

Sheeting, shoring and bracing shall not be left in place unless otherwise provided for in the contract or authorized by the Engineer. The removal of sheeting, shoring, and bracing shall be done in such manner as not to endanger or damage either new or existing structures, private or public properties, and so as to avoid cave-ins or sliding of the banks. All holes or voids left by the removal of the sheeting, shoring, or bracing shall be immediately and completely filled and compacted with suitable materials. Sheeting, shoring, and bracing ordered left in place by the Engineer will be paid for at the unit price bid for this item when such pay item is provided. In the event no separate pay item is provided, then the cost of sheeting, shoring and bracing is to be included in such items as are provided.

W.4.5. PUMPING, BAILING AND DRAINING

The Contractor shall immediately remove all surface or seepage water from sewers, drains, ditches, and other sources which may accumulate during the excavation and construction work by providing the necessary underdrains or otherwise and by doing the necessary pumping, bailing or draining. The Contractor shall have available at all times sufficient equipment in proper working order for doing the work herein required. All water removed from excavations shall be disposed of in an approved manner so as not to create unsanitary conditions nor to interfere unduly with the use of streets, private driveways, or entrances. Pumping, bailing, draining, underdrains, ditches, etc., shall be considered as incidental work and will not be bid for as separate items but their cost shall be included in the contract prices bid in the Proposal for the various units of measure.

W.4.6. SUPPORT OF EXISTING PIPES ACROSS TRENCH

It shall be the responsibility of the Contractor to protect and support all water, sewer, gas, and other conduits crossed by the excavation or work to be performed by him or to arrange for their temporary removal and subsequent replacement. All expense incidental to this phase of the work shall be borne by the Contractor.

W.4.7. DISPOSAL OF EXCAVATED MATERIALS

Excavated materials, so far as needed and of a suitable character, shall be piled adjacent to the work to be used for backfilling as required. Excavated materials unsuitable for the backfilling or in excess of that required for backfilling shall be disposed of in an approved manner at locations designated on the plans or approved by the Engineer. Desirable top soil, sod, etc. shall be carefully piled separately and replaced in its original position when required. Excavated materials shall be handled at all times in such a manner as to cause a minimum of inconvenience to public travel and to permit safe and convenient access to private and public property adjacent to or along the line of the work. In parkways and easements where it is necessary to deposit excavated materials on lawns during the work, burlap or canvas shall be placed on the lawn to prevent contact between excavated materials and the lawn.

W.4.8. PROTECTION OF TREES, PLANTS, SHRUBBERY, ETC.

Where trees, plants, shrubbery, etc., are adjacent to the line of the work and are not to be removed or removed and replaced, the Contractor shall protect such trees, plants, shrubbery, etc., by substantial wooden boxes and guards and shall not permit machinery or employees to scrape, tear the limbs from or damage or attach guy cables to them and if, in the

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opinion of the Engineer, such trees, plants, shrubbery, etc. would be damaged by machinery, etc., hand excavation may be required. The Contractor shall be responsible for all damages to adjacent trees, plants, shrubbery, etc.

W.4.9. PROTECTION OF BUILDINGS

The Contractor shall, at his own expense, shore up and otherwise protect any building or other structure which may, in the opinion of the Engineer, be endangered during the work, and he shall restore all buildings, culverts, fences, walls, or other properties disturbed during his work to a condition similar or equal to that existing before his operations.

The Contractor shall be responsible for any injuries to persons and property, for all damages to any pipe, conduit, sewer, or other structures injuriously affected by the work. The Owner shall not be liable therefore.

W.4.10. CROSSINGS TO BE KEPT OPEN

At such street, railroad, and all other crossings as may be designated by the Engineer, the trenches are to be filled in such a manner as to prevent any serious interruption of traffic upon the roadway or sidewalks. The cost thereof shall be borne by the Contractor.

W.4.11. PROTECTION OF UNFINISHED WORK

Before leaving work for the night, during a storm, or at other times, care must be taken to protect and securely close the unfinished end of the pipe. Any earth or other materials that may find entrance into the pipe through any such open or unplugged end of the pipe must be removed at the Contractor's expense.

W.4.12. LIGHTS AND GUARDS

The Contractor must provide and maintain adequate detours around the work under construction. The Contractor shall provide lights, warning signs, and/or watchmen to provide adequately for the safety of the public.

