section.

1.03 Refer to the other specifications for items affecting gravity sewers. Coordinate this work with that specified by other sections for timely execution.

1.04 All sanitary sewer line construction shall be in accordance with standard specifications of the local review authority. Standard specifications of the local review authority supersede these specifications on areas of conflict.

PART 2 - PRODUCTS

2.01 MANHOLES

A. All manholes shall be reinforced, pre-cast concrete meeting ASTM C478. The manholes shall be pre-cast with Xypex Admix C-1000, at a rate of 3% by weight of cement.

B. Joints: Manhole joints shall be an approved flexible plastic gasket equal to RAM-NEK.

C. Manhole construction and joints shall be in accordance with the specifications of the Utility District having authority.

2.02 PIPE

A. Polyvinyl Chloride (PVC): To meet and/or exceed the requirements of ASTM D3034, SDR 35; suitable for use as a gravity sewer conduit with provisions for contraction and expansion at each joint; with a rubber ring and standard lengths of 20 feet and 12.5 feet plus or minus 1 inch; designed to pass all tests at 73 degrees F (plus or minus 3 degrees F); 6 inch long sections of pipe to be subjected to impact from a free falling type (20 pounds, Type A) in accordance with ASTM D2444 with no evident splitting or shattering (denting not considered a failure); and with a minimum envelope of 4 inches of granular material around the pipe, but with all other bedding and backfilling requirements remaining the same as for other pipe material.

B. Ductile Iron Pipe (DIP): Shall conform to the requirements of ANSI 21.51/AWWA C-151 and ANSI A21.10/AWWA C-110. Pipe class shall be 50 unless otherwise indicated on the Drawings.

C. Lateral Branches: To be tees of the same material as the main sewer and have an inside diameter the same as the existing service, but in no case less than 4 inches of granular material around the pipe, but with all other bedding and backfilling requirements remaining the same as for other pipe material.

2.03 JOINTS AND JOINTING MATERIALS

A. Polyvinyl Chloride (PVC) Pipe Joints: Joints for sewer plastic pipe shall meet all requirements of ASTM D3212 standard specifications. Joint design shall be tested and certified to result in no

leakage under prescribed laboratory test conditions of joint alignment, load conditions, pressure and vacuum, and deflection. Pipe and fittings shall have integral bell elastomeric seal joint.

B. Ductile Iron (DI) Pipe Joints: Shall be the slip-type single gasket joints conforming to requirements of ANSI, A21.11 and AWWA C-111. Ductile iron joints shall be rated for 150 psi operating pressure.

2.04 COMPRESSION COUPLINGS

A. When dissimilar pipe materials like PVC and concrete pipe are joined, compression couplings that are resistant to the corrosive action of soils and sewage and that will provide a permanent watertight joint. The compression couplings shall be of natural or synthetic rubber or rubber-like material and shall comply with the requirements and test methods specified in Table 2 of ASTM C425. The coupling shall meet the leak requirements specified in ASTM C425, and the bands for attaching the couplings to the dissimilar pipes shall be of stainless-steel meeting ASTM A167 or A240. Each coupling shall bear the manufacturer's identifying mark and an indication of its size.

PART 3 - EXECUTION

3.01 PIPE LAYING

A. Before placing sewer pipe in position in the trench, carefully prepare the bottom and sides of the trench, and install any necessary bracing and sheeting as provided in Section 31 23 16.13, Unclassified Excavation for Utilities.

B. Wherever necessary to provide a satisfactory bearing surface, place concrete cradles as shown on the drawings or as directed by the A/E. Cradles shall be of concrete with f'=4,000 psi, as defined by ACI standards, and shall conform to the dimensions shown on the detailed drawings. Concrete placed outside the dimensions shown shall be at the contractor's expense.

C. Tightly stretch a mason's line or wire above the ground level, parallel to and directly above the axis of the pipe to be installed; this line is to be supported at intervals of no more than 50 feet on sewers being laid on a grade of 2% or more and not exceeding 25 feet for grades of less than 2%. Determine the exact line and grade for each section of pipe by measuring down from this line to the invert of the pipe in place. Accurately place each pipe to the exact line and grade called for on the drawings. Furnish all labor and materials necessary for erecting batter boards. The use of laser beams will be allowed.

D. Lasers may be used after the type and procedures are approved by the A/E. When lasers are used, set reference points for both line and grade at each manhole or cleanout. Where grades are 0.6% or less, check the elevation of the beam each 100 feet with an offset point or engineer's level.

E. Do not allow water to run or stand in the trench while pipe laying is in progress, before the joint has completely set or before the trench has been backfilled. Do not at any time open up more trench than the available pumping facilities are able to dewater.

F. Correct trench bottoms found to be unsuitable for foundations after pipe laying operations have been started and bring them to exact line and grade with compacted earth as necessary.

G. Carefully inspect each piece of pipe and special fitting before it is placed and lay no defective pipe in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells upgrade. When pipe laying is not in progress, keep the ends of the pipe tightly closed with an approved temporary plug.

