CITY OF SPRING HILL

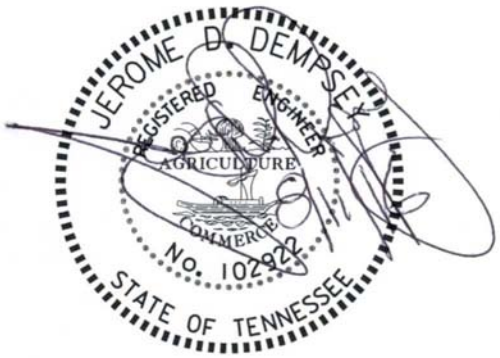
STANDARD SPECIFICATIONS FOR

WATER FACILITIES

SIA BEECHCROFT ROAD (SR247)

MAURY COUNTY

TDOT PIN #121394.00



INDEX TO PROJECT MANUAL

(WATER)

DIVISION 2:	**SITE WORK**	**PAGES**
02221	Unclassified Excavation for Utilities	10
02575	Pavement Repair	4
02640	Valves and Hydrants	5
02713	Water Lines	18
02725	Boring and Casing For Water Lines	3
DIVISION 3:	**SITE WORK**	
03303	Concrete for Utility Lines	1

SECTION 02221

UNCLASSIFIED EXCAVATION FOR UTILITIES

PART 1. GENERAL

1.1 The work called for by this section shall consist of clearing, grubbing and removal of any existing trees that may be in the alignment of the sewer line easement, loosening, loading, removing, and disposing of, in the specified manner, all wet and dry materials (including rock) encountered that must be removed for construction purposes; furnishing, placing, and maintaining all sheeting, shoring, bracing, and timbering necessary for the proper protection and safety of the work; the workmen, the public, and adjacent property and improvements; the dewatering of trenches and other excavations; the preparation of satisfactory pipe beds; the backfilling and tamping of trenches, foundations, and other structures; the preparation of fills and embankments; the removal of unsuitable material from outside the normal limits of excavation and, where ordered by the A/E, their replacement with suitable materials; and all other grading or excavation work incidental to or necessary for the work. This work shall be performed as specified below and shall be considered incidental to the project in which no extra pay item shall be allowed.

PART 2. PRODUCTS

Not Used.

PART 3. EXECUTIONS

3.1 PREPARATION OF THE SITE

A. Before starting construction, remove from the work site all vegetable growth (except as hereinafter excluded), debris, and/or other objectionable matter as well as any buildings and/or other structures that the drawings and/or the A/E specifically indicate are to be removed. Dispose of this refuse material in a manner acceptable to the A/E.

B. In certain areas it may be desirable for existing trees, shrubs, or other vegetation on the site to be preserved for the permanent landscape. Such vegetation may be shown on the drawings, specifically listed in the specifications, marked on the site, or identified by the A/E. In no case damage or remove such growth without written permission from the Owner.

C. If the area to be excavated is occupied by trees, brush, or other vegetable growth, clear such growth, grub the excavated area, and remove all large roots to a depth of not less than 2 feet below the bottom of the proposed construction. Dispose of the growth removed in a manner satisfactory to the A/E. Fill all holes or cavities created during this work that extend below the subgrade elevation with suitable material, and compact to the same density as the surrounding material.

D. Trees, cultivated shrubs, etc., that are situated within public rights-of-way and/or construction easements through private property but not directly within the excavation area shall remain undisturbed unless it is necessary to remove them so that the work can be performed safely and unless their removal is specifically ordered by the A/E. Take special precautions to protect and preserve such growth throughout all stages of the construction.

E. Preparation of the site shall be considered an integral part of the excavation and one for which no separate payment shall be allowed.

3.2 UNSUITABLE MATERIALS

A. Wherever muck, quicksand, soft clay, swampy ground, or other material unsuitable for foundations, subgrade, or backfilling is encountered, remove it and continue excavation until suitable material is encountered. The material removed shall be disposed of in the manner described below. Then refill the areas excavated for this reason with 1 inch to 2 inch lifts of crushed stone up to the level of the lines, grades, and/or cross sections shown on the drawings. The top 6 inches of this refill shall be No. 67 (TDOT) crushed stone for bedding.

3.3 ROCKS AND BOULDERS

A. Any material that is encountered within the limits of the required excavation that cannot be removed except by drilling and/or blasting, including rock, boulders, masonry, hard pan, chert, shale, street and sidewalk pavements, and/or similar materials, shall be considered as unclassified excavation, and no separate payment will be made therefore.

B. Should rock be encountered in the excavation, remove it by blasting or otherwise. Where blasts are made, cover the excavation with enough excavation material and/or timber or steel matting to prevent danger to life and property. The Contractor shall secure, at his own expense, all permits required by law for blasting operations and the additional hazard insurance required. Observe all applicable laws and ordinances pertaining to blasting operations.

C. Excavate rock over the horizontal limits of excavation and to a depth of not less than 6 inches below the bottom of pipe up to 30 inches in diameter and not less than 12 inches below the bottom of larger pipes if rock extends to such depth. Then backfill the space below grade with No. 67 (TDOT) crushed stone or other approved material, tamp to the proper grade, and make ready for construction. For monolithic concrete sewers and for structures, excavate rock to the outside bottom of the structure or sewer.

3.4 DISPOSAL OF MATERIALS

A. Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the drawings or directed by the A/E shall be used for these purposes. Any materials not so used shall be considered waste materials and disposed of by the Contractor as specified below.

B. Waste materials may be deposited in spoil areas at locations approved by the A/E. Do not leave in unsightly piles but instead spread in uniform layers, neatly level, and shape to drain. Seed as specified in Section 02485, Seeding.

C. Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of that work. Leave the surface of the work in a neat and workman like condition, as described below.

D. The disposal of waste materials shall be considered an integral part of the excavation work and one for which no separate payment shall be allowed.

3.5 EXCAVATION FOR TRENCHES, MANHOLES, AND STRUCTURES

A. Unclassified excavation for pipelines shall consist of the

excavation necessary for the construction of water, sewer, and other pipes and their appurtenances (including manholes, inlets, outlets, headwalls, check dams, collars, concrete saddles, and pipe protection) that are called for by the drawings. It shall include clearing and grubbing where necessary, backfilling and tamping pipe trenches and around structures, and disposing of waste materials, all of which shall conform to the applicable provisions set forth elsewhere in these specifications.

B. The Contractor may, if he chooses, use a motor powered trenching machine. If he does, however, he shall be fully responsible for the preservation or repair of existing utility service connections.

C. Unless the construction of lines by tunneling, jacking, or boring is called for by the drawings or specifically authorized by the A/E, make excavation for pipelines in open cut and true to the lines and grades shown on the drawings or established by the A/E on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed, but shall not be more than the distance determined by the following formula: 4/3d + 15 inches, where "d" represents the internal diameter of the pipe in inches. When approved in writing by the A/E, the banks of trenches from the ground surface down to a depth not closer than 1 foot above the top of the pipe may be excavated to non-vertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula 4/3d + 15 inches shall be at the expense of the Contractor and may be cause for the A/E to require that stronger pipe and/or a higher class of bedding be used at no cost to the Owner.

D. For rigid pipe, shape the bottom of all trenches to provide uniform bearing for the bottom of the pipe barrel. For plastic sewer lines, provide a minimum of 6 inches of No. 67 (TDOT) crushed stone for bedding.

E. Excavate bell holes for bell and spigot pipe at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes

shall be large enough to permit proper jointing of the pipe. Do not excavate bell holes more than 2 joints ahead of pipe laying.

F. Excavation for manholes, inlets, and other incidental structures shall not be greater in horizontal area than that required to allow a 2 foot clearance between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings. No earth backfilling will be permitted under manholes, inlets, headwalls, or similar structures. Should the Contractor excavate below the elevations shown or specified, he shall, at his own expense, fill the void with either concrete or granular material approved by the A/E.

G. Do not excavate pipe trenches more than 200 feet ahead of the pipe laying, and perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where the A/E deems necessary to maintain vehicular or pedestrian traffic.

H. In all cases where materials are deposited along open trenches, place them so that in the event of rain no damage will result to the work and/or to adjacent property.

I. Excavation for other structures may be performed with non-vertical banks except beneath pavements or adjoining existing improvements. Do not permit the horizontal area of the excavation to exceed that required to allow a 2 foot clearance between the outer surface of the structure and the banks of the excavation or the sheeting used to protect the embankments. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings.

3.6 SHEETING, SHORING, AND BRACING

A. Take special care to avoid damage wherever excavation is being done. Sufficiently sheet, shore, and brace the sides of all excavations to prevent slides, cave-ins, settlement, or movement of the banks and to maintain the specified trench widths. Use solid sheets in wet, saturated, or flowing ground. All sheeting, shoring, and bracing shall have enough strength and rigidity to withstand the pressures exerted, to keep the walls of the

excavation properly in place, and to protect all persons and property from injury or damage. Separate payment will not be made for sheeting, shoring, and bracing, which are considered an incidental part of the excavation work.

B. Wherever employees may be exposed to moving ground or cave-ins, shore and lay back exposed earth excavation surfaces more than 5 feet high to a stable slope, or else provide some equivalent means of protection. Effectively protect trenches less than 5 feet deep when examination of the ground indicates hazardous ground movement may be expected. Guard the walls and faces of all excavations in which employees are exposed to danger from moving ground by a shoring system, sloping of the ground, or some equivalent protection.

C. Comply with all OSHA standards in determining where and in what manner sheeting, shoring, and bracing are to be done. The sheeting, shoring, and bracing system shall be designed by a professional engineer licensed in the State of Tennessee and shall be subject to approval by the A/E. However, such approval does not relieve the Contractor of the sole responsibility for the safety of all employees, the effectiveness of the system, and any damages or injuries resulting from the lack or inadequacy of sheeting, shoring, and bracing.

D. Where excavations are made adjacent to existing buildings or structures or in paved streets or alleys, take particular care to sheet, shore, and brace the sides of the excavation so as to prevent any undermining of or settlement beneath such structures or pavement. Underpin adjacent structures wherever necessary, with the approval of the A/E.

E. Do not leave sheeting, shoring, or bracing materials in place unless this is called for by the drawings, ordered by the A/E, or deemed necessary or advisable for the safety or protection of the new or existing work or features. Remove these materials in such a manner that the new structure or any existing structures or property, whether public or private, will not be endangered or damaged and that cave-ins and slides are avoided.

F. Fill and compact all holes and voids left in the work by the removal of sheeting, shoring, or bracing as specified herein.

G. The Contractor may use a trench box, which is a pre-

fabricated movable trench shield composed of steel plates welded to a heavy steel frame. The trench box shall be designed to provide protection equal to or greater than that of an appropriate shoring system.

3.7 THE DEWATERING OF EXCAVATION

A. Provide and keep in operation enough suitable pumping equipment whenever necessary or whenever directed to do so by the A/E. The contractor shall make himself familiar with existing surface and groundwater conditions prior to submitting his bid as to determine the extent of dewatering equipment required to complete the project on within the contract time. No additional payments will be made by the owner for dewatering equipment and labor. Give special attention to excavations for those structures that, prior to proper backfilling, are subject to flotation from hydrostatic uplift.

3.8 BORROW EXCAVATION

A. Whenever the backfill of excavated areas or the placement of embankments requires more material than is available from authorized excavations, or whenever the backfill material from such excavations is unsuitable, then obtain additional material from other sources. This may require the opening of borrow pits at points accessible to the work. In such cases, make suitable arrangements with the property owner and pay all incidental costs, including any royalties, for the use of the borrowed material. Before a borrow pit is opened, the quality and suitability of its material shall be approved by the A/E. All state and local regulations concerning borrow pits, drainage and erosion control shall be strictly followed.

B. Excavate borrow pits in such a way that the remaining surfaces and slopes are reasonably smooth and that adequate drainage is provided over the entire area. Construct drainage ditches wherever necessary to provide outlets for water to the nearest natural channel, thus preventing the formation of pools in the pit area. Leave the sides of borrow pit cuts at a maximum slope of 2:1 unless otherwise directed by the A/E.

C. Properly clear and grub borrow pits, and remove all objectionable matter from the borrow pit material before placing it in the backfill.

D. The taking of materials from borrow pits for use in the

construction of backfill, fills, or embankments shall be considered an incidental part of the work; no separate payment shall be made for this.

3.9 BACKFILLING

A. Begin backfilling after the line construction is completed and then inspected and approved by the A/E. Trenches 10-feet deep or less shall contain a 6-inch stone envelope around the pipe. Trenches grater than 10-feet deep shall contain 6-inches of stone under the pipe and on each side with 12-inches of stone placed above the pipe.

B. Backfill material above the pipe envelopes shall consist either of fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone, and/or objectionable materials and that has a size of no more than 2-inches. Place this backfill simultaneously on either side of the trench in even layers that before compaction are no more than 6 inches deep. Thoroughly and completely tamp each layer into place before placing additional layers. When shown on the drawings, this backfill shall, at locations beneath or closely adjacent to pavement, consist of No. 67 (TDOT) crushed stone. Compaction of backfill material layers shall be at 98% by standard proctor test. Where adjacent to and within paved areas the top 12-inches of the trench at subgrade shall consist of crusher-run stone compacted at 98% by standard proctor test. Compaction testing shall be at intervals not greater than 500 feet along the trench and/or at spacing as directed by the site inspector.

C. From 1 foot above the pipe upward, the backfill material may contain broken stones that make up approximately 3/4 of the backfill's total volume. However, if this type of backfill is used, there must be enough spalls and earth materials to fill all voids completely. The maximum dimension of individual stones in such backfill shall not exceed 6 inches, and the backfill material shall be placed and spread in even layers not more than 12 inches deep. At locations beneath or closely adjacent to pavement or at locations of improvements subject to damage by displacement, tamp and thoroughly compact the backfill in layers that, before compaction, are 6 inches deep. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling

equipment from causing any damage to the pipe.

D. If earth material for backfill is, in the opinion of the A/E, too dry to allow thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material that the A/E considers too wet or otherwise unsuitable.

E. Wherever excavation has been made within easements across private property, the top 1 foot of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stone, and/or other objectionable materials.

F. Wherever trenches have been cut across or along existing pavement, temporarily pave the backfill of such trenches by placing Class A, Grade D, crushed stone as the top 12 inches of the backfill. Maintain this temporary pavement either until the permanent pavement is restored or until the project is accepted by the Owner. On heavily traveled roadways, cold mix or leveling course binder 2 inches thick shall be installed and maintained until permanent pavement is installed.

G. Conduct backfilling around manholes, inlets, outfalls, and/or structures in the same manner as specified above for pipelines except that even greater care is necessary to prevent damage to the utility structure.

H. Wherever pipes have diameters of 15 inches or less, do not use power operated tampers to tamp that portion of the backfill around the pipe within 1 foot above the pipe.

I. Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfill is being placed. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary, whenever directed to do so by the A/E.

J. Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the A/E's requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.

K. Compaction Requirements: Unless specified otherwise elsewhere, under buildings and 2 times the depth of pipe beyond, and under roads and 2 times the depth beyond the shoulder, compact to 95% maximum density in accordance with ASTM D698. In all other locations, compact to 90%

maximum density.

3.10 MAINTENANCE

A. Seed and maintain in good condition all excavated areas, trenches, fills, embankments, and channels until final acceptance by the Owner.

B. Maintain trench backfill at the approximate level of the original ground surface by periodically adding backfill material wherever necessary and whenever directed to do so by the A/E. Continue such maintenance until final acceptance of the project, or until the A/E issues a written release.