W.5.1 BACKFILL

Excavation shall be backfilled only with approved materials. The placing of backfill material shall not begin until approval has been given by the Engineer and shall be done immediately when so ordered by the Engineer.

Backfilling shall be brought up to an elevation slightly above the original ground level to allow for subsequent settlement. The top surface or slopes of all backfill shall be neatly graded off in a workmanlike manner, and where select topsoil, sod, or other material is removed and piled separately, such material shall be carefully replaced in a manner satisfactory to the Engineer.

W.5.2. BACKFILL MATERIAL

Backfilling shall be done with good sound earth. Broken concrete, rock, bituminous pavement, or other lumpy material shall not be used in the backfill except as the lumps are small and their dispersal in the backfill is made in the upper section in a manner satisfactory to the Engineer. Materials of a perishable, spongy, or otherwise improper nature shall not be used in backfilling. Where good sound earth is not available from the excavated material, pea gravel cushion and/or sand and granular backfill material will be used for the initial backfill operation to a point six (6") inches above the top of the pipe. Gravel cushion and/or granular backfill material will not be required when concrete encasement is specified or used around the pipe. No backfill shall be made until it is authorized by the Engineer. All debris shall be removed. Sheeting, shoring and bracing shall be pulled and removed during the progress of the backfilling in a manner satisfactory to the Engineer.

W.5.3. CONCRETE ENCASEMENT

Concrete encasement, when required, shall be composed of a free-flowing material consisting of small stone, pea gravel, limestone chat, or pit run sand and gravel and shall always consist of at least sixty (60) percent sand. The material shall all pass a three-quarter (3/4) inch screen and be free from sticks, lumps, stones, and organic matter. The material shall be mixed with Portland Cement in the proportions of one (1) part cement to ten (10) parts of the above described granular material, by volume measurement. Concrete encasement shall be poured either wet or dry as may be directed by the Engineer.

When concrete encasement backfill material is specified or ordered by the Engineer to be poured DRY, the Contractor shall place this material on each side of the pipe for the full width of the trench using shovels to cut the material back under the pipe and shall be tamped to a height of six (6") inches above the pipe to receive final backfill. Care must be exercised not to dislocate or disturb the grade and alignment of the pipe. If ordered by the Engineer to be poured WET, caution and care must be used not to float the pipe out of place. In the event pipes are floated out of proper position they shall be removed and re-laid at the expense of the Contractor.

W.5.4. GRAVEL CUSHION OR BACKFILL

On water line construction when, in the opinion of the Engineer, the subgrade material encountered at grade is soft, spongy, and unsuitable, it shall be removed to such a depth that the replacement thereof with firmly tamped gravel or crushed stone will provide an unyielding, stable foundation. The gravel used in cushion or backfill shall be pit run gravel or crushed stone and shall be free from silt, loam, or vegetable matter and shall be of a gradation suitable to the Engineer.

Gravel cushion or backfill, when required by the plans or the Engineer, will be paid for at the contract unit price and shall be the total compensation for furnishing all labor materials, tools, and equipment for performing this particular phase of work.

Subgrades that have been allowed to become unstable by neglect of the Contractor, by improper drainage or lack of drainage, and when in the opinion of the Engineer, the condition was caused by the neglect or fault of the Contractor, the Engineer shall order the

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Contractor to remove the unstable subgrade and replace the same with gravel at the expense of the Contractor, and no extra compensation will be allowed.

W.5.5. CEMENT STABILIZED BACKFILL

Where backfill material shown or called for on the plans to be used in the pipe zone is cement stabilized sand, the material shall extend from a point six (6") inches below the pipe to a point six (6") inches above the top of the pipe. The backfill material shall be deposited simultaneously on both sides of the pipe and worked carefully around and under the pipe with the point of a shovel. Payment for this bedding material shall be included in the unit price bid per linear foot of cement stabilized backfill material. Cement stabilized backfill shall contain a minimum of one (1) sack mix (per yard of pit run sand).

W.5.6. INITIAL BACKFILL

After the pipe has been laid the pipe lines shall be backfilled as follows:

Good sound earth, free of clods or lumps exceeding three (3") inches in any dimension, from the spoil bank shall be brought up by hand backfilling equally on each side of the pipe to a height of six (6") inches over the top of the pipe. To insure a good firm bedding the backfill shall be cut under and around the pipe with shovels up to the spring line of the pipe. This backfill shall be done so as not to displace the pipe from its original position.