H. Bell holes shall be large enough to allow ample room for the pipe joint to be properly made. Do not cut out bell holes more than 2 joints ahead of pipe laying. Carefully grade the bottom of the trench between bell holes so that each pipe barrel will rest on a solid foundation for its entire length. Lay each pipe joint so as to form a close concentric joint with adjoining pipe and to avoid sudden offsets or inequalities in the flow line.

I. Before constructing or placing any joints, demonstrate to the owner's representative, by completing at least one sample joint, that the methods to be used conform to the specifications and will provide a watertight joint and further that the workmen to be involved in this phase of work are thoroughly familiar and experienced with the type of joint proposed.

J. No other type of joint may be used unless authorized in writing by the A/E.

K. New service laterals shall conform to the standard drawings.

L. As the work progresses, thoroughly clean the interior of the pipe in place. After each line of pipe has been laid, carefully inspect it and remove all earth, trash, rags and other foreign matter from its interior.

M. After the joints have been completed, they shall be inspected, tested and accepted by the owner's representative before being covered. The pipe shall meet the test requirements for water tightness; immediately repair any leak or defect discovered at any time after completion of the work. Any pipe that has been disturbed after joints were formed shall be taken up, the joints cleaned and remade, and the pipe re-laid at the contractor's expense. Carefully protect all pipe in place from damage until backfilling operations are completed.

N. Do not begin the backfilling of trenches until the pipe in place has been inspected and approved by the owner's representative.

O. Lay sewers at least 10 feet horizontally from any existing or proposed water main. If this is not practical, the sewer may be laid closer than 10 feet provided it is laid in a separate trench and the top of the sewer is at least 18 inches below the bottom of the water main.

P. Where a sewer crosses under water mains, the top of the sewer shall be at least 18 inches below the bottom of the water main. If the elevation of the sewer cannot be varied to meet the above requirements relocate the water main to provide this separation, or reconstruct it with mechanical joint ductile iron pipe for a distance of 10 feet on each side of the sewer with a full joint of the water main centered over the sewer.

Q. If it is impossible to obtain proper horizontal and vertical separation as stipulated above, construct both the water main and the sewer of mechanical joint ductile iron pipe and pressure test each.

R. Make connections to all existing sewer lines as shown on the drawings or as directed by the A/E.

S. Make connections to existing manholes or inlets by core drilling a hole in the wall of the existing structure, inserting a length of sewer pipe into the hole, filling around the pipe with concrete or mortar and troweling the inside and outside surfaces of the joint with a neat finish. Shape or reshape the bottom of the manholes as necessary to fit the invert of the sewer pipe.

T. Joint dissimilar pipe by using suitable compression couplings. If compression couplings are not available, make jointing with a special fabricated coupling approved by the A/E.

U. Provide concrete protection or concrete cap for pipe sewers that, when completed, have less than 3 feet of covering in non-traffic areas and 2 feet of covering in traffic areas. If such protection is not shown on the drawings, place it in accordance with the typical section shown.

V. Carefully protect from damage all existing sewers, water lines, gas lines, sidewalks, curbs, gutters, pavements, electrical lines and other utilities or structures in the vicinity of the work at all times. If it is necessary to repair, remove and/or replace any such utility or structure in order to complete the work properly, do so in compliance with the provisions set forth in other sections of these specifications. Any such work shall be considered incidental to the construction of pipe sewer and no additional payment will be allowed therefore.

W. Water service connections will be repaired or replaced by the contractor at his expense as an incidental part of the work. Water loss shall be paid for at the contractor's expense.

X. Service or house connections to existing sewers that are damaged or removed shall be repaired or replaced by the contractor at his own expense as an incidental part of the work.

Y. For PVC pipe, furnish a certificate from the pipe manufacturer indicating that the pipe meets all applicable requirements of these specifications.

Z. The minimum pipe stiffness for PVC pipe at 5% deflection shall be 46 for all sizes when tested in accordance with ASTM D2412; external loading properties of plastic pipe shall be by parallel plate loading.

AA. A specimen of PVC pipe 6 inches long shall be flattened between parallel plates in a suitable press until the distance between the plates is 40% of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is complete in 2 to 5 minutes.

BB. After being immersed for 2 hours in a sealed container of anhydrous acetone (99.5% pure), a sample ring of PVC shall show no visible spalling or cracking when tested in accordance with ASTM D2152 (swelling or softening is not considered a failure).

CC. When bypass pumping is required to ensure the completion of the replacement, inspection, testing and sealing work, for any unit(s) as determined by the owner's representative, the contractor shall furnish pumping equipment, conduit, etc. Conduct pumping operations from manhole to manhole and discharge no flow on the surface or in natural waterways.