3.11 SLOPES

A. Neatly trim all open cut slopes, and finish to conform either with the slope lines shown on the drawings or the directions of the A/E. Leave the finished surfaces of bottom and sides in reasonably smooth and uniform planes like those normally obtainable with hand tools, though the Contractor will not be required to use hand methods if he is able to obtain the required degree of evenness with mechanical equipment. Conduct grading operations so that material is not removed or loosened beyond the required slope.

END OF SECTION

SECTION 02575

PAVEMENT REPAIR

PART 1. GENERAL

1.1 The work specified by this section shall consist of repairing or replacing all damaged pavement, whether public or private. Soil and gravel shoulders, roads, streets, drives, and walks are to be restored to their original condition as an incidental part of the installation of utilities. Repair damaged base on either side of a trench wherever necessary. Trim the oxidation surface to neat lines outside of the trench wall, and repave the entire area as specified below and as shown on the drawings or on the standard drawings.

1.2 Both these specifications and the drawings make reference to the current edition of the standard specifications of the Tennessee Department of Transportation (TDOT). Even though the weather limitations, construction methods, and materials specifications contained in the TDOT specifications may not be explicitly repeated in these specifications, they shall, wherever applicable to the work called for by this section, be considered as implied and therefore adhered to. However, the various subsections "Basis for Payment" contained in the TDOT specifications shall not be considered applicable.

A. Refer to other sections for work related to that covered by this section.

PART 2. PRODUCTS

2.1 MINERAL AGGREGATE BASE: Class A, Grading D crushed stone (TDOT specifications, Section 303, subsection 903.05)

2.2 BITUMINOUS PRIME COATS: cutback asphalt, Grade RC-250, or emulsified asphalt, Grade AE-P (Section 402, Subsections 904.02 and 904.03)

2.3 CRUSHED STONE CHIPS: Size 6 or Size 7 (Subsection 903.14)

2.4 DOUBLE BITUMINOUS SURFACE: for both courses, either cutback asphalt, Grade RC-800 or RC-3000, or emulsified asphalt, Grade RS-2 (Subsections 904.02 and 904.03)

2.5 ASPHALTIC CONCRETE BINDER: Grading B or C (Section 307).

2.6 BITUMINOUS TACK COAT: cutback asphalt, Grade RC-250, or emulsified asphalt, Grade SS-1 (Section 403, Subsections 904.02 and 904.03).

2.7 ASPHALTIC CONCRETE SURFACE: Grading “D” or “E” (Section 411) as approved by the City of Spring Hill.

2.8 PAVEMENT MARKINGS (WHITE AND YELLOW): Thermoplastic, Paint, Paint with Glass, Reflectors, Etc. Section 716.

PART 3. EXECUTION

3.1 SUBGRADE

A. Before any base material is installed, compact the subgrade of the area to be paved to 98% of optimum density as determined by ASTM D698 (Standard Proctor).

B. The backfill material shall contain no topsoil or organic matter. For all areas where subgrade has been prepared, test for uniformity of support by driving a loaded dump truck at a speed of 2 to 3 mph over the entire surface. Make further improvements on all areas that show a deflection. When completed, the finished subgrade shall be hard, smooth, stable, and constructed in reasonably close conformance with the lines and grades that existed prior to beginning construction.

C. When a base course is compacted, cut back the surface course of the existing pavement a minimum of 1 foot beyond the limit of the joint between the old and new base course or as shown on the standard drawings. Take special care to ensure good compaction of the new base course at the joint. Apply and compact the surface to conform to the existing pavement so that it will have no surface irregularity.

3.2 BASE

A. Install a mineral aggregate base of the type specified above in accordance with Section 303 of the TDOT specifications. The maximum compacted thickness of any one layer shall be 6 inches and the total thickness of the base shall be a minimum of 8-inches at trench repairs and 10-inches on new roadways or that indicated by the standard drawings or as shown on the plans.

3.3 BITUMINOUS PRIME COAT SURFACE

A. Uniformly apply a bituminous prime coat of either emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, over the entire width of the area to be surfaced at a rate of 0.3 gallon per square yard.

3.4 ASPHALTIC CONCRETE BINDER

A. Apply a bituminous prime coat of emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, at a rate of 0.30 gallons per square yard. Take care to prevent the bituminous material from splashing on exposed faces of curbs and gutters, walls, walks, trees, etc; if such splashing does occur, remove it immediately. After the prime coat has been properly cured, apply an asphaltic concrete binder layer to the thickness shown on the standard drawings or as specified by the City of Spring Hill.

B. Carefully place the material to avoid segregation of the mix. Broadcasting of the material will not be permitted. Remove any lumps that do not readily break down.

3.5 BITUMINOUS TACK COAT SURFACE

A. Uniformly apply a bituminous tack coat of either emulsified asphalt, Grade SS-1, or cutback asphalt, Grade RC-250, over the entire width of the area to be surfaced at a rate of 0.1 gallon per square yard.

3.6 ASPHALTIC CONCRETE SURFACE

A. When the surface course is to be placed on a binder course, then apply a bituminous tack coat of the sort specified above under at a rate of 0.10 gallon per square yard. Take care to prevent the bituminous material from splashing on exposed faces of curbs, gutters, walls, walks, trees, etc.; if such splashing does occur, remove it immediately. After the tack coat has been properly cured, apply the asphaltic concrete surface layer to the thickness shown of the drawings or as specified by the City of Spring Hill. Apply the surface course as described above for the binder course.

3.7 SMOOTHNESS

A. The finished surfaces shall conform to the lines and

grades that existed prior to construction. No deviations, variations, or irregularities exceeding 1/4 inch in any direction when tested with a 12 foot straightedge will be permitted in the finished work, nor will any depressions that will not drain. Correct all such defects in a manner approved by the City of Spring Hill.

3.8 SAMPLING AND TESTING

A. Submit to the City of Spring Hill test reports made by an independent testing laboratory on the crushed stone aggregate, bituminous materials, and asphaltic concrete design mixes, and obtain approval of these reports before starting paving operations.

B. Tests shall be made of the completed elements of the pavement to ascertain the compacted thickness of the base and surface courses. If sections with deficient thicknesses are found, the full section for a reasonable distance on each side of the deficiency shall be refused. Remove and reinstall all such sections. Patch all test holes in connection with thickness tests.

C. When making surface tests, furnish one man to mark all surface defects for corrections.

END OF SECTION

SECTION 02640

VALVES and HYDRANTS

PART 1. GENERAL

1.1 Refer to other sections for work related to that specified under this heading.

PART 2. PRODUCTS

2.1 VALVES

A. Valves on water lines ten inches and smaller shall be of double disc, parallel seat, iron body bronze mounted type or resilient wedge, iron body, iron gate with bond-in-place Nitrile elastomer designed to work equally well with pressure on either side of the gate. All gate valves shall be in accordance with or exceed AWWA C500. Working pressure shall be 200 psi.

B. Valves shall be supplied with O-ring seal stuffing boxes and shall open to the left. Valves ten inches and smaller shall be Mueller A2380-20, American Darling No. 55, Clow F-5065, or American Flow Control Series 2500, or equal, with mechanical joints.

C. Valves on water lines 12 inches and larger shall be butterfly valves, be designed for direct burial service, and meet or exceed performance requirements for water application of applicable standards such as AWWA C504. Valves shall be fitted with operators designed to accept Metro Valve Box "John Bouchard & Sons Company, No. 8006" valves shall open to the left.

D. Bodies shall be constructed of cast iron (ASTM A126, Class B) and shall have integrally cast mechanical joint ends in accordance with AWWA C111. Accessories (bolts, glands, and gaskets) shall be supplied by the valve manufacturer. Valves shall be steel body of molded-in vulcanized Buna-N bonded to the valve body.

E. Vane for the valve employing stainless steel body seat shall be of cast iron ASTM A48, Class 40, and have the rubber seat mechanically secured with an integral 18-8 stainless steel clamp ring and 18-8 stainless steel nylon locked seat not penetrated by the valve shaft. Vane for valves employing molded-in vulcanized, bonded Buna-N body seat shall be constructed of ASTM A436 Ni-Resist, Type I.

F. Valve shaft shall be of one piece extending full size through the valve disc. Stub shafts will not be acceptable for valve sizes 12" and smaller.

G. Valve operators shall be of the traveling nut type designed to withstand a minimum input torque at fully open or fully closed position of 300 foot-pounds without damage to the valve or operator. It shall be designed to resist submergence in water to a head pressure of 25 feet.

H. Valves shall be Dresser Manufacturing Company No. 450 butterfly valve, Henry Pratt Company "Groundhog," American Darling Class 150B, or equal.

I. All valve box castings shall be made accurately to the required dimensions, and shall be sound, smooth, clean and free from blisters and other defects. Defective casting which have been plugged or otherwise treated to remedy defects shall be rejected. Contact surfaces of frames and covers shall be machined so that the covers rest securely in the frames with no rocking and with the cover in contact with the frames for the entire perimeter of the contact surface. All castings shall be thoroughly cleaned subsequent to machining and before rusting begins, painted with a bituminous coating so as to present a smooth finish, tough and tenacious when cold, but not tacky with no tendency to scale. Install valve boxes on each proposed valve in accordance with the details shown on the standard drawings.

2.2. FIRE HYDRANTS

A. Fire hydrants shall comply in all respects with AWWA C502 and shall be of the compression type, with the main valve opening against the pressure and closing with the pressure. The main valve opening shall be not less than 4-1/2 inches in diameter. The main valve facing of the hydrant shall be made of balata or similar material especially suited and proven for the service intended. The bottom stem threads of the main valve rod shall be fitted with an acorn nut or suitable means for sealing the threads away from the water. Hydrants shall be connected to the main by a 6 inch mechanical joint shoe, unless otherwise shown on the drawings, and fitted with strapping lugs. Two 2-1/2 inch hoses and one 4-1/2 inch steamer nipple shall be threaded and screwed into the nozzle section and then pinned to prevent turning.

B. Operating nut shall be provided with convenient means to afford lubrication to ensure ease of operation and the prevention of wear and corrosion.

C. Hydrant shall be the dry barrel type, and hydrant shoe shall have two positive acting noncorrodible drain valves that drain the hydrant completely by opening as soon as the main valve is closed and by closing tightly when the main valve is open. Drain valves operated by springs or gravity will not be acceptable.

D. The packing gland located in the bonnet shall be solid bronze, and gland bolts shall be steel with bronze nuts. A double O-ring seal may be used in lieu of conventional stuffing box.

E. The hydrant shall open by being turned to the left and be so marked on the bonnet in cast letters with an arrow.

F. Threads on hose and steamer nipples, operating nut, and cap nuts shall conform to local Water Department standards.

G. Bury shall be as required for the installation, with the depth being measured from grade line to bottom of trench or connecting pipe.

H. Fire hydrant shall be white in color from manufacturer Mueller Centurion M & H or hydrant approved in system.

PART 3. EXECUTION

3.1 SETTING VALVES AND FITTINGS

A. General

1. Set valves, fittings, plugs, and caps and joint to pipe in the manner heretofore specified for cleaning, laying, and jointing pipe.

2. Megalugs are required on all fittings (valves, tees, reducers, hydrants, elbows, vertical and horizontal bends).

3. All water mains 10-inch and above must have a minimum of four (4) galvanized rods at all fittings. All water mains 8-inch and below must have a minimum of three (3) galvanized rods at all fittings.

B. Location of Valves

1. Valves in water mains shall, where possible, be located behind the concrete curb unless otherwise shown on the drawings. If unable to install behind curb the valve shall be installed within the roadway pavement and the water valve box be encased with a 2x2 concrete apron.

C. Valve Boxes and Valve Pits

1. Provide a valve box for every valve.

2. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished pavement or such other level as may be directed by the A/E.

3. Valve boxes shall be Metro Nashville Valve Box "John Bouchard & Sons No. 8006".

3.2 SETTING HYDRANTS

A. Location

1. Locate hydrants as shown on the drawings or as directed by the A/E and in a manner that will provide complete accessibility and also minimize the possibility of damage from vehicles or injury to pedestrians.

B. Position

1. All hydrants shall stand plumb. Set hydrants to the established grade, with nozzles at least 18 inches above the ground, as shown on the drawings or as directed by the A/E.

C. Connection to Main

1. Connect each hydrant to the main with a 6 inch ductile cast iron branch, as applicable, and a gate valve of the size indicated on the plans. The cost of the ductile cast iron branch shall be included in the unit price for the hydrant, where applicable.

D. Hydrant Drainage

1. Provide drainage at the base of the hydrant by placing coarse gravel or crushed stone from the bottom of the trench to at least 6 inches above the waste opening in the hydrant to a distance of 1 foot around the elbow. Connect no drainage system to a sewer.

E. Anchorage for Hydrants

1. Rod the gate valve ahead of each hydrant to the tee, and rod the hydrant from the gate valve. Brace the bowl of each hydrant well against unexcavated earth at the end of the trench with stone slabs or concrete blocking. Where rods cannot be used, metal harness may be used. Metal harness, steel rods, or clamps shall be galvanized or otherwise rustproof treated as approved by the A/E. Self restraining fittings may be allowed in conjunction with concrete thrust blocking.

END OF SECTION

SECTION 02713

WATER LINES

PART 1. GENERAL

1.1 Contractor shall be responsible for safely storing materials needed for the work that have been accepted by him until they have been incorporated into the completed project. Keep the interiors of all pipes, fittings, and other accessories free from dirt and foreign matter at all times.

1.2 Wherever reaction blocking is necessary, it shall be considered an integral part of the water line work, and no separate payment shall be made for it.

PART 2. PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

A. Ductile cast iron pipe shall be made of good quality ductile iron that meets the requirements for nodular iron castings of ASTM E8. It shall be plain end ductile iron pipe with push-on, single gasket joints. The design thickness shall be that specified by ANSI A21.50/AWWA C150 except that all pipe with a diameter of 12 inches or less shall have a wall thickness of 0.25 inches and all pipe with a diameter of 14 inches or more shall have a thickness of 0.28 inches or greater.

B. Ductile iron pipe shall be centrifugally cast in metal or sand-lined molds and shall conform to the specifications of ANSI A21.51/AWWA C151. It shall be made and tested in accordance with ASTM A339 and shall be subjected to and able to withstand a hydrostatic pressure of 500 psi. The maximum depth of pits shall be half that allowed in the AWWA specifications.

C. The length of each individual piece of ductile iron pipe shipped must be plainly marked on that piece of pipe.

D. The push-on, single gasket joints shall be either Fastite (manufactured by American Cast Iron Pipe Company), Tyton (U. S. Pipe and Foundry Company), Super Bell-Tite (Clow Corporation), or other joints of similar type and equal quality. They shall be UL approved and able to withstand 200 psi of operating pressure.

E. The bell of each pipe shall have a tapered annular opening and a cast or machined retaining groove for the gasket. The gasket groove shall have a flared design so that maximum deflection will be provided. The plain spigot end of the pipe shall be beveled in order to simplify its entry into and centering within the bell and the compression of the gasket.

F. The gasket shall be of high quality vulcanized rubber made in the form of a solid ring to exact dimensions. The design of the gasket groove in the bell of the pipe and the design, hardness, and other properties of the gasket itself shall be such that the joint is liquidtight for all pressures from a vacuum to a maximum rating of 350 psi of internal liquid pressure.

G. Enough lubricant shall be furnished with each order to provide a thin coat on the spigot end of each pipe. This lubricant shall be approved for being in contact with potable water and shall be nontoxic, impart no taste of smell to the water, and have no harmful effect on the rubber gasket. It shall have a consistency that will allow it to be easily applied to the pipe in either hot or cold weather and that will enable it to adhere to either wet or dry pipe. In no case shall lubricant other than that supplied by the pipe manufacturer be used.