In summation, initial backfill will be composed of one or more of the following in the manner described above:

1. Good sound earth free of lumps or clods in dimension not exceeding three (3") inches shall be brought up six (6") inches over the top of the pipe.
2. Gravel cushion, when shown on the plans, shall be poured into place to the top of the pipe lines. Gravel cushion is defined as a free-flowing material like sand or mixed sand and pea gravel, free from lumps, large stone, clay and organic material. When wet, the material shall not form mud or muck.
3. 2,500-pound concrete poured and rodded into place six (6") inches over top of the pipe and all around the pipe a minimum of six (6") inches thickness as shown on the plans as concrete encasement or as required by the Engineer.

W.5.7. FINAL BACKFILL

The final backfilling operation shall be one of the following for any of the methods used in the initial backfill procedure:

1. The remainder of the backfill material may be made from the spoil bank, free from clods or lumps exceeding 6" in any dimension, placed in uniformly compacted layers not exceeding one (1') foot in loose depth and hand or mechanically tamped in a manner approved by the Engineer.

2. The backfill material may be placed loosely in the trench, rounded up over the trench slightly above the original ground elevation without tamping and the trench jetted with water until all settlement has ceased. In open rights-of-way the trench may be left crowned above the original ground as directed by the Engineer. Except in cases where pipe lines cross open field, surplus soil is in such excess that drainage and/or adjacent property may be affected, the surplus material shall be removed from the site as directed by the Engineer.

3. Where an asphalt existing street or driveway surface has been cut (all asphalt and concrete pavements shall be saw cut before excavation), the following procedure is to be used in backfilling and replacing the pavement (unless otherwise shown on the plans):

- a. The top 24" of the trench shall be filled with gravel aggregate, consisting of hard durable uncoated pebbles or stone particles mixed with sand, free from clay lumps, shales, salt or alkali, well graded from coarse, not to exceed 3", to fine with 55% retained on 1/4" screen or washed gravel will be poured and compacted into place taking care not to disturb the pipe to level with the finished surface.
- b. In not less than fourteen (14) days after backfill of the pavement cut is completed, unless otherwise approved by the Engineer, the Contractor shall remove the gravel backfill to one and one-half (1 1/2") inches below the pavement surface and furnish and place fine graded surface course hot mix asphaltic concrete, which when compacted will be not less than one and one-half (1 1/2") inches thick.

4. Where concrete pavement is cut, the pavement shall be cut by sawing six (6") inches beyond trench width on each side of the ditch and breaking out the concrete. The reinforcing steel shall be cut and bent back to be replaced after pipe laying operation has been completed. The ditch shall be backfilled from around the pipe and over the pipe to the pavement surface with pit run gravel or washed gravel jetted into place as in paragraph 3 (A) above. In not less than five (5) days after the backfill of pavement cut is completed, the Contractor shall remove gravel backfill to six (6") inches below the surface of the pavement and shall pour a six (6") inch thick 3,000 psi concrete slab the width of the paving cut.

Prior to completion and final acceptance of the entire job, the Contractor will be required to refill and re-crown all trenches which have settled below ground level or where the crown is reduced to indicate that such subsidence will occur.

W.6.1. BORING PIPE

This item shall govern furnishing and installing of encasement pipe by methods of jacking or boring as indicated on the Drawings and in conformity with this specification. This item shall also include, but not be limited to other constructions activities such as traffic control measures, excavation, removal of all materials encountered in jacking or boring pipe operations, disposal of all material not required in the work, grouting, bulkhead installation, backfilling and re-vegetation.

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W.6.2. SUBMITTALS

The submittal requirements for this specification item shall include:

1. Shop drawings identifying proposed jacking or boring method complete in assembled position;
2. Design for jacking or boring head;
3. Installation of jacking or boring supports or back stop;
4. Arrangement and position of jacks and pipe guides, and
5. Grouting plan.

W.6.3. MATERIALS

Steel Pipe shall conform to ASTM A134 with a minimum thickness of 3/8 inch for pipe with a diameter of 12 inches and greater, and 1/4 inch for pipe less than 12 inches.

Grout for void areas shall consist of 1-part Portland cement and 4 parts fine, clean sand mixed with water.

W.6.4. CONSTRUCTION METHODS

A. General

The Contractor is responsible for:

1. Adequacy of jacking and boring operations;
2. Installation of support systems as indicated on the Drawings;
3. Provision of encasement and carrier pipe, and
4. Execution of work involving the jacking operation, the wet or dry method of boring and the installation of encasement pipe simultaneously.