3.02 TESTING OF GRAVITY SEWERS

A. Visual Tests:

1. Upon completion of the construction or earlier if the A/E deems advisable, the owner's representative will make a visual inspection of the sewer and const. site. Immediately repair all leaks and defects found by such inspection.
2. Sewers shall be built so as to remain true to line and grade. The inclining grade of the bottom of the sewer after completion shall be such that, after flooding, the floodwater drains off and no remaining puddle of water is deeper than ½ inch on pipe 36 inches internal diameter or smaller and ¾ inch on pipe larger than 36 inches. Any section of pipe that does not comply with the specifications at any time previous to final acceptance of the work shall be replaced or re-laid at the contractor's expense.
3. The contractor will be held strictly responsible that all parts of the work bear the load of the backfill. If cracks 1/100 inch develop in the pipe within one year from the date of final acceptance, the contractor will be required to replace all such cracked pipe at his expense.

B. Air Testing for Sewers 24 inches and Smaller:

1. Perform low-pressure air testing as follows:
   a. Furnish all equipment, facilities and personnel necessary to conduct the test. The test shall be observed by a representative of the owner.

b. Make the air test after all services have been installed and backfilling has been completed and compacted.
c. Perform the first series of air tests after 2,000 LF but before 4,000 LF of sewer has been laid. The purpose of this first series of tests is to assure both the contractor and the owner that the materials and method of installation meet the intent of these specifications. Conduct the remainder of the tests after approximately each 10,000 LF has been laid.
d. Plug all tees and ends of sewer services with flexible joint plugs or caps securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.
e. Prior to testing, check the pipe to see that it is clean. If not, clean it by passing a full-gauge squeegee through the pipe. It is the contractor's responsibility to clean the pipes.
f. Immediately follow this check or cleaning, test the pipe installation with low-pressure air. Supply the air slowly to the plugged pipe installation until the internal air pressure reaches 4.0 psi more than the average back pressure of any ground water that may submerge the pipe. Allow at least 2 minutes for temperature stabilization.
g. The pipeline shall be considered acceptable if the section under testing does not lose air at a rate greater than 0.0015 cfm per square foot in internal pipe surface area, when tested at an average pressure of 3.0 psi more than the average back pressure on any ground water that may submerge the pipe. Calculate the

pressure drop as the number of seconds for the air pressure to drop from a stabilized pressure of 3.5 to 2.5 psi more than the average back pressure of any ground water that may submerge the pipe. Calculate time as described in ASTM C828.
h. Allowable air loss values per 100 LF: Pipe size 6 inches = 42 seconds, pipe size 8 inches = 72 seconds.
i. If the pipe installation fails, the contractor shall determine at his own expense the source or sources of leakage and repair or replace all defective materials.

2. Recommended Procedures for Acceptance Tests:
   a. Clean pipe that is to be tested.
   b. Plug all pipe outlets with suitable plugs and brace securely.
   c. Increase gauge pressure in the test by the amount of ground water pressure at the crown of the pipe.
   d. Add air slowly to the portion of the pipe installation being tested until the internal air pressure is raised to 4.0 psi more than the average back pressure above the crown of the pipe.
   e. After the pressure is obtained, allow at least 2 minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
   f. Disconnect air supply after 2 minutes.
   g. When pressure decreases to 3.5 psig either by leaking down or by bleeding down with a release valve, start the stopwatch and determine the time (in seconds) that it takes to reach 2.5 psig. Compare this time interval as calculated above. If the time is more than that calculated, the pipe shall assume to be acceptable.
3. Plugs used to close the sewer pipe for the air test must be securely braced to prevent the unintentional release of a plug that could become a high velocity projectile. Locate gauges, air piping manifolds and valves at the top of the ground. No one shall be permitted to enter a manhole where a plugged pipe is under pressure. Four pounds air pressure (gauge) develops a force against the plug in a 12-inch pipe of approximately 450 pounds. Pipes more than 30 inches in diameter shall not be air tested because of

the difficulty of adequately blocking the plugs. Provide a safety release device set to release at 10 psi between the air supply and the sewer under test.

4. Regardless of the outcome of the tests, repair any noticeable leak.

3.03 VISUAL INSPECTION OF MISCELLANEOUS MATERIALS

A. All material used on this project will be visually inspected by the owner's representative at the site for conformance to the required specifications. When reasonable doubt exists that said material meets the specifications, the A/E may require certified mill tests, samples and/or tests by an independent laboratory or other suitable form of verification that the material meets the required specifications. The contractor shall pay for the testing lab.

3.04 DEFLECTION TESTING FOR PVC PIPE

A. Test deflection of the pipe by passing a 9-arm pin go/no-go mandrel sized to 95% of the pipe diameter of the actual pipe used with the pipe in place and covered. Make this acceptance test after backfill consolidation has occurred.

3.05 CLEANUP

A. After completing each section of sewer line, remove all debris, construction materials and equipment from the site of work. Grade and smooth over the surface on both sides of the line, leaving the entire right-of-way in a clean, neat and serviceable condition.

- END OF SECTION -