H. Standard and special fittings shall be ductile iron. Use standard mechanical joint fittings. All fittings shall conform to the specifications of ANSI A21.10/AWWA C110.

I. Pipe and fittings shall be lined with enameline or a thin cement lining as specified in ANSI A21.4/AWWA C104. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately 1 mil thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices.

J. Fitting laying lengths shall conform to ANSI A21.10/AWWA C110, short body.

K. Fittings shall be in accordance with the standard mechanical joint fittings manufactured by the U.S. Pipe and Foundry Company, American Cast Iron Pipe Company, Clow Corporation, or equal.

L. The pipe manufacturer is to furnish the A/E a certificate of inspection, sworn to by the factory inspector in the presence of a notary public, stating that the pieces of

pipe in the shipment were made and tested in accordance with ANSI A21.51 and that they were subjected to and withstood a hydrostatic pressure of 500 psi. Each statement is to give the number of pieces of pipe in the shipment, the length of each piece of pipe, and the serial number of each piece of pipe making up the shipment. In addition, the weight of each individual piece of pipe making up the shipment is to be listed opposite the serial number of each pipe length and attached to the certificate of inspection.

2.2 PVC PIPE

A. All plastic pipe shall be made from Class 12454-B polyvinyl chloride plastic (PVC 1120) as defined by ASTM D1784.

B. All Class 200, 250, or 315 pipe shall have NSF approval and be manufactured in accordance with ASTM D2241. The following tests shall be run for each machine on each size and type of pipe being produced, as specified below:

1. Flattening Test: once per shift in accordance with ASTM D2412. Upon completion of the test, the specimen shall not be split, cracked, or broken.

2. Acetone Test (Extrusion Quality Test): once per shift in accordance with ASTM D2152. There shall be no flaking, peeling, cracking, or visible deterioration on the inside or outside surface after completion of the test.

3. Quick Burst Test: once per 24 hours in accordance with ASTM D1599.

SDR	Pressure Rating	Minimum Bursting Pressure, psi
13.5	315	1,200
17	250	1,000
21	200	800

4. Impact Tests: for 6 inches and larger, once per shift in accordance with ASTM D2444; for 4 inches and smaller, once each two hours in accordance with ASTM D2444.

5. Wall Thickness and Outside Dimensions Tests: once per hour in accordance with ASTM D2122.

6. Bell Dimension Test: once per hour in accordance with ASTM D3139.

C. If any specimen fails to meet any of the above mentioned tests, all pipe of that size and type manufactured between the test periods must be scrapped and a full set of tests rerun.

D. Furnish a certificate from the pipe manufacturer stating that he is fully competent to manufacture PVC pipe of uniform texture and strength and in full compliance with these specifications and further stating that he has manufactured such pipe and done so in sufficient quantities to be certain that it will meet all normal field conditions. In addition, the manufacturer's equipment and quality control facilities must be adequate to ensure that each extrusion of pipe is uniform in texture, dimensions, and strength. Also furnish a certificate from the manufacturer certifying that the pipe furnished for this project meets the requirements of these specifications.

E. All pipe shall be manufactured in the United States of America. All pipe for any one project shall be made by the same manufacturer.

F. All 6 inch pipe may be furnished in the manufacturer's standard laying lengths of 20 feet, 38 feet, or 40 feet. Pipe 8 inches and larger shall be furnished in 20 feet lengths. The Contractor's methods of storing and handling the pipe shall be approved by the A/E. All pipe shall be supported within 5 feet of each end; in between the end supports, there shall be additional supports at least every 15 feet. The pipe shall be stored away from heat or direct sunlight. The practice of stringing pipes out along the proposed water line routes will not be allowed.

G. Certain information shall be applied to each piece of pipe. At the least, this shall consist of:

1. Nominal size
2. Type of material
3. SDR or class
4. Manufacturer
5. NSF Seal of Approval

H. Pipe that fails to comply with the requirements set forth in these specifications shall be rejected.

I. The pipe shall have push-on joints designed with grooves in which continuous molded rubber ring gaskets can be placed. Gaskets shall be made of vulcanized natural or synthetic rubber; no reclaimed rubber will be allowed. Gasket materials shall meet the requirements of ASTM F477. The gaskets shall be of the manufacturer's standard design dimensions and of such size and shape as to provide a positive seal under all combinations of joint and gasket tolerance. The gasket and annular groove shall be designed and shaped so that when the joint is assembled, the gasket will be radially compressed to the pipe and locked in place against displacement, thus forming a positive seal.

J. The spigot end of each pipe shall be beveled so that it can be easily inserted into the gasket joint, which in turn shall be designed so that the spigot end may move in the socket as the pipe expands or contracts. The spigot end shall be striped to indicate the distance into which it is to be inserted into the socket. Each joint shall be able to accommodate the thermal expansions and contractions experienced with a temperature shift of at least 75 degrees F.

K. Enough lubricant shall be furnished with each order to provide a coat on the spigot end of each pipe. This lubricant shall be approved for being in contact with potable water and shall be nontoxic, impart no taste or smell to the water, have no harmful effect on the gasket or pipe material, and support or promote any bacterial growth. The lubricant containers shall be labeled with the manufacturer's name. In no case shall lubricant other than that supplied by the pipe manufacturer be used.

L. Joints shall be manufactured in accordance with ASTM D3139 except that the thickness of the bell shall be, as a minimum, equal to that of the barrel. Joints shall be either integral bell and ring joints with rubber compression gaskets as manufactured by the Clow Corporation, Johns-Manville, or Vulcan Plastic Corporation; twin gasket couplings as manufactured by the Certain-Teed Products Corporation; or equal. However, the pipe and bell must be made by the same manufacturer.

M. Standard and special fittings shall be gray iron or ductile iron. Use standard mechanical joint fittings. All fittings shall conform to the specifications of ANSI A21.10/AWWA C110. The gaskets shall be ducked tipped transition gaskets for use with PVC pipe.

N. Fittings shall be lines with enameline or a thin cement lining as specified in ANSI A21.4/AWWA C104. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately 1 mil thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices.

O. Fitting laying lengths shall conform to ANSI A21.10/AWWA C110.

P. Fittings shall be in accordance with the standard mechanical joint fittings manufactured by the U.S. Pipe and Foundry Company, American Cast Iron Pipe Company, Clow Corporation, or equal.

Q. All PVC pipe shall be installed within one year from the date of manufacture. Any PVC pipe that is older than one year shall not be installed and will be rejected.

PART 3. EXECUTION

3.1 INSTALLATION PROCEDURES

A. Verify on site storage location for pipe and supplies, with contractor, is adequate to allow accessibility for inspections.

B. Ensure all water fittings, hydrants, and other apparatus is stored off the ground to stay as clean as possible. Pipe shall not be strung out in the mud unless the ends of pipes are sealed.

C. Construction can only begin when approved plans from TDEC have been received and shop drawings have been submitted to the inspector.

D. Start of Construction Notice will be submitted to TDEC and to the City’s inspector before laying any water lines.

E. All water lines will be laid in accordance with City specifications and under daily inspections conducted by the City. The water line disinfection process will also be performed in accordance with the City’s Standard Water Specifications and verified by the City inspector.

F. Tracer wire (12 gauge) will be taped to the top of water lines and will be looped up into each valve box with enough slack to allow locating equipment to be attached.

G. Tracer tape will be installed, at a minimum of one foot, above the water line to locate when digging is required.

H. Chlorine will be used in water lines to disinfect in accordance with American Water Works Association (AWWA) guidelines. The contractor must follow AWWA Methods of Chlorination Section 4.4.2 "Placing of Calcium Hypochlorite Granules. During construction, Calcium Hypochlorite Granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-feet intervals. The quantity of granules shall be as shown in the following table.

65% HTH granules/powder Required for 24 hour detention time
New Construction

	Pipe Length									
Pipe Diameter	**100 ft** ounces	**200 ft** ounces	**300 ft** ounces	**400 ft** ounces	**500 ft** ounces	**600 ft** ounces	**700 ft** ounces	**800 ft** ounces	**900 ft** ounces	**1000 ft** ounces
4"	1	2	3	3	4	5	6	7	8	9
6"	2	4	6	8	10	11	13	15	17	19
8"	3	7	10	13	17	20	23	27	30	34
10"	5	11	16	21	26	32	37	42	47	53
12"	8	15	23	30	38	45	53	60	68	76
16"	13	27	40	54	67	80	94	107	121	134
18"	17	34	51	68	85	102	119	136	153	170
24"	30	60	91	121	151	181	211	242	272	302

Source: Table 1 AWWA C651-99, corrected from weight to volumetric using specific gravity = 0.8, then applying a 2.0 safety factor. All values have been rounded to the nearest ounce.

I. The end of lines will be plugged each time it is left unattended.

J. While the water line is being laid, it will be kept clean of soil and debris. Continually inspect pipes and valves for contaminants entering new lines and provide decontamination processes as approved by the inspector.

K. When the water line installation is finished, the line may be filled though a jumper, eliminating all air

Examples: Given segment is 8-inch at 659 ft Go into table at 8" and look at 700 ft (round up) - need 23 ounces for the entire segment. 659 ft/ 19.5 nominal joint lengths = 34 joints 34 joints/ 23 ounces= 1.5 joints per ounce which is 2 ounces per 3 joints OR 23ounces/ 34 joints = 0.675 ounces per joint which is 2 ounces per 3 joints

pockets, followed by pressure testing. Once the pressure test is completed and documented, the highly chlorinated water will be flushed from the new water line until the residual chlorine level is in range of existing systems. The set of bacteriological samples are to be pulled 48 hours after flushing the highly chlorinated water from the water line. Samples will be collected at approximately 2,500 feet intervals, with samples near the beginning point, ending point and each branch.

L. In accordance with AWWA standards, new water lines will not be connected to the existing distribution system until item 11 (above) has been completed and documented. When the new water line has a negative reading on the bacteriological test, the line may be connected to the existing distribution system. If the bacteriological sample is positive, the new water line must be re-chlorinated. A chlorine reading will be taken after re-chlorinating the water line to determine how much chlorine residual is in the line and then flushing must be repeated before the second set of bacteriological samples are to be pulled. If the second set of bacteriological samples read positive then the new main must be re-chlorinated and a third set of bacteriological samples are to be pulled. Once the connection is completed and additional bacteriological samples are determined to be negative, the water line will be flushed and put into service.

M. Inform the water plant supervisor the line is on service to add to their sampling sites. Also inform the Fire Department and GIS Department locator in order to add the hydrants and valves to the system.

3.2 INSTALLATION OF WATER LINES

A. Lay water lines to and maintain at the lines and grades required by the drawings. All fittings, valves, and hydrants shall be at the required locations, the spigots centered in the bells, and all valves and hydrant stems plumb.

B. Unless otherwise indicated by the drawings, all water pipes shall have at least 30 inches of cover. No departure from this policy shall be made except with the approval of the A/E.

C. Provide and use tools and facilities that are satisfactory to the A/E and that will allow the work to be done in a safe and convenient manner. All pipe, fittings, valves,

and hydrants are to be unloaded from the trucks using suitable tools and equipment. Use a derrick, ropes, or other suitable tools or equipment to lower all pipe, fittings, valves, and hydrants into the trench one piece at a time. Lower each piece carefully so that neither it nor any protective coating or lining it may have will be damaged. Under no circumstances drop or dump water line materials into the trench.

D. Any pipes strung out along the route of the proposed lines before the actual installation of those lines is due to take place shall not be lowered into the trench until they have been swabbed to remove any mud, debris, etc., that may have accumulated within them. PVC pipe shall be strung out a maximum of one day ahead of pipe laying. Remove all unnecessary material from the bell and spigot end of each pipe. Before any pipe is laid, brush and wipe clean the outside of its spigot end and the inside of its bell, and leave dry and oil-free.

E. Take every precaution to keep foreign material from getting into the pipe while it is being placed in the line. If the crew laying the pipe cannot put it into the trench and in place without allowing earth to get inside, then put a heavy, tightly woven canvas bag of suitable size over each end of the pipe, and leave in place until it is time to connect that pipe to the one adjacent to it.

F. Place no debris, tools, clothing, or other materials in the pipe during laying operations.

G. After a length of pipe has been placed in the trench, center the spigot end in the bell of the adjacent pipe, and then insert to the depth specified by the manufacturer and bring to the correct line and grade. Secure the pipe in place by tamping an approved backfill material around it.

H. Bell holes shall be big enough so that there is ample room for the pipe joints to be properly made. Between bell holes, carefully grade the bottom of the trench so that each pipe barrel will rest on a solid foundation for its entire length.

I. Whenever pipe laying is not in progress, close the open ends of pipe either with a watertight plug or by other means approved by the A/E. If the joints of any pipe in the trench cannot be completed until a later time, caulk them with packing in order to make them as watertight as possible; this shall be done not only at the end of each

working day but also before work is stopped for lunch periods, bad weather, or any other reason. If there is water in a trench, leave this seal in place until the trench has been pumped completely dry.

J. Cut pipe so that valves, fittings, or closure pieces can be inserted in a neat and workmanlike manner and without any damage to the pipe. Follow the manufacturer's recommendations concerning how to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipe's axis.

K. Lay pipe with the bell ends facing in the direction of laying unless otherwise directed by the A/E.

L. Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions or plumb stems, or wherever long radius curves are permitted, the amount of deflection shall not exceed that necessary for the joint to be satisfactorily made, nor that recommended by the pipe manufacturer, and shall be approved by the A/E.

M. Lay no pipe in water or when it is the A/E's opinion that trench conditions are unsuitable. If crushed stone is used to improve trench conditions or as backfill for bedding the pipe, its use is considered incidental to the project, and no separate payment will be made for its use.

N. Where a water line crosses over a sanitary sewer, use a full joint of pipe with a standard mechanical joint, and center over the sewer. Where a water line is to be parallel to a sanitary or storm sewer, lay it at least 10 feet from the sewer. If it is not practical for the water and sewer lines to be separated as described above, then lay the water line at least 18 inches above the top of the sewer.

O. Joint all pipe in the exact manner specified by the manufacturer of the pipe and jointing materials.

P. For detection purposes, a 12 gauge solid strand copper tracing wire (shielded) will be taped to the top of the new water line. Connections between wires shall be soldered or connected with wire nut fasteners and wrapped. An approved metallic tape identified as "water" shall be installed as per the manufacturer’s instructions. Tracer tape will be installed, at a minimum of one foot, above the water line to locate when digging is required.

3.3 HYDROSTATIC TESTS

A. Pressure Test

1. After pipe has been laid and backfilled as specified above, subject all newly laid pipe or any valved section thereof to a pressure of 200 psi. All services are to be laid prior to testing the main and tested as part of the test of the main.

2. The duration of each pressure test shall be at least one hour.

3. Slowly fill each valved section of pipe with water, and apply the specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) with a pump connected to the pipe in a manner satisfactory to the A/E. Furnish the pump, pipe, connections, gauges, and all necessary apparatus.

4. Before applying the specified test pressure, expel all air from the pipe. If hydrants or blowoffs are not available at high places, make the necessary taps at the points of highest elevation before testing, and insert plugs after the test has been completed.

5. Carefully examine all exposed pipes, fittings, valves, and hydrants during the test. Remove any cracked or defective pipes, fittings, valves, or hydrants discovered in consequence of this pressure test, and replace with sound material in the manner specified. Repeat the test until the results are satisfactory to the A/E.

B. Leakage Test

1. Conduct the leakage test after the pressure test has been satisfactorily completed. Furnish the pump, pipe, connections, gauges, measuring devices, and all other necessary apparatus as well as all necessary assistance to conduct the test.