The Contractor shall have sole responsibility for the safety of the jacking and boring operations and for persons engaged in the work. The Contractor's attention is directed to the Construction Industry Occupational Safety and Health Administration (OSHA) Standards (29 FR 1926/1920) as published in U.S. Department of Labor publication OSHA 2207, latest revision.

When the grade of the pipe at the jacking or boring end is below the ground surface, suitable pits or trenches shall be excavated to provide sufficient room to conduct the jacking or boring operations and for placement of end joints of the pipe. In order to provide a

safe and stable work area, the excavated area shall be securely sheeted and braced to prevent earth caving in accordance with the Trench Safety Plan.

The location of the work pit and associated traffic control measures required for the jacking or boring operations shall conform to the requirements of the TxDOT Manual on Uniform Traffic Control Devices.

Where installation of pipe is required under railroad embankments, highways, streets, or other facilities by jacking or boring methods, construction shall be undertaken in such a manner that it will not interfere with operation of any railroad, street, highway, utility or other facility and shall not weaken or damage any embankment or structure.

During construction operations, and until the work pits are backfilled and fill material compacted, traffic barricades and warning lights to safeguard traffic and pedestrians shall be furnished and maintained by the Contractor. The Contractor shall submit the proposed pit location and traffic control plan for review by the Engineer or designated representative.

The pipe shall be jacked or bored from the low or downstream end, if possible. Minor lateral or vertical variation in the final position of pipe from line and grade established by Engineer or designated representative will be permitted at the discretion of Engineer or designated representative provided that such variation is regular and occurs only in one direction and that the final grade of the flow line conforms to the specified direction.

When conforming to details indicated on the drawings, but the bottom of the work pit is unstable or excessively wet or the installation of water and wastewater pipe will result in less than 30 inches of cover, the Contractor shall notify the Engineer or designated representative. The Engineer or designated representative may require the Contractor to install a concrete seal, cradle, cap or encasement or other appropriate action.

Immediately after jacking or boring is complete and the encasement pipe is accurately positioned and approved for line and grade, the clear space between the pipe and the surrounding excavated material shall be completely filled by pressure grouting for entire length of installation.

Any pipe damaged in jacking operations shall be removed and replaced by the Contractor at its entire expense.

B. Boring

The boring shall proceed from a work pit provided for the boring equipment and workmen. The location of the pit shall be approved by the Engineer or designated representative. The boring shall be done mechanically using either a pilot hole or the augur method.

In the pilot hole method an approximate 2-inch pilot hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit. This pilot hole shall serve as the centerline of the larger diameter hole to be bored.

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When the augur method is used, a steel encasement pipe of the appropriate diameter equipped with a cutter head to mechanically perform the excavation shall be used. Augurs shall be of sufficient diameter to convey the excavated material to the work pit.

Excavated material will be removed from the working pit and disposed of properly. The use of water or other fluids in connection with the boring operation will be permitted only to the extent to lubricate cuttings. Water jetting will not be permitted.

In unstable soil formations, a gel-forming colloidal drilling fluid, that consists of at least 10 percent of high grade carefully processed bentonite, may be used to consolidate the drill cuttings, seal the walls of the hole and furnish lubrication to facilitate removal of the cuttings from the bore.

W.6.5. MEASUREMENT

Boring pipe will be measured by the linear foot of pipe complete in place. Such measurement will be made between the ends of the pipe along the central axis as installed.

W.6.6. PAYMENT

The work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit bid price per linear foot for "Boring Pipe", of type, size and class of encasement pipe indicated on the Drawings. The price shall include full compensation for furnishing, preparing, hauling and installing required materials, encasement pipe, carrier pipe, for grouting and for labor, tools, equipment and incidentals necessary to complete work, including excavation, backfilling and disposal of surplus material.

W.7.1. FLANGED CAST IRON PIPE AND FITTINGS

All flanged end, flange and bell, and flange and spigot pipe and fittings shall meet ANSI/AWWA Specifications as outlined below and shall have American Standard Class 125 flanges. Bolts, bolt circles, heads and nuts shall be standard as to quantity of material. Gaskets shall be made from the best quality insertion rubber 1/16 inch thick. Flanged fittings shall be American Standard Class 125, except where noted on the plans.

Flanges shall be cast solid and faced accurately at right angles to the axis of the casting. Dimensions and drilling of flanges shall be in accordance with the American Standards Association for a working pressure of 250 pounds per square inch. Special drilling shall be provided where necessary.