2. The duration of each leakage test shall be two hours; during the test, subject the main to a pressure of 150 psi.

3. Leakage is defined as the amount of water which must be supplied to the newly laid pipe or any valved section in order to maintain the specified leakage

test pressure after the pipe has been filled with water and the air expelled.

4. No pipe installation will be accepted until the leakage is less than the number of gallons per two hour period listed below:

Pipe Sizes	Gallons per 1,000 Feet of Pipe
6 inches	0.9
8 inches	1.2
10 inches	1.5
12 inches	1.9
14 inches	2.2
16 inches	2.6
18 inches	2.9
20 inches	3.2
24 inches	3.8

5. Should any test of pipe laid disclosure leakage greater that specified, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

3.4 DISINFECTION

A. During construction, take precautions to protect pipe interiors, fittings, and valves against contamination. When pipe laying is not in progress (e.g., at the end of the day's work), place watertight plugs in the ends of all pipe already in the trench; if water accumulates in the trench, leave the plugs in place until the trench is dry. Complete the joints of all pipe in the trench before stopping work for any reason.

B. If dirt or other foreign material that has gotten into a pipe will not, in the opinion of the A/E, be removed by flushing, clean the interior of the pipe, and swab with a disinfecting solution of 5% hypochlorite.

C. Make water flow from the existing distribution system or some other source approved by the A/E into the newly laid pipeline, and add chlorine to it. Feed water into the pipe, and chlorine into the water, at constant, measured rates so proportioned that the chlorine concentration in the water in the pipe is kept at a minimum of 50 mg/l available chlorine. To ensure that this concentration is

maintained, measure the chlorine residual at regular intervals.

D. Table I shows how much chlorine is needed for each 100 feet of line for pipes of various diameters. A 1% chlorine solution may be prepared either with 1 pound of calcium hypochlorite for each 8.5 gallons of water or with sodium hypochlorite.

TABLE I

CHLORINE REQUIRED TO PRODUCE A 50 MG/L CONCENTRATION IN 100 FEET OF PIPE, BY DIAMETER

Pipe Size (Inches)	100% Chlorine (Pounds)	1% Chlorine Solutions (Gallons)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88
14	0.328	3.96
16	0.428	5.12
18	0.540	6.48
20	0.680	8.00
24	0.980	11.52

E. While the chlorine is being applied, manipulate valves so that the treatment dosage will not flow back into the line that is supplying the water. Continue the application of chlorine until the entire line being treated is filled with the chlorine solution. Then retain the chlorinated water in the line for at least 24 hours, during which time all valves and hydrants in the line being treated shall be operated so that appurtenances can also be disinfected. After 24 hours, the treated water shall have a chlorine concentration of at least 25 mg/l throughout the line.

F. After the applicable retention period, flush the heavily chlorinated water from the line until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 mg/l. Perform such flushing only at sites where there is adequate drainage.

G. The velocity of the water used to flush a line shall be at least 2.5 fps. The flow rates required to produce this velocity in various sizes of pipe are shown in Table II.

TABLE II

REQUIRED OPENINGS TO FLUSH PIPELINES
(40 PSI RESIDUAL PRESSURE)

Pipe Size (Inches)	Flow Required to Produce 2.5 fps Velocity (gpm)	Orifice Size (Inches)	Hydrant Outlet Nozzles	
			Number	Size (Inches)
4	100	15/16	1	2-1/2
6	220	1-3/8	1	2-1/2
8	390	1-7/8	1	2-1/2
10	610	2-5/16	1	2-1/2
12	880	2-13/16	1	2-1/2
14	1,200	3-1/42	2	2-1/2
16	1,565	3-5/8	2	2-1/2
18	1,980	4-3/16	2	2-1/2
20	2,440	---	2	2-1/2
24	3,470	---	2	2-1/2

H. Once a line has been flushed, test to make certain that the residual chlorine in the water is within acceptable limits.

I. It must be noted that flushing is no substitute for taking preventative measures before and during the laying of water lines. Certain contaminants especially those in caked deposits are difficult or even impossible to remove by flushing, no matter how high the velocity. Furthermore, in pipes with diameters of 16 inches or more, it can be difficult to achieve even the minimum recommended flushing velocity of 2.5 fps.

3.5 WATER LINE REPAIR PROCEDURES

We recognize that chlorine is an effective disinfectant for only some of the contaminants that may enter a line during a leak.

Chlorine is ineffective for chemicals and cryptosporidium and many other possible contaminants.

Therefore the primary concern during repairs will be to maintain the integrity of the line. This will be accomplished by

1. Valve off the line downstream from leak.

2. Reduce the flow upstream from the leak but allow enough flow to maintain a positive pressure at the leak site.

3. Cover shall be removed from the line at the leak and a hole approximately 18” lower than the line shall be drug. Excess water shall be pumped or dipped from the hole until all cover is removed from the pipe at the leak.

4. If the leak can be repaired with a full circle clamp, repair will be made the line will be flush and service restored. No further action will be taken.

5. If the line will have to be cut and section replaced, the following actions will be taken.

6. Upstream valve will be closed and excess water will continue to be pumped from the leak site and all cover will be removed from pipe at least 18” in both directions from the cut sites on pipe.

7. The customer’s service will be cut off to protect from contaminants.

8. A 1% hypochlorite solution will be prepared by adding 2 oz. of 65% HTH to 1 gallon of water.

9. The surrounding area will be checked for signs of broken sewer or septic lines and animal waste. If present, special care must be taken and some of the 1% hypochlorite solution should be scattered around the work site.

10. Work can now proceed with the cutting of the pipe. Once the defective section is removed, both ends of the remaining pipe should be checked and any debris from pipe cuttings or other sources should be removed.

11. The new section of pipe and both ends of the remaining pipe should be swabbed with the 1% hypochlorite solution and repairs completed.

12. Upstream valve will be opened and the nearest hydrant down stream of line leak will be flushed vigorously at a velocity of at least 2 ft. per second. Highly chlorinated water should be de-chlorinated. To determine how long to flush a line divided the estimated distance (feet) between the upstream valve and the nearest flushing site by two. Example (if the flushing point is 3000 ft. from the leak site the line should be flushed a minimum of 1500 sec. or 25 minutes.) Flushing shall continue until chlorine residual readings are equal at the flushing site and at a site upstream from the repaired line. In addition, flushing shall continue until turbid water is no longer visible at the flushing site. These steps will be taken on the downstream valve as the upstream valve.

13. After the line is flushed at least one bacteria sample shall be obtained immediately prior to service being restored. This sample shall be coded as type “D.” If the sample is negative no further action is required other than to properly and fully document the repaired event and procedures. If the sample is positive, then the original positive site will be resampled and 3 repeat samples will be obtained in the downstream area of the repair and from customer taps within 24 hours of notification of the positive sample. The original site will be coded as “R” and each of the three downstream samples, and will be coded as “R”, repeat distribution samples, and will be counted as compliance samples

14. If all 4 samples are negative, no further action will be taken. If the sample from the original site is positive and the other 3 are negative, the system may ask the state to invalidate the sample as site specific due to a contaminated tap and no further action will be required. If any of the downstream samples are positive, normal repeat sample monitoring procedures become effective. If any repeat sample is fecal coliform positive or E-coli positive or if the repeat sample following an initial positive fecal coliform or E-coli sample is total coliform positive, the system will issue a Tier-1 Boil Water Notice.

15. If it is suspected that the line may have had contaminants enter the line, slug disinfection shall be employed to disinfect the line. The line shall be slug disinfected from closed valve to closed valve. Slug disinfection consists of putting HTH in a line, completely filling the line with water and slowly flowing the slug of water through the line. The slug should contain about 100ppm free chlorine and flow rates adjusted to keep the chlorine in contact with the line for about three hours. Chlorine will be added to the line in addition to all of the above procedures. Chlorine doses needed

per 1000 feet of pipe: 2″ pipe 1oz. of 65% HTH, 4″ pipe 4oz. of HTH, 6″ pipe 8oz. of HTH, 8″ pipe 16oz. of HTH will produce about 25 ppm free chlorine. If the suspected contaminant is not affected by chlorine, alternative measures must be employed to remove the contamination.

16. Service line of one-inch diameter or less will not have any samples taken or additional disinfectant added. The leak will be clamped off to prevent any contaminant from entering the main line. The service line will be flushed and chlorine residual will be taken. Line larger than one-inch in diameter will be treated as a water main.

17. For any repair procedure, detailed records of the repair must be prepared documenting the procedure utilized, disinfection information, contact time, dose calculations, bacteriological sample time and location. Bacteriological sample results shall be attached to corresponding repair records.

3.6 BACTERIOLOGICAL TESTS

A. After a water line has undergone final flushing but before it is placed into service, collect a sample for bacteriological testing from the end of that line. In the case of extremely long lines, take additional samples if the engineer or inspector so directs.

B. Collect these samples in sterile bottles treated with sodium thiosulfate. Do not use a hose or fire hydrant to collect samples. One suggested sampling method is to install a standard corporation cock in the line with a copper tube gooseneck assembly; after the samples have been taken, the gooseneck assembly can be removed and retained for later use.

C. Take the samples collected to an approved laboratory to be tested for bacteriological quality in order to determine if they contain any coliform organisms. If the initial disinfection fails to produce satisfactory samples, repeat disinfection until satisfactory samples are obtained.

D. When the samples tested are found to be satisfactory, the water line may be placed in service.

3.7 DISINFECTION PROCEDURE AFTER CUTTING INTO OR REPAIRING EXISTING LINES

A. The procedures outlined above apply primarily to cases in which the lines are wholly or partially dewatered.

B. However, leaks or breaks that are repaired with clamping devices while the lines remain full of water under pressure present little danger of contamination and require no disinfection.

C. When an existing line is opened, whether by accident or design, the excavated area could be wet and contaminated because of the presence of sewers nearby. The danger of contamination from such pollution can be lessened if liberal quantities of hypochlorite are applied to the open trenches. It is better to use tablets for disinfection in such cases because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation site.

D. Where practical, treat the lines by the slug method in accordance with ANSI / AWWA C651.

E. The following disinfection procedure is considered the minimum that may be used when existing lines are repaired:

1. Swab the interior of all pipes and fittings (particularly couplings and tapping sleeves) that are to be used in repairing an existing line with a solution of 5% hypochlorite before installing them.

2. The most practical means of removing contamination introduced into a line during repairs is to give the line a thorough flushing. If the locations of valves and hydrants make it possible, flushing in both directions is recommended. Start flushing as soon as repairs are completed, and continue until all discolored water is eliminated.

3.8 CLEANUP

A. After completing each section of water line, remove all debris and all construction materials from the work site. Then grade and smooth over the surface of both sides of the line. Leave the entire area clean and in a condition satisfactory to the A/E.

END OF SECTION

SECTION 02725

BORING AND CASING FOR WATER LINES

PART 1. GENERAL

1.1 The work to be performed hereunder shall consist of the installation of casing pipe and carrier pipe for water lines as shown on the drawings or as called for in these specifications. For the open cut casing pipes, it shall include the excavation of the trench, placing proper bedding material, furnishing and installing the casing pipe, furnishing and installing the carrier pipe, backfilling, and disposing of the excess excavated materials. For the boring and jacking of casing pipes, it shall include the excavation of a boring pit, auger boring between the point as specified on the drawings, furnishing and installing of the carrier pipe, and disposing of the excavated materials in the manner herein provided.

PART 2. PRODUCTS

2.1 CASING PIPE

A. The casing pipe shall be of steel meeting the latest approved American Railway Engineering Association "Specifications" for Pipelines for Carrying Flammable and Nonflammable Substances." The steel casing pipe shall have a minimum yield strength of 35,000 PSI and shall have the minimum wall thickness shown in the following table:

TABLE OF MINIMUM WALL THICKNESS FOR STEEL CASING PIPE FOR E72 LOADING

Carrier Pipe Diameter	Casing Pipe Diameter	Nominal Thickness
6 inches	12 inches	0.250 inches
8 inches	16 inches	0.312 inches
10 inches	20 inches	0.312 inches
12 inches	22 inches	0.312 inches
14 inches	24 inches	0.344 inches
16 inches	26 inches	0.375 inches
18 inches	28 inches	0.406 inches

B. When the casing pipe is installed without benefit of a protective coating, the wall thickness shown above shall be increased to the nearest standard size, which is a minimum of 0.063 inches greater than the thickness shown.

2.2 CARRIER PIPE: The carrier pipe shall be PVC, SDR 21, unless otherwise noted on the drawings.

PART 3. EXECUTION

3.1 BORING

A. The boring shall be accomplished by means of auguring to the size, line and grade shown on the drawings.

3.2 INSTALLATION OF CASING PIPE

A. For open cut of casing pipes, install the steel casing pipe into the open cut as the trench excavation proceeds. Weld sections of casing pipe together to provide watertight joints, and replace the protective coatings in areas where it is damaged by welding.

B. For boring casing pipes, jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide watertight joints.

C. Do not remove unacceptable casing without prior approval from the A/E. If the removal of casing pipe is permitted, make proper provisions to prevent caving in of the earth surrounding the casing.

3.3 INSTALLATION OF CARRIER PIPE

A. The carrier pipe shall be furnished by the Contractor. Upon acceptance of the casing, install the carrier pipe in the casing by jacking it through the casing. In order to achieve proper line and grade on the carrier pipe, install pipe spacers to the carrier pipe to offset any minor variations in the alignment of the casing and to secure the pipe within the casing.

3.4 LAYOUT OF WORK

A. The Owner will provide the necessary control points required by the Contractor for this construction. The Contractor will provide the detailed layout required to keep the excavation and pipe installation on grade.

4. GUARANTEE OF WORK

4.1 Guarantee a usable completed casing between the points specified and to the line and grade specified. The allowable tolerance at the downstream end point of the casing shall be such that the invert of the carrier pipe may be positioned within a vertical area limited on the top by an elevation no higher than the elevation shown on the drawings and on the bottom by an elevation no lower than the existing inlet pipe invert.

4.2 The allowable tolerance at the upstream end point of the casing shall be such that the invert of the carrier pipe may be positioned at the elevation shown on the drawings.

END OF SECTION

SECTION 03303

CONCRETE FOR UTILITY LINES

PART 1. GENERAL

1.1 This item shall include furnishing and installing concrete blocking, cradles, anchors, caps, pipe protection, and/or encasement at the locations shown on the drawings and/or directed by Spring Hill's representative.

PART 2. PRODUCTS

Not used.

PART 3. EXECUTION

3.1 Concrete work shall conform to ACI 301-72 (as revised), as modified by the supplemental requirements below:

A. Strength

1. The strength of concrete shall be 3,000 psi unless otherwise shown on the drawings.

B. Durability

1. All concrete exposed to weather shall be air entrained.

C. Slump

1. Concrete shall be proportional and produced to have a slump of 3 inches with a 1 inch tolerance.

D. Admixtures

1. Air entrainment, mandatory for concrete exposed to weather, may be used. A water reducing admixture (retarding, normal, or accelerating, depending on placing temperature), may be used if approved by the Spring Hill's representative.

E. Reinforcing Steel

1. Yield strength of reinforcing steel shall be 60,000 psi.

END OF SECTION

CITY OF SPRING HILL

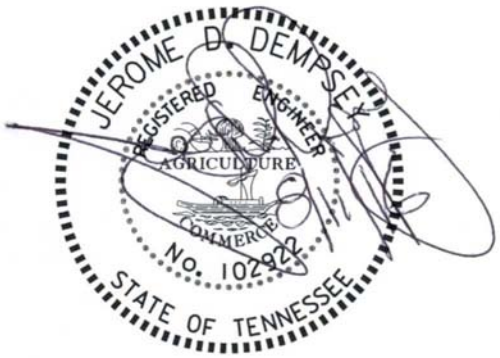
STANDARD SPECIFICATIONS FOR

SEWER FACILITIES

SIA BEECHCROFT ROAD (SR247)

MAURY COUNTY

TDOT PIN #121394.00



INDEX TO PROJECT MANUAL

(SEWER)

DIVISION 2:	**SITE WORK**	**PAGES**
02221	Unclassified Excavation for Utilities	10
02575	Pavement Repair	4
02600	Manholes	5
02722	Sanitary Sewers	12
02724	Sewage Force Main	9
02725	Boring and Casing For Sanitary Sewers	3
DIVISION 3:	**SITE WORK**	
03303	Concrete for Utility Lines	1
DIVISION 13:	**SPECIAL CONSTRUCTION**	
13514	Television Inspection	2

SECTION 02221

UNCLASSIFIED EXCAVATION FOR UTILITIES

PART 1. GENERAL

1.1 The work called for by this section shall consist of clearing, grubbing and removal of any existing trees that may be in the alignment of the sewer line easement, loosening, loading, removing, and disposing of, in the specified manner, all wet and dry materials (including rock) encountered that must be removed for construction purposes; furnishing, placing, and maintaining all sheeting, shoring, bracing, and timbering necessary for the proper protection and safety of the work; the workmen, the public, and adjacent property and improvements; the dewatering of trenches and other excavations; the preparation of satisfactory pipe beds; the backfilling and tamping of trenches, foundations, and other structures; the preparation of fills and embankments; the removal of unsuitable material from outside the normal limits of excavation and, where ordered by the A/E, their replacement with suitable materials; and all other grading or excavation work incidental to or necessary for the work. This work shall be performed as specified below and shall be considered incidental to the project in which no extra pay item shall be allowed.

PART 2. PRODUCTS

Not Used.

PART 3. EXECUTIONS

3.1 PREPARATION OF THE SITE

A. Before starting construction, remove from the work site all vegetable growth (except as hereinafter excluded), debris, and/or other objectionable matter as well as any buildings and/or other structures that the drawings and/or the A/E specifically indicate are to be removed. Dispose of this refuse material in a manner acceptable to the A/E.

B. In certain areas it may be desirable for existing trees, shrubs, or other vegetation on the site to be preserved for the permanent landscape. Such vegetation may be shown on the drawings, specifically listed in the specifications, marked on the site, or identified by the A/E. In no case damage or remove such growth without written permission from the Owner.

C. If the area to be excavated is occupied by trees, brush, or other vegetable growth, clear such growth, grub the excavated area, and remove all large roots to a depth of not less than 2 feet below the bottom of the proposed construction. Dispose of the growth removed in a manner satisfactory to the A/E. Fill all holes or cavities created during this work that extend below the subgrade elevation with suitable material, and compact to the same density as the surrounding material.

D. Trees, cultivated shrubs, etc., that are situated within public rights-of-way and/or construction easements through private property but not directly within the excavation area shall remain undisturbed unless it is necessary to remove them so that the work can be performed safely and unless their removal is specifically ordered by the A/E. Take special precautions to protect and preserve such growth throughout all stages of the construction.

E. Preparation of the site shall be considered an integral part of the excavation and one for which no separate payment shall be allowed.

3.2 UNSUITABLE MATERIALS

A. Wherever muck, quicksand, soft clay, swampy ground, or other material unsuitable for foundations, subgrade, or backfilling is encountered, remove it and continue excavation until suitable material is encountered. The material removed shall be disposed of in the manner described below. Then refill the areas excavated for this reason with 1 inch to 2 inch lifts of crushed stone up to the level of the lines, grades, and/or cross sections shown on the drawings. The top 6 inches of this refill shall be No. 67 (TDOT) crushed stone for bedding.

3.3 ROCKS AND BOULDERS

A. Any material that is encountered within the limits of the required excavation that cannot be removed except by drilling and/or blasting, including rock, boulders, masonry, hard pan, chert, shale, street and sidewalk pavements, and/or similar materials, shall be considered as unclassified excavation, and no separate payment will be made therefore.

B. Should rock be encountered in the excavation, remove it by blasting or otherwise. Where blasts are made, cover the excavation with enough excavation material and/or timber or steel matting to prevent danger to life and property. The Contractor shall secure, at his own expense, all permits required by law for blasting operations and the additional hazard insurance required. Observe all applicable laws and ordinances pertaining to blasting operations.

C. Excavate rock over the horizontal limits of excavation and to a depth of not less than 6 inches below the bottom of pipe up to 30 inches in diameter and not less than 12 inches below the bottom of larger pipes if rock extends to such depth. Then backfill the space below grade with No. 67 (TDOT) crushed stone or other approved material, tamp to the proper grade, and make ready for construction. For monolithic concrete sewers and for structures, excavate rock to the outside bottom of the structure or sewer.

3.4 DISPOSAL OF MATERIALS

A. Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the drawings or directed by the A/E shall be used for these purposes. Any materials not so used shall be considered waste materials and disposed of by the Contractor as specified below.

B. Waste materials may be deposited in spoil areas at locations approved by the A/E. Do not leave in unsightly piles but instead spread in uniform layers, neatly level, and shape to drain. Seed as specified in Section 02485, Seeding.

C. Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of that work. Leave the surface of the work in a neat and workman like condition, as described below.

D. The disposal of waste materials shall be considered an integral part of the excavation work and one for which no separate payment shall be allowed.

3.5 EXCAVATION FOR TRENCHES, MANHOLES, AND STRUCTURES

A. Unclassified excavation for pipelines shall consist of the

excavation necessary for the construction of water, sewer, and other pipes and their appurtenances (including manholes, inlets, outlets, headwalls, check dams, collars, concrete saddles, and pipe protection) that are called for by the drawings. It shall include clearing and grubbing where necessary, backfilling and tamping pipe trenches and around structures, and disposing of waste materials, all of which shall conform to the applicable provisions set forth elsewhere in these specifications.

B. The Contractor may, if he chooses, use a motor powered trenching machine. If he does, however, he shall be fully responsible for the preservation or repair of existing utility service connections.

C. Unless the construction of lines by tunneling, jacking, or boring is called for by the drawings or specifically authorized by the A/E, make excavation for pipelines in open cut and true to the lines and grades shown on the drawings or established by the A/E on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed, but shall not be more than the distance determined by the following formula: 4/3d + 15 inches, where "d" represents the internal diameter of the pipe in inches. When approved in writing by the A/E, the banks of trenches from the ground surface down to a depth not closer than 1 foot above the top of the pipe may be excavated to non-vertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula 4/3d + 15 inches shall be at the expense of the Contractor and may be cause for the A/E to require that stronger pipe and/or a higher class of bedding be used at no cost to the Owner.

D. For rigid pipe, shape the bottom of all trenches to provide uniform bearing for the bottom of the pipe barrel. For plastic sewer lines, provide a minimum of 6 inches of No. 67 (TDOT) crushed stone for bedding.

E. Excavate bell holes for bell and spigot pipe at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes

shall be large enough to permit proper jointing of the pipe. Do not excavate bell holes more than 2 joints ahead of pipe laying.

F. Excavation for manholes, inlets, and other incidental structures shall not be greater in horizontal area than that required to allow a 2 foot clearance between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings. No earth backfilling will be permitted under manholes, inlets, headwalls, or similar structures. Should the Contractor excavate below the elevations shown or specified, he shall, at his own expense, fill the void with either concrete or granular material approved by the A/E.

G. Do not excavate pipe trenches more than 200 feet ahead of the pipe laying, and perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where the A/E deems necessary to maintain vehicular or pedestrian traffic.

H. In all cases where materials are deposited along open trenches, place them so that in the event of rain no damage will result to the work and/or to adjacent property.

I. Excavation for other structures may be performed with non-vertical banks except beneath pavements or adjoining existing improvements. Do not permit the horizontal area of the excavation to exceed that required to allow a 2 foot clearance between the outer surface of the structure and the banks of the excavation or the sheeting used to protect the embankments. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings.

3.6 SHEETING, SHORING, AND BRACING

A. Take special care to avoid damage wherever excavation is being done. Sufficiently sheet, shore, and brace the sides of all excavations to prevent slides, cave-ins, settlement, or movement of the banks and to maintain the specified trench widths. Use solid sheets in wet, saturated, or flowing ground. All sheeting, shoring, and bracing shall have enough strength and rigidity to withstand the pressures exerted, to keep the walls of the

excavation properly in place, and to protect all persons and property from injury or damage. Separate payment will not be made for sheeting, shoring, and bracing, which are considered an incidental part of the excavation work.

B. Wherever employees may be exposed to moving ground or cave-ins, shore and lay back exposed earth excavation surfaces more than 5 feet high to a stable slope, or else provide some equivalent means of protection. Effectively protect trenches less than 5 feet deep when examination of the ground indicates hazardous ground movement may be expected. Guard the walls and faces of all excavations in which employees are exposed to danger from moving ground by a shoring system, sloping of the ground, or some equivalent protection.

C. Comply with all OSHA standards in determining where and in what manner sheeting, shoring, and bracing are to be done. The sheeting, shoring, and bracing system shall be designed by a professional engineer licensed in the State of Tennessee and shall be subject to approval by the A/E. However, such approval does not relieve the Contractor of the sole responsibility for the safety of all employees, the effectiveness of the system, and any damages or injuries resulting from the lack or inadequacy of sheeting, shoring, and bracing.

D. Where excavations are made adjacent to existing buildings or structures or in paved streets or alleys, take particular care to sheet, shore, and brace the sides of the excavation so as to prevent any undermining of or settlement beneath such structures or pavement. Underpin adjacent structures wherever necessary, with the approval of the A/E.

E. Do not leave sheeting, shoring, or bracing materials in place unless this is called for by the drawings, ordered by the A/E, or deemed necessary or advisable for the safety or protection of the new or existing work or features. Remove these materials in such a manner that the new structure or any existing structures or property, whether public or private, will not be endangered or damaged and that cave-ins and slides are avoided.

F. Fill and compact all holes and voids left in the work by the removal of sheeting, shoring, or bracing as specified herein.

G. The Contractor may use a trench box, which is a pre-

fabricated movable trench shield composed of steel plates welded to a heavy steel frame. The trench box shall be designed to provide protection equal to or greater than that of an appropriate shoring system.

3.7 THE DEWATERING OF EXCAVATION

A. Provide and keep in operation enough suitable pumping equipment whenever necessary or whenever directed to do so by the A/E. The contractor shall make himself familiar with existing surface and groundwater conditions prior to submitting his bid as to determine the extent of dewatering equipment required to complete the project on within the contract time. No additional payments will be made by the owner for dewatering equipment and labor. Give special attention to excavations for those structures that, prior to proper backfilling, are subject to flotation from hydrostatic uplift.

3.8 BORROW EXCAVATION

A. Whenever the backfill of excavated areas or the placement of embankments requires more material than is available from authorized excavations, or whenever the backfill material from such excavations is unsuitable, then obtain additional material from other sources. This may require the opening of borrow pits at points accessible to the work. In such cases, make suitable arrangements with the property owner and pay all incidental costs, including any royalties, for the use of the borrowed material. Before a borrow pit is opened, the quality and suitability of its material shall be approved by the A/E. All state and local regulations concerning borrow pits, drainage and erosion control shall be strictly followed.

B. Excavate borrow pits in such a way that the remaining surfaces and slopes are reasonably smooth and that adequate drainage is provided over the entire area. Construct drainage ditches wherever necessary to provide outlets for water to the nearest natural channel, thus preventing the formation of pools in the pit area. Leave the sides of borrow pit cuts at a maximum slope of 2:1 unless otherwise directed by the A/E.

C. Properly clear and grub borrow pits, and remove all objectionable matter from the borrow pit material before placing it in the backfill.

D. The taking of materials from borrow pits for use in the

construction of backfill, fills, or embankments shall be considered an incidental part of the work; no separate payment shall be made for this.

3.9 BACKFILLING

A. Begin backfilling after the line construction is completed and then inspected and approved by the A/E. Trenches 10-feet deep or less shall contain a 6-inch stone envelope around the pipe. Trenches grater than 10-feet deep shall contain 6-inches of stone under the pipe and on each side with 12-inches of stone placed above the pipe.

B. Backfill material above the pipe envelopes shall consist either of fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone, and/or objectionable materials and that has a size of no more than 2-inches. Place this backfill simultaneously on either side of the trench in even layers that before compaction are no more than 6 inches deep. Thoroughly and completely tamp each layer into place before placing additional layers. When shown on the drawings, this backfill shall, at locations beneath or closely adjacent to pavement, consist of No. 67 (TDOT) crushed stone. Compaction of backfill material layers shall be at 98% by standard proctor test. Where adjacent to and within paved areas the top 12-inches of the trench at subgrade shall consist of crusher-run stone compacted at 98% by standard proctor test. Compaction testing shall be at intervals not greater than 500 feet along the trench and/or at spacing as directed by the site inspector.

C. From 1 foot above the pipe upward, the backfill material may contain broken stones that make up approximately 3/4 of the backfill's total volume. However, if this type of backfill is used, there must be enough spalls and earth materials to fill all voids completely. The maximum dimension of individual stones in such backfill shall not exceed 6 inches, and the backfill material shall be placed and spread in even layers not more than 12 inches deep. At locations beneath or closely adjacent to pavement or at locations of improvements subject to damage by displacement, tamp and thoroughly compact the backfill in layers that, before compaction, are 6 inches deep. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling

equipment from causing any damage to the pipe.

D. If earth material for backfill is, in the opinion of the A/E, too dry to allow thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material that the A/E considers too wet or otherwise unsuitable.

E. Wherever excavation has been made within easements across private property, the top 1 foot of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stone, and/or other objectionable materials.

F. Wherever trenches have been cut across or along existing pavement, temporarily pave the backfill of such trenches by placing Class A, Grade D, crushed stone as the top 12 inches of the backfill. Maintain this temporary pavement either until the permanent pavement is restored or until the project is accepted by the Owner. On heavily traveled roadways, cold mix or leveling course binder 2 inches thick shall be installed and maintained until permanent pavement is installed.

G. Conduct backfilling around manholes, inlets, outfalls, and/or structures in the same manner as specified above for pipelines except that even greater care is necessary to prevent damage to the utility structure.

H. Wherever pipes have diameters of 15 inches or less, do not use power operated tampers to tamp that portion of the backfill around the pipe within 1 foot above the pipe.

I. Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfill is being placed. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary, whenever directed to do so by the A/E.

J. Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the A/E's requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.

K. Compaction Requirements: Unless specified otherwise elsewhere, under buildings and 2 times the depth of pipe beyond, and under roads and 2 times the depth beyond the shoulder, compact to 95% maximum density in accordance with ASTM D698. In all other locations, compact to 90%

maximum density.

3.10 MAINTENANCE

A. Seed and maintain in good condition all excavated areas, trenches, fills, embankments, and channels until final acceptance by the Owner.

B. Maintain trench backfill at the approximate level of the original ground surface by periodically adding backfill material wherever necessary and whenever directed to do so by the A/E. Continue such maintenance until final acceptance of the project, or until the A/E issues a written release.

3.11 SLOPES

A. Neatly trim all open cut slopes, and finish to conform either with the slope lines shown on the drawings or the directions of the A/E. Leave the finished surfaces of bottom and sides in reasonably smooth and uniform planes like those normally obtainable with hand tools, though the Contractor will not be required to use hand methods if he is able to obtain the required degree of evenness with mechanical equipment. Conduct grading operations so that material is not removed or loosened beyond the required slope.

END OF SECTION

SECTION 02575

PAVEMENT REPAIR

PART 1. GENERAL

1.1 The work specified by this section shall consist of repairing or replacing all damaged pavement, whether public or private. Soil and gravel shoulders, roads, streets, drives, and walks are to be restored to their original condition as an incidental part of the installation of utilities. Repair damaged base on either side of a trench wherever necessary. Trim the oxidation surface to neat lines outside of the trench wall, and repave the entire area as specified below and as shown on the drawings or on the standard drawings.

1.2 Both these specifications and the drawings make reference to the current edition of the standard specifications of the Tennessee Department of Transportation (TDOT). Even though the weather limitations, construction methods, and materials specifications contained in the TDOT specifications may not be explicitly repeated in these specifications, they shall, wherever applicable to the work called for by this section, be considered as implied and therefore adhered to. However, the various subsections "Basis for Payment" contained in the TDOT specifications shall not be considered applicable.

A. Refer to other sections for work related to that covered by this section.

PART 2. PRODUCTS

2.1 MINERAL AGGREGATE BASE: Class A, Grading D crushed stone (TDOT specifications, Section 303, subsection 903.05)

2.2 BITUMINOUS PRIME COATS: cutback asphalt, Grade RC-250, or emulsified asphalt, Grade AE-P (Section 402, Subsections 904.02 and 904.03)

2.3 CRUSHED STONE CHIPS: Size 6 or Size 7 (Subsection 903.14)

2.4 DOUBLE BITUMINOUS SURFACE: for both courses, either cutback asphalt, Grade RC-800 or RC-3000, or emulsified asphalt, Grade RS-2 (Subsections 904.02 and 904.03)

2.5 ASPHALTIC CONCRETE BINDER: Grading B or C (Section 307).

2.6 BITUMINOUS TACK COAT: cutback asphalt, Grade RC-250, or emulsified asphalt, Grade SS-1 (Section 403, Subsections 904.02 and 904.03).

2.7 ASPHALTIC CONCRETE SURFACE: Grading “D” or “E” (Section 411) as approved by the City of Spring Hill.

2.8 PAVEMENT MARKINGS (WHITE AND YELLOW): Thermoplastic, Paint, Paint with Glass, Reflectors, Etc. Section 716.

PART 3. EXECUTION

3.1 SUBGRADE

A. Before any base material is installed, compact the subgrade of the area to be paved to 98% of optimum density as determined by ASTM D698 (Standard Proctor).

B. The backfill material shall contain no topsoil or organic matter. For all areas where subgrade has been prepared, test for uniformity of support by driving a loaded dump truck at a speed of 2 to 3 mph over the entire surface. Make further improvements on all areas that show a deflection. When completed, the finished subgrade shall be hard, smooth, stable, and constructed in reasonably close conformance with the lines and grades that existed prior to beginning construction.

C. When a base course is compacted, cut back the surface course of the existing pavement a minimum of 1 foot beyond the limit of the joint between the old and new base course or as shown on the standard drawings. Take special care to ensure good compaction of the new base course at the joint. Apply and compact the surface to conform to the existing pavement so that it will have no surface irregularity.

3.2 BASE

A. Install a mineral aggregate base of the type specified above in accordance with Section 303 of the TDOT specifications. The maximum compacted thickness of any one layer shall be 6 inches and the total thickness of the base shall be a minimum of 8-inches at trench repairs and 10-inches on new roadways or that indicated by the standard drawings or as shown on the plans.

3.3 BITUMINOUS PRIME COAT SURFACE

A. Uniformly apply a bituminous prime coat of either emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, over the entire width of the area to be surfaced at a rate of 0.3 gallon per square yard.

3.4 ASPHALTIC CONCRETE BINDER

A. Apply a bituminous prime coat of emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, at a rate of 0.30 gallons per square yard. Take care to prevent the bituminous material from splashing on exposed faces of curbs and gutters, walls, walks, trees, etc; if such splashing does occur, remove it immediately. After the prime coat has been properly cured, apply an asphaltic concrete binder layer to the thickness shown on the standard drawings or as specified by the City of Spring Hill.

B. Carefully place the material to avoid segregation of the mix. Broadcasting of the material will not be permitted. Remove any lumps that do not readily break down.

3.5 BITUMINOUS TACK COAT SURFACE

A. Uniformly apply a bituminous tack coat of either emulsified asphalt, Grade SS-1, or cutback asphalt, Grade RC-250, over the entire width of the area to be surfaced at a rate of 0.1 gallon per square yard.

3.6 ASPHALTIC CONCRETE SURFACE

A. When the surface course is to be placed on a binder course, then apply a bituminous tack coat of the sort specified above under at a rate of 0.10 gallon per square yard. Take care to prevent the bituminous material from splashing on exposed faces of curbs, gutters, walls, walks, trees, etc.; if such splashing does occur, remove it immediately. After the tack coat has been properly cured, apply the asphaltic concrete surface layer to the thickness shown of the drawings or as specified by the City of Spring Hill. Apply the surface course as described above for the binder course.

3.7 SMOOTHNESS

A. The finished surfaces shall conform to the lines and

grades that existed prior to construction. No deviations, variations, or irregularities exceeding 1/4 inch in any direction when tested with a 12 foot straightedge will be permitted in the finished work, nor will any depressions that will not drain. Correct all such defects in a manner approved by the City of Spring Hill.

3.8 SAMPLING AND TESTING

A. Submit to the City of Spring Hill test reports made by an independent testing laboratory on the crushed stone aggregate, bituminous materials, and asphaltic concrete design mixes, and obtain approval of these reports before starting paving operations.

B. Tests shall be made of the completed elements of the pavement to ascertain the compacted thickness of the base and surface courses. If sections with deficient thicknesses are found, the full section for a reasonable distance on each side of the deficiency shall be refused. Remove and reinstall all such sections. Patch all test holes in connection with thickness tests.

C. When making surface tests, furnish one man to mark all surface defects for corrections.

END OF SECTION

SECTION 02600

MANHOLES

PART 1. GENERAL

1.1 Manholes shall be precast or monolithic concrete with eccentric cones with exterior bituminous coating, unless otherwise approved by the A/E.

1.2 Refer to other sections for items affecting manholes. Coordinate this work with that specified by other sections for timely execution.

1.3 Shop drawings are required for castings, plastic gaskets, and precast manholes specified in this section.

PART 2. PRODUCTS

2.1 CONCRETE MASONRY: reinforced or plain, meeting the applicable requirements of Section 03303, Concrete for Utility Lines.

2.2 CASTING ADJUSTMENT: Only concrete grade rings only will be allowed to adjust the casting elevation.

2.3 MORTAR: composed of one (1) part portland cement and two (2) parts sand (volumetric measure) thoroughly mixed in a tight box, with water added gradually and mixed continually until mortar has attained the proper consistency for use in brick masonry; prepared only in such quantities as needed for immediate use; mortar mixed for more than 30 minutes, retempered, or previously set will not be allowed.

2.4 GRAY IRON CASTINGS: cast iron conforming to the requirements of Class 30, ASTM A48; made accurately to the required dimensions; sound, smooth, clean, and free from blisters and other defects; not plugged or otherwise treated to remedy defects; machined so that covers rest securely in the frames with no rocking and are in contact with frame flanges for the entire perimeter of the contact surfaces; thoroughly cleaned subsequent to machining and, before rusting begins, painted with a bituminous coating so as to present a smooth finish; tough and tenacious when cold, but not tacky and with no tendency to scale; and with the actual weight in pounds stenciled or printed by the manufacturer on each casting in white paint.

2.5 PLASTIC GASKET FOR PRECAST MANHOLES: Preformed plastic gasket shall meet or exceed all requirements of FS SS-S-00210, "Sealing Compound, Preformed Plastic for Pipe Joints," Type I, rope form. The sealing compound shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler and shall contain no solvents, irritating fumes, or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength. It shall be supplied in extruded rope form of suitable cross section and in such sizes as to seal the joint space when the pipes are laid. Use two (2) complete ropes at each joint. The sealing compound shall be protected by a suitable removable two (2) piece wrapper, which shall be designed so that half may be removed longitudinally without disturbing the other half in order to facilitate application of the sealing compound. The flexible plastic gasket shall also meet the requirements of the following table:

Composition	Test Method	Minimum	Maximum
Bitumen (Petroleum Plastic Content)	ASTM D4	50	70
Ash Inert Mineral Matter	AASHO T111	30	50
Volatile Matter	ASTM D6	--	2.0

Property	Test Method	Minimum	Maximum
Specific Gravity at 77 degrees F	ASTM D71	1.20	1.30
Ductility at 77 degrees F (cm)	ASTM D113	5.0	---
Softening Point	ASTM D36	320 degrees F	---
Penetration at 77 degrees F (150 gms) 5 sec.	ASTM D217	50	120

2.6 LADDER BARS: an aluminum alloy weighing 2.2 pounds or 1/2 inch steel reinforced rod encapsulated in polypropylene plastic.

2.7 MATERIAL TESTING: All precast reinforced concrete manhole risers and tops specified herein shall be tested and inspected by a commercial testing laboratory approved by the A/E prior to delivery to the site, and all materials that fail to conform to these specifications shall be rejected. After delivery to the site, any materials that have been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site. Supply certified copies in duplicate of the inspection and acceptance reports of the testing laboratory to the A/E before using the materials. The commercial testing laboratory shall be

engaged and paid for by the Contractor. Submit a certificate from the manufacturer of the castings indicating that they meet all applicable requirements of these specifications.

PART 3. EXECUTION

3.1 Dewater sufficiently to maintain the ground water level at or below the bottom of the manhole foundation prior to and during placement of the foundation.

3.2 Obtain an adequate foundation for all manhole structures by removing and replacing unsuitable material with well graded granular material, by tightening with coarse rock, or by such other means as provided for foundation preparation of the connected sewers or as directed by the A/E. Wherever water is encountered at the site, place all cast-in-place bases or monolithic structures on a one-piece waterproof membrane to prevent any movement of water into the fresh concrete.

3.3 When the foundation subgrade has been prepared and is approved by the Town, carefully construct the concrete foundation for monolithic manholes to the line and grade required by the drawings. Construct the manholes after the concrete foundation has been allowed to set for a period of not less than 24 hours.

3.4 For precast manholes, carefully block the base section above the prepared surface so that it is fully and uniformly supported in true alignment; make sure that all entering pipe can be inserted at proper grade. Then place the concrete foundation and invert under and upon this base section as shown in the standard drawings. A base section with monolithic foundation (bottom) may be used when approved by the A/E.

3.5 Thoroughly wet and then completely fill all lift holes and all joints between precast elements with mortar. Smooth and paint them both inside and outside to ensure watertightness.

3.6 Construct monolithic concrete manholes and bases of 4,000 psi concrete in accordance with the provisions of this section and applicable provisions of Section 03303, Concrete for Utility Lines. The ladder bars shall be cast in place.

3.7 Carefully set the cast iron frame for the cover at the required elevation, and properly bond it to the masonry with cement grout and mastic seal. The required elevation is defined as the top of casting elevation on the approved construction plans. Whenever manholes are constructed in paved areas, tilt the top

surface of the frame and cover so as to conform to the exact slope, crown, and grade of the existing adjacent pavement.

3.8 Manhole inverts shall be constructed of concrete or Portland cement mortared masonry fill and may, at the Contractor's option, be covered with cement mortar to the approximate cross section of the sewers connected to them. Make any necessary changes in cross sections gradually from side to side of the manhole; make changes in direction of flow of the sewers to a true curve of as large a radius as is permitted by the size of the manhole.

3.9 All rigid unreinforced pipe entering or leaving the manhole shall be provided with flexible joints within 12 inches of the manhole structure, or encase the full joint in concrete. Place such pipe on firmly compacted bedding, particularly in the area of the manhole excavation, which is normally deeper than excavation for sewer trenches. Take special care to see that the openings through which pipes enter the structures are completely and firmly rammed full of shrinkproof mortar or otherwise constructed to ensure watertightness.

3.10 A flexible pipe to manhole connector shall be used to provide a watertight joint between the gravity sewer line and manhole. This connector shall be Kor-N-Seal Connector or an approved equal.

3.11 Where the difference in the invert elevation of two or more lines intersecting in one manhole is 24 inches or more, construct a drop manhole. Drop manholes shall be similar in construction to standard manholes except that a drop connection of pipe and fittings of the proper sizes and materials shall be constructed outside the manhole and supported by 3,000 psi concrete as indicated by the standard drawings.

3.12 Place backfill by hand around the manhole and to a distance of at least one (1) pipe length into each trench, and tamp with selected material up to an elevation of 12 inches above the crown of all entering pipes. Continue backfilling in accordance with the requirements for trench backfilling.

3.13 Each manhole shall be vacuum tested immediately after installation or rehabilitation and prior to backfilling. No standing water shall be allowed in the manhole excavation which may affect the accuracy of the test. All lifting holes and exterior joints shall be filled and pointed with an approved non-shrink mortar. All pipes and other openings into the manhole shall be suitably plugged in such a manner as to prevent displacement of the plugs while the vacuum is drawn. Installation and operation of the vacuum equipment and indicating devices shall be in accordance with equipment specification and instructions provided by the

manufacturer. A vacuum of 10 inches shall be drawn. The time for the vacuum to drop to 9.0 inches for one minute shall be recorded. Acceptance for four (4) feet diameter manholes shall be defined as when the time to drop one (1) inch meets 60 minutes.

For manholes five (5) feet in diameter, add an additional 15 seconds. For manholes six (6) feet in diameter, add an additional 30 seconds. If the manhole fails the test, necessary repairs shall be made and the vacuum test repeated until the manhole passes the test. If the manhole joint mastic on gasket is displaced during the vacuum test, the manhole shall be disassembled, the seal replaced, and the manhole re-tested.

END OF SECTION

SECTION 02722

SANITARY SEWERS (GRAVITY)

PART 1. GENERAL

1.1 Pipe material for sewer lines shall be SDR 26 PVC unless otherwise shown on the drawings. Ductile iron pipe shall be used only when so indicated on the drawings or approved by the A/E.

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

1.3 Refer to other sections for items affecting gravity sewers. Coordinate this work with that specified by others sections for timely execution.

PART 2. PRODUCTS

2.1 PIPE

A. Polyvinyl Chloride (PVC): to meet and/or exceed the requirements of ASTM D3034, SDR 26; suitable for use as a gravity sewer conduit with provisions for contraction and expansion at each joint; with a rubber ring and standard length 12.5 feet plus or minus one (1) inch; designed to pass all tests at 73 degrees F (plus or minus 3 degrees F); six (6) inches 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 four (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: with push-on joints conforming to ASTM A746, Class 250 thickness unless otherwise shown on the drawings.

C. Lateral Branches: to be tees of the same material as the main sewer and have a six (6) inches inside diameter unless otherwise specified or noted; able to withstand all test pressures involved without leakage.

2.2 JOINTS AND JOINTING MATERIALS

A. All rubber end rings shall be extruded or molded and cured such that any cross section will be dense, homogenous and free of parasites, blisters, pitting, and other imperfections. The basic rubber material, EPDM, shall meet ASTM C443 with the exception of 40-60 duro hardness. The resilient interlocked end seals shall be duro A-40-70, plus or minus 2.

B. 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 with elastomeric seal joint.

C. Ductile Iron Pipe Joints: gasket type joints for bell and spigot ductile iron pipe designed to meet the infiltration requirements of these specifications; jointing to comply with the applicable provisions of ANSI A21.11.

2.3 COMPRESSION COUPLINGS

A. When dissimilar pipe materials like PVC are joined, use 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

3.1 PIPE LAYING

A. Lay no pipe except in the presence of an inspector representing the City.

B. 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 02221, Unclassified Excavation for Utilities.

C. Wherever necessary to provide satisfactory bearing surface, place concrete cradles as shown on the drawings or as directed by the A/E. Cradles shall be of concrete and conform to the dimensions shown on the drawings. Concrete placed outside the dimensions shown shall be at the Contractor's expense.

D. Tightly stretch a mason's line or wire above ground level, parallel to and directly above the axis of the pipe to be installed, supporting this line at intervals of no more than 50 feet for sewers being laid on a grade of 2% or more and of no more than 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, and accurately place each pipe to the exact line and grade called for on the drawings. Furnish all labor and materials necessary for erecting batterboards.

E. 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. Where grades are 0.6% or less, check the elevation of the beam each 100 feet with an offset point or engineer's level.

F. Do not allow water to run or stand in the trench while pipe laying is in progress 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.

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

H. 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.

I. Bell holes shall be large enough to allow ample room for the pipe joints to be properly made. Cut out bell holes no more than two (2) joints ahead of the pipe laying. Carefully grade the bottom of the trench between bell holes so that each pipe barrel rests 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.

J. Before constructing or placing any joints, demonstrate to the A/E, 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.

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

L. Install tee branches in sewer lines to serve properly each lot facing or abutting on the street or alley in which sewer is being laid and at such other locations as may be designated by the A/E. If tee branches are not to be used immediately, close them with approved stoppers that are held in place to prevent infiltration and withstand all test requirements. All tees shall be marked with a green metal fence post.

M. For all tees that are plugged and laid in rock, blast a minimum of six (6) linear feet of ditch line in the direction and to the approximate grade of the future lateral as directed by the A/E, but do not excavate the material. This shall be done at no extra cost to the Owner. Furnish the A/E with a record of the exact location of each tee installed.

N. If the work consists of constructing a new sewer to replace an existing one, connect existing service lines to the new line.

O. New service laterals shall conform to the standard details.

P. The Contractor shall provide above-ground green metal fence post markers at the property line to indicate the termination of new service laterals.

Q. 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.

R. After the joints have been completed, they shall be

inspected, tested, and accepted by the A/E before being covered. The pipe shall meet the test requirements for watertightness; 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 relaid at the Contractor's expense. Carefully protect all pipe in place from damage until backfilling operations are completed.

S. Do not begin the backfilling of trenches until the pipe in place has been inspected and approved by the A/E.

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

U. 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 else reconstruct it with mechanical joint ductile iron pipe for a distance of ten (10) feet on each side of the sewer with a full joint of the water main centered over the sewer.

V. 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.

W. Perform boring by means of auguring to the size, line, and grade shown on the drawings. Jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide a watertight joint.

X. Make connections to all existing sewer lines as shown on the drawings or as directed by the A/E. Make connections either by removing a section of the sewer from the existing line and inserting a wye or tee branch of the proper size or by constructing a manhole, junction box, regulator chamber, or other structure as shown on the drawings.

Y. Make connections to existing manholes or inlets by

cutting a hole in the wall of the existing structure, inserting a length of sewer pipe with PVC gasketed sleeve into the hole, filling around the pipe with concrete or mortar, and troweling the inside and outside surfaces of the joint to a neat finish. Shape or reshape the bottom of the manholes as necessary to fit the invert of the sewer pipe.

Z. 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.

AA. Provide concrete protection or concrete cap as shown on the drawings for pipe sewers that, when completed, have less than 2.5 feet of covering in nontraffic areas and four (4) feet of cover in traffic areas. If such protection is not shown on the drawings, place it in accordance with the typical section shown.

BB. 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 section of these specifications. Any such work shall be considered incidental to the construction of pipe sewers, and no additional payment will be allowed therefore.

CC. Water service connections will be repaired or replaced by the Contractor at his expense as an incidental part of the work.

DD. 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.

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

FF. 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.

GG. A specimen of PVC pipe six (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 two (2) to five (5) minutes.

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

II. The Contractor shall provide a cut-off wall in the trench for the gravity sewer lines. The wall shall be constructed in accordance with the detail included in the Standard Drawings. The cutoff wall shall be provided for all gravity sewer lines. The maximum spacing of the walls shall be 400 feet, with at least one (1) cut-off wall between manholes and one (1) cut-off wall below each creek crossing.

3.2 TESTING OF GRAVITY SEWERS

A. Visual Tests

1. Upon completion of the construction or earlier if the A/E deems advisable, the A/E will make a visual inspection of the sewer and construction site. Immediately repair all leaks and defects found by such inspection.

2. In addition to general cleanup and leakage, the following standards shall be used to determine failure or defects of this project.

3. 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 flood water drains off so that no remaining puddle of water is deeper than 1/2 inch on pipe 36 inches internal diameter or smaller and 3/4 inch on pipe larger than 36 inches internal diameter. 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 relaid at the Contractor's expense.

4. 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 (1) year from the date of final acceptance of the work, the Contractor will be required to replace, at his expense, all such cracked pipe. To this end, the Contractor is advised to purchase pipe under a guarantee from the manufacturer, guaranteeing proper service of sewer pipe under conditions established by the drawings, specifications, and local conditioning at the site of the work.

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 A/E.

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 linear feet but before 4,000 linear feet of sewer has been laid. The purpose of this first series of tests is to assure both the Contractor and the A/E that the materials and methods of installation meet the intent of these specifications. Conduct the remainder of the tests after approximately each 10,000 linear feet 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 shall be the Contractor's responsibility to have the pipe cleaned.

f. Immediately following 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 two (2) minutes for temperature stabilization.

g. The pipeline shall be considered acceptable when tested at an average pressure of 3.0 psi more than the average back pressure of any ground water that may submerge the pipe, if the section under test does not lose air at a rate greater than 0.0015 cfm per square foot of internal pipe surface area. Air pressure drop from a stabilized pressure of 4 to 3 psi for one minute more than the average back pressure of any ground water that may submerge the pipe.

h. The requirements of this specification shall be considered satisfied if the time required in seconds for the pressure to decrease from 4.0 to 3.0 psi more than the average back pressure of any ground water that may submerge the pipe is not less than that shown in the following table:

ALLOWABLE AIR LOSS VALUES PER 100 LF

Pipe Size	Time In Seconds
6 inches	42
8 inches	60
10 inches	60
12 inches	60
15 inches	60
18 inches	60
21 inches	60
24 inches	60

i. If the pipe installation fails to meet these requirements, the Contractor shall determine at his own expense the source or sources of leakage and repair or replace all defective materials or workmanship. The completed pipe installation shall meet the requirements of

this test before being considered acceptable.

2. The recommended procedures for conducting acceptance tests are as follows:

   a. Clean pipe that is to be tested.

   b. Plug all pipe outlets with suitable test plugs, and brace each plug 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 above internal pressure is obtained, allow at least two (2) minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.

   f. After two (2) minutes, disconnect the air supply.

   g. When pressure decreases to 4.0 psig either by leaking down or by bleeding down with a release valve, start the stopwatch, and determine the time in seconds that is required for the internal air pressure to reach 3.0 psig. Compare this time interval as calculated above. If the time is more than that calculated, the test shall be assumed 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, which can 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 ten (10) psi between the air supply and the sewer under

test.

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

C. Testing for Sewers Larger than 24 Inches

1. Using Existing High Ground Water

a. Where the natural ground water is 24 inches or more above the top of a section of pipe, measure the flow of water in the pipe and the rates of seepage and infiltration. Measure the flow rate by using a calibrated weir. Leave the weir in the line until the flow rate has stabilized. The Contractor is responsible for verifying the ground water level by providing sight gauges in manholes or digging test holes at suitable locations.

b. The total seepage and infiltration of ground water as determined by the test shall in no case exceed 25 gallons per 24 hours per inch-mile of pipe. Make infiltration tests on all sewer construction before placing the lines in service and before making any connections to other sewers. If the amount of infiltration into the sewer(s) is in excess of the maximum quantity specified above, then recaulk or remake the joints, relay the sewer (if necessary), or perform other remedial construction, at the Contractor's expense, in order to reduce ground water infiltration to within the specified limits.

c. In making infiltration tests, furnish the required equipment and labor and do the necessary pumping under the direction of the A/E. Tests must be repeated until each sewer individually meets the specifications for infiltration amounts as set out above.

2. Exfiltration Test

a. Where the ground water is not 24 inches or more above the top of the pipe section being tested, then perform an exfiltration test. Bulkhead

the pipe below the lower manhole of the section being tested with a pneumatic plug or other device. Insert a vent pipe 48 inches long in the stopper of the upper end of that section. Then fill the lower manhole with water, or add water until there is a minimum of four (4) feet over the upper end; make certain that all air is forced out through the vent tube. Measure the drop in the level of the water in the manhole due to exfiltration over a specific time, and calculate the water loss due to exfiltration. The total exfiltration shall not exceed that specified above for infiltration. Conditions encountered in construction may vary this procedure slightly, but essentially this is the method to be used.

3. Repairs
   a. Regardless of the outcome of any tests, repair any noticeable leak.

3.3 VISUAL INSPECTION OF MISCELLANEOUS MATERIALS

A. All material used on this project will be visually inspected by the A/E 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.

3.4 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.

3.5 CLEANUP

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

END OF SECTION

SECTION 02724

SEWAGE FORCE MAIN

PART 1. GENERAL

1.1 Furnish all material, equipment, tools, and labor in connection with the sewage force main, complete and in accordance with the drawings and these specifications.

1.2 It shall be the Contractor's responsibility to ensure that all necessary materials are furnished to him and that those found to be defective in manufacture are replaced at no extra cost to the Owner. Materials damaged in handling after being delivered by the manufacturer shall be replaced at the Contractor's own expense. If installed material is found to be defective before the final acceptance of the work, the cost of both the material and labor needed to replace it shall not be passed on to the Owner.

1.3 The Contractor shall be responsible for safely storing materials needed for the work that have been accepted by him until they have been incorporated into the completed project. Keep the interiors of all pipes, fittings, and other accessories free from dirt and foreign matter at all times.

1.4 Refer to other sections for work related to that specified by this section. Coordinate this work with that required by other sections for timely execution.

1.5 Minimum force main size shall be four (4) inches in diameter or as indicated on the drawings.

PART 2. PRODUCTS

2.1 Ductile Iron Pipe and Fittings

2.1.1 Ductile iron pipe shall be made of good quality ductile cast iron that meets the requirements of ASTM E8-61T. The pipe shall be centrifugally cast in metal or sand-lined molds. It shall be made and tested in accordance with ASTM A536 and be subjected to and able to withstand a hydrostatic pressure of 500 psi.

2.1.2 The pipe shall be plain end ductile iron pipe with a push-on single gasket joint and shall conform to ANSI A21.51/AWWA C151. The design thickness shall be Class 50 for pipe as defined by ASTM A21.50/AWWA C150.

2.1.3 The length of each individual piece of ductile iron pipe shipped must be plainly marked on that piece of pipe.

2.1.4 The push-on single gasket joints shall be UL approved and able to withstand an operating pressure of 200 psi.

2.1.5 The bell of each pipe shall have a tapered annular opening and a cast or machined retaining groove for the gasket. The gasket groove shall have a flared design so that maximum deflection will be provided. The plain spigot end of the pipe shall be beveled in order to simplify its entry into and centering within the bell and the compression of the gasket.

2.1.6 The gasket shall be of high quality vulcanized rubber made in the form of a solid ring to exact dimensions. The design of the gasket groove in the bell of the pipe and the design, hardness, and other properties of the gasket itself shall be such that the joint is liquidtight for all pressures from a vacuum to the maximum internal liquid pressure of 350 psi.

2.1.7 Enough lubricant shall be furnished with each order to provide a thin coat on the spigot end of each pipe. This lubricant shall be nontoxic, impart no taste or smell, and have no harmful effect on the rubber gasket. It shall have a consistency that will allow it to be easily applied to the pipe in either hot or cold weather and that will enable it to adhere to either wet or dry pipe.

2.1.8 Standard and special fittings shall be ductile iron. Use standard mechanical joint fittings unless otherwise shown on the drawings. All fittings shall conform to ANSI A21. 10/AWWA C110.

2.1.9 Pipe and pipe fittings shall have cement linings as specified in ANSI A21. 4/AWWA C104. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately 1 mil thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices.

2.2 <u>PVC Pipe</u>

2.2.1 All plastic pipe shall be made from Class 12454-B polyvinyl chloride plastic (PVC 1120) as defined by ASTM D1784.

2.2.2 All Class 200 pipe shall have NSF approval and be manufactured in accordance with ASTM D2241. The following tests shall be run for each machine on each size and type of pipe being produced, as specified below:

2.2.2.1 Flattening Test: once per shift in accordance with ASTM D2412. Upon completion of the test, the specimen shall not be split, cracked, or broken.

2.2.2.2 Acetone Test (Extrusion Quality Test): once per shift in accordance with ASTM D2152. There shall be no flaking, peeling, cracking, or visible deterioration on the inside or outside surface after completion of the tests.

2.2.2.3 Quick Burst Test: once per 24 hours in accordance with ASTM 5199.

SDR	Pressure Rating	Minimum Bursting Pressure, psi
13.5	315	1,200
17	250	1,000
21	200	800

2.2.2.4 Impact Tests: for 6" and larger, once per shift in accordance with ASTM D2444; for 4" and smaller, once each 2 hours in accordance with ASTM D2444.

2.2.2.5 Wall Thickness and Outside Dimensions Tests: once per hour in accordance with ASTM D2122.

2.2.2.6 Bell Dimensions Test: once per hour in accordance with ASTM D3139.

2.2.3 If any specimen fails to meet any of the above mentioned tests, all pipe of that size and type manufactured between the test periods must be scrapped and a full set of tests rerun.

2.2.4 Furnish a certificate from the pipe manufacturer stating that he is fully competent to manufacture PVC pipe of uniform texture and strength and in full compliance with these specifications and further stating that he has manufactured such pipe and done so in sufficient quantities to be certain that it will meet all normal field conditions. In addition, the manufacturer's equipment and quality control facilities must be adequate to ensure that each extrusion of pipe is uniform in texture, dimensions, and strength. Also furnish a certificate from the manufacturer certifying that the pipe furnished for this project meets the requirements of these specifications.

2.2.5 All pipe shall be manufactured in the United States of America. All pipe for any one project shall be made by the same manufacturer.

2.2.6 Pipe 8" and larger shall be furnished in 20 feet lengths. The Contractor's methods of storing and handling the pipe shall be approved by the A/E. All pipe shall be supported within five (5)

of each end; in between the end supports, there shall be additional supports at least every 15 feet. The pipe shall be stored away from heat or direct sunlight. The practice of stringing pipes out along the proposed force main routes will not be allowed.

2.2.7 Certain information shall be applied to each piece of pipe. At the least, this shall consist of:

2.2.7.1 Nominal size
2.2.7.2 Type of material
2.2.7.3 SDR or class
2.2.7.4 Manufacturer
2.2.7.5 NSF Seal of Approval

2.2.8 Pipe that fails to comply with the requirements set forth in these specifications shall be rejected.

2.2.9 The pipe shall have push-on joints designed with grooves in which continuous molded rubber ring gaskets can be placed. Gaskets shall be made of vulcanized natural or synthetic rubber; no reclaimed rubber will be allowed. The gaskets shall be of the manufacturer's standard design dimensions and of such size and shape as to provide a positive seal under all combinations of joint and gasket tolerance. The gasket and annular groove shall be designed and shaped so that when the joint is assembled, the gasket will be radially compressed to the pipe and locked in place against displacement, thus forming a positive seal.

2.2.10 The spigot end of each pipe shall be beveled so that it can be easily inserted into the gasket joint, which in turn shall be designed so that the spigot end may move in the socket as the pipe expands or contracts. The spigot end shall be striped to indicate the distance into which it is to be inserted into the socket. Each joint shall be able to accommodate the thermal expansions and contractions experienced with a temperature shift of at least 75 degrees F.

2.2.11 Enough lubricant shall be furnished with each order to provide a coat on the spigot end of each pipe. This lubricant shall be nontoxic, impart no taste or smell, have no harmful effect on the gasket or pipe material, and support no bacterial growth. The lubricant containers shall be labeled with the manufacturer's name.

2.2.12 Joints shall be manufactured in accordance with ASTM D3139 except that the thickness of the bell shall be, as a minimum, equal to that of the barrel. Joints shall be either integral bell and ring joints with rubber compression gaskets as manufactured by the

Clow Corporation, Johns-Manville, or Vulcan Plastic Corporation; twin gasket couplings as manufactured by the Certain-Teed Products Corporation; or equal. However, the pipe and bell must be made by the same manufacturer.

2.2.13 Standard and special fittings shall be ductile iron. Use standard mechanical joint fittings. All fittings shall conform to the specifications of ANSI A21. 10/AWWA C110. The gaskets shall be ducked tipped transition gaskets for use with PVC pipe.

2.2.14 Fittings shall be lined with a thin cement lining as specified in ANSI A21. 4/AWWA C104; this lining is to be furnished at no extra cost. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately 1 mil thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices.

2.2.15 Fitting laying lengths shall conform to ANSI A21. 10/AWWA C110.

2.2.16 Fittings shall be in accordance with the standard mechanical joint fittings manufactured by the U.S. Pipe and Foundry Company, American Cast Iron Pipe Company, Clow Corporation, or equal.

PART 3. EXECUTION

3.1 Installation of Force Main

3.1.1 Lay the force main to and keep it at the lines and grades required by the drawings. All fittings shall be at the required locations, and spigots well centered in the bells. Where the grades are 0.2% or less, use a laser to maintain the required slopes.

3.1.2 Unless otherwise indicated by the drawings, all force mains shall have at least 30 inches of cover. The pipe shall slope continuously between high and low points and have a minimum of 48" cover at the high points. No departure from this policy shall be made except at the order of the A/E, or unless shown otherwise on the drawings. Full trench stone backfill (TDOT No. 67) shall be required in areas of roadways, shoulders, parking lots, paved or concrete areas, and all traffic bearing locations. The top 12” shall be TDOT Type A Grading D crushed stone compacted to 98% standard proctor density.

3.1.3 Provide and use tools and facilities that are satisfactory to the A/E and that will allow the work to be done in a safe and convenient manner. Use a derrick, ropes, or other suitable equipment to lower all pipe and fittings into the trench one piece at a time. Carefully lower each piece so that neither it nor any protective coating or lining it may have will be damaged. Under no circumstances, drop or dump force main materials into the trench.

3.1.4 Lower no pipes and fittings into the trench until they have been swabbed to remove any mud, debris, etc., that may have accumulated within them. After the pipe has been lowered, remove all unnecessary materials from it. Before any pipe is laid, brush and wipe clean the outside of its spigot end and the inside of its bell and ensure that the pipe is dry and oil-free.

3.1.5 Take every precaution to keep foreign material from getting into the pipe while it is being placed in the trench. If the crew laying the pipe cannot put it into the trench and in place without allowing earth to get inside it, then place a heavy, tightly woven canvas bag of suitable size over each end of the pipe and leave it there until it is time to connect that pipe to the one adjacent to it.

3.1.6 Place no debris, tools, clothing, or other materials in the pipe during laying operations.

3.1.7 After a length of pipe has been placed in the trench, center the spigot end in the bell of the adjacent pipe, and then insert to the depth specified by the manufacturer and bring to the correct line and grade. Secure the pipe in place by tamping an approved backfill material around it.

3.1.8 Bell holes shall be big enough so that there is ample room for the pipe joints to be properly made. Between bell holes, carefully grade the bottom of the trench so that each pipe barrel will rest on a solid foundation for its entire length.

3.1.9 Whenever pipe laying is not in progress, close the open ends of pipe in the trench with a water tight plug or by other means approved by the A/E. Caulk the joints of any pipe in the trench that cannot be completed until a later time with packing in order to make them as watertight as possible; this shall be done not only at the end of each working day but also before work is stopped for lunch periods, bad weather, or any other reason. If there is water in a trench, this seal shall remain in place until the trench has been pumped completely dry.

3.1.10 The cutting of pipe so that fittings or closure pieces can be inserted shall be done in a neat and workmanlike manner and without any damage to the pipe. Follow the manufacturer's recommendations concerning how to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipe's axis.

3.1.11 The flame cutting of pipe by means of an oxyacetylene torch will not be allowed.

3.1.12 Unless otherwise directed by the A/E, lay pipe with the bell ends facing in the direction of laying.

3.1.13 Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions or plumb stems, or wherever long radius curves are permitted, the amount of deflection shall not exceed that necessary for the joint to be satisfactorily made, nor that recommended by the pipe manufacturer, and shall be approved by the A/E.

3.1.14 Lay no pipe in water or when it is the A/E's opinion that trench conditions are unsuitable. If crushed stone is used to improve trench conditions or as backfill for bedding the pipe, this shall be considered incidental to the project, and no separate payment will be made for its use.

3.1.15 Install thrust blocks wherever the force main changes direction (e.g., at tees and bends), at dead ends, or at any other point where the manufacturer recommends and/or the A/E indicates that they are to be used.

3.1.16 Make all joints, whether standard mechanical or push-on joints, in conformance with the recommendations of the joint manufacturer as approved by the A/E.

3.1.17 For detection purposes, a 14 gage solid strand copper tracing wire (shielded) and an approved metallic tape identified as "sewer" shall be installed as per the manufacturer's instructions. Connections between wires shall be soldered or connected with wire nut fasteners and wrapped.

3.2 Hydrostatic Tests

3.2.1 Pressure Test

3.2.11 After pipe has been laid and backfilled as specified above, subject all newly laid pipe or any valved section thereof to a pressure of 200 psi. All connections (if applicable) are to be

laid prior to testing the main and tested as part of the test of the main.

3.2.1.2 The duration of each pressure test shall be at least one (1) hour.

3.2.1.3 Slowly fill each valved section of pipe with water, and apply the specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) with a pump connected to the pipe in a manner satisfactory to the A/E. Furnish the water, pump, pipe, connections, gauges, and all necessary apparatus.

3.2.1.4 Before applying the specified test pressure, expel all air from the pipe. If air/vacuum assemblies are not available at high places, make the necessary taps at the points of highest elevation before testing, and insert plugs after the test has been completed.

3.2.1.5 Carefully examine all exposed pipes, fittings, and valves, during the test. Remove any cracked or defective pipes, fittings, and/or valves, discovered in consequence of this pressure test, and replace with sound material in the manner specified. Repeat the test until the results are satisfactory to the A/E.

3.2.2 Leakage Test

3.2.2.1 Conduct the leakage test after the pressure test has been satisfactorily completed. Furnish the water, pump, pipe, connections, gauges, measuring devices, and all other necessary apparatus as well as all necessary assistance to conduct the test.
3.2.2.2 The duration of each leakage test shall be two (2) hours; during the test, subject the main to a pressure of 150 psi.

3.2.2.3 Leakage is defined as the amount of water which must be supplied to the newly laid pipe or any valved section in order to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

3.2.2.4 No pipe installation will be accepted until the leakage is less than the number of gallons per two (2) hour period listed below:

Pipe Sizes	Gallons per 1,000 Feet of Pipe
2" - 2-1'4"	0.2
3"	0.5
4"	0.6
6"	0.9
8"	1.2
10"	1.5
12"	1.9
14"	2.2
16"	2.6
18"	2.9
20"	3.2
24"	3.8

3.2.2.5 Should any test of pipe laid disclose leakage greater than that specified, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

3.3 Cleanup

After completing each section of force main, remove all debris and all construction materials and equipment from the work site. Then grade and smooth over the surface on both sides of the main. The entire area shall be clean and left in a condition satisfactory to the A/E. Seed and mulch as required elsewhere in these specifications.

END OF SECTION

SECTION 02725

BORING AND CASING FOR SANITARY SEWERS

PART 1. GENERAL

1.1 The work to be performed hereunder shall consist of the installation of casing pipe and carrier pipe for water lines as shown on the drawings or as called for in these specifications. For the open cut casing pipes, it shall include the excavation of the trench, placing proper bedding material, furnishing and installing the casing pipe, furnishing and installing the carrier pipe, backfilling, and disposing of the excess excavated materials. For the boring and jacking of casing pipes, it shall include the excavation of a boring pit, auger boring between the point as specified on the drawings, furnishing and installing of the carrier pipe, casings spacers, casing end caps, casing vents and disposing of the excavated materials in the manner herein provided.

PART 2. PRODUCTS

2.1 CASING PIPE

A. The casing pipe shall be of steel meeting the latest approved American Railway Engineering Association "Specifications" for Pipelines for Carrying Flammable and Nonflammable Substances." The steel casing pipe shall have a minimum yield strength of 35,000 PSI and shall have the minimum wall thickness shown in the following table:

TABLE OF MINIMUM WALL THICKNESS FOR STEEL CASING PIPE FOR E72 LOADING

Carrier Pipe Diameter	Casing Pipe Diameter	Nominal Thickness
4 inches	8 inches	0.250 inches
6 inches	12 inches	0.250 inches
8 inches	16 inches	0.312 inches
10 inches	20 inches	0.312 inches
12 inches	22 inches	0.312 inches
14 inches	24 inches	0.344 inches
16 inches	26 inches	0.375 inches
18 inches	28 inches	0.406 inches

B. When the casing pipe is installed without benefit of a protective coating, the wall thickness shown above shall be increased to the nearest standard size, which is a minimum of 0.063 inches greater than the thickness shown.

2.2 CARRIER PIPE: The carrier pipe shall be PVC, SDR 21, unless otherwise noted on the drawings.

PART 3. EXECUTION

3.1 BORING

A. The boring shall be accomplished by means of auguring to the size, line and grade shown on the drawings.

3.2 INSTALLATION OF CASING PIPE

A. For open cut of casing pipes, install the steel casing pipe into the open cut as the trench excavation proceeds. Weld sections of casing pipe together to provide watertight joints, and replace the protective coatings in areas where it is damaged by welding.

B. For boring casing pipes, jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide watertight joints.

C. Do not remove unacceptable casing without prior approval from the A/E. If the removal of casing pipe is permitted, make proper provisions to prevent caving in of the earth surrounding the casing.

3.3 INSTALLATION OF CARRIER PIPE

A. The carrier pipe shall be furnished by the Contractor. Upon acceptance of the casing, install the carrier pipe in the casing by jacking it through the casing. In order to achieve proper line and grade on the carrier pipe, install casing spacers specifically manufactured for this type installation, to offset any minor variations in the alignment of the casing. End caps and casing vents shall also be installed.

3.4 LAYOUT OF WORK

A. The Owner will provide the necessary control points required by the Contractor for this construction. The Contractor will provide the detailed layout required to keep the excavation and pipe installation on grade.

4. GUARANTEE OF WORK

4.1 Guarantee a usable completed casing between the points specified and to the line and grade specified. The allowable tolerance at the downstream end point of the casing shall be such that the invert of the carrier pipe may be positioned within a vertical area limited on the top by an elevation no higher than the elevation shown on the drawings and on the bottom by an elevation no lower than the existing inlet pipe invert.

4.2 The allowable tolerance at the upstream end point of the casing shall be such that the invert of the carrier pipe may be positioned at the elevation shown on the drawings.

END OF SECTION

SECTION 03303

CONCRETE FOR UTILITY LINES

PART 1. GENERAL

1.1 This item shall include furnishing and installing concrete blocking, cradles, anchors, caps, pipe protection, and/or encasement at the locations shown on the drawings and/or directed by Spring Hill's representative.

PART 2. PRODUCTS

Not used.

PART 3. EXECUTION

3.1 Concrete work shall conform to ACI 301-72 (as revised), as modified by the supplemental requirements below:

A. Strength

1. The strength of concrete shall be 3,000 psi unless otherwise shown on the drawings.

B. Durability

1. All concrete exposed to weather shall be air entrained.

C. Slump

1. Concrete shall be proportional and produced to have a slump of 3 inches with a 1 inch tolerance.

D. Admixtures

1. Air entrainment, mandatory for concrete exposed to weather, may be used. A water reducing admixture (retarding, normal, or accelerating, depending on placing temperature), may be used if approved by the Spring Hill's representative.

E. Reinforcing Steel

1. Yield strength of reinforcing steel shall be 60,000 psi.

END OF SECTION

SECTION 13514

TELEVISION INSPECTION

1. GENERAL

Perform the inspection in one line segment at a time and control the flow into the line segment being inspected as necessary.

2. EQUIPMENT

2.1 The television camera used for the inspection shall be one specifically designed and constructed for such inspections. It shall be operative in conditions of 100% humidity. The lighting and camera quality shall be suitable to allow a clear, in-focus, color, picture of a minimum of 6 LF of the entire inside periphery of the sewer pipe. Picture quality and definition shall be to the satisfaction of the A/E; otherwise, the equipment shall be removed from the line, and no payment made for the unsatisfactory inspection.

2.2 Locate the camera monitor within a temperature controlled television unit that will accommodate 3 people to watch the sewer line inspection. The A/E and Owner shall have access to view the television monitor at all times.

2.3 A skilled technician shall control the operation of the equipment from a control panel located in the television unit and shall have control of the movement of the television camera at all times. This may be accomplished by remote control winches or by telephone or other suitable means of communication between the winches at either end of the line segment being inspected.

2.4 A Polaroid type camera with proper lens and mountings to frame the monitor exactly shall be available for making still photographs. Pictures that include less than the total screen or extend beyond the screen dimensions shall not be accepted. Take photographs at the request of the A/E to record conditions of interest during the television inspection.

2.5 A video cassette recorder using a VHS standard format shall be available for making video and audio recordings. The video tape recordings shall be in color. The tape width shall be 1/2" and the speed, 1.31" per second. The recorder shall be suitable for recording directly from the television inspection camera. Video recording shall be of all lines televised or information of interest during the television inspection.

3. EXECUTION

3.1 Pull the closed circuit television camera slowly through the pipe in order to record defects, leaking joints, and leaking service lines. Keep a log of the television inspection on a form acceptable to the A/E, and note identification of the line segment, manhole-to-manhole direction of travel, line size, pipe construction material, point of entry of service connections (using a clock system), running leaks, continuously running service lines, bad joints, dips in the pipe, structural defects. Record each of the above items on the inspection log, along with the distance from the manhole of reference. Observe running service line for 5 minutes to determine if the service line is actually leaking or if the flow is the result of water use. Observe and quantify all leaks in the sewer line or service lines in gallons per minute (gpm) and record on the inspection log. Submit any photographs or video tapes taken during the inspection to the A/E along with one typewritten copy of the television inspection log. The television inspection logs will be submitted weekly within 5 working days after completion of the television inspection. Any video tapes required shall be VHS video cassettes and include reference distances of the television logs in a format acceptable to the A/E.

3.2 If a unit becomes lodged in the line during televising, remove the unit from the line, and replace or repair any damages that occur as a result of removing the unit.

END OF SECTION