W.7.2. FITTINGS

Fittings may be gray or ductile iron. See SECTION DIP – DUCTILE IRON PIPE AND FITTINGS for details.

W.7.3. DUCTILE IRON PIPE

See SECTION DIP – DUCTILE IRON PIPE AND FITTINGS for details.

W.7.4. PVC PIPE

This specification designates general requirements for polyvinyl chloride pipe with integral thickened wall bells used primarily for conveying potable water under pressure.

All pipe furnished shall meet the requirements of AWWA C-900 or latest revisions thereof. PVC pipe must have a dimension ratio (DR) as shown on the plans or noted in special provision with outside diameters equivalent to cast iron pipe. All pipe furnished shall have a pressure class rating as shown on the plans or noted in special provisions at 73.4°F and shall bear the National Sanitation Foundation Seal of approval for potable water pipe. Provisions shall be made for contraction and expansion at each joint with a rubber ring type gasket in a thickened bell as part of each joint, or a separate double bell coupling. All joints shall be made using a non-toxic lubricant in accordance with manufacturer's recommendations.

W.7.5. POLYETHYLENE TUBING

All polyethylene (PE) tubing shall be high density, high molecular weight plastic tubing meeting ASTM D 2737; it shall be pressure rated at 200 psi working pressure and must bear the National Sanitation Foundation seal of approval for potable water service.

Materials: Polyethylene plastics shall be Designation PE3408 (Grade P34 with hydrostatic design stress of 800 psi).

Markings: Permanent marking on the tubing shall include the following at intervals of not more than 5 feet:

1. Nominal tubing size.
2. Type of plastic material, i.e., PE 3408.
3. Dimension Ratio (DR) and pressure rating in psi for water at 73.4 F (e.g., SDR-9, 200 psi).
4. ASTM D 2737 designation.
5. Manufacturer's name or trademark, code and seal of approval (NSF mark) of the National Sanitation Foundation.

Tube Size: PE tubing shall be standard copper tube size (CTS) outside diameter, with Standard Dimension Ratio (SDR) of 9.

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W.7.6. ORIGIN OF PIPE

All pipe shall be new and shall be manufactured within the Continental Limits of the United States of America, and shall be approved by Underwriters Laboratories, Inc. or Factory Mutual and acceptable to the Texas State Board of Insurance.

W.8.1. GATE VALVES

In general, all gate valves shall conform to the Standard Specifications for Gate Valves for Ordinary Water Works Service, AWWA C 515 or latest revision for valves up to 12", and AWWA C 500, or latest revision for sizes over 12", except for changes or additions specifically outlined as follows.

Valves shall have hub, flanged, or mechanical joint ends, or a combination of hub, flange, or mechanical joint ends as may be specified. Bell and spigot pipe sizes two (2") inch to twenty-four (24") inch will use valves with bells conforming to AWWA C 100.

Mechanical joint pipe sizes two (2") inch to thirty-six (36") inch will use valves with bells conforming to AWWA C 111. Flanged pipe will use valves with flanged ends conforming to ASA B 16.1 Class 125.

All gate valves shall be iron body, bronze mounted, resilient seat or double disc, parallel seat, non-rising stem, internal wedging type. Valves must embody the best workmanship and finish, and open and close freely and easily. In closing, the gates must move without friction to their position opposite their ports, both discs being then closed squarely against the seat rings. When valves are in full opened position, the discs shall be raised clear of the water way and provide an opening equal to the full normal diameter of the valve.

Gate valves shall be tested at a hydrostatic pressure of 400 psi and shall be guaranteed for 250 psi water working pressure. Any leakage at the pressures through any castings or between the bronze ring and the cast iron body shall cause the said casting or assembled fitting to be rejected. No plugging or patching to stop any leakage will be permitted.

The body, bonnet, and stuffing box shall be flanged together with ASTM A-307 Grade B bolts and nuts to insure reparability.

All gate valves shall open by turning to the left.

Gate valves two (2") inch to sixteen (16") inch, inclusive, shall be nut or handwheel operated, as shown on the plans. Gate valves twenty (20") inch and larger shall be equipped with wheels and nuts. Gate valves twenty (20") inch and larger shall be equipped with spur or beveled gears as indicated on the plans. All geared valves shall be equipped with extended type grease cases. Stuffing boxes shall be located on top of valve bonnet and shall be outside of the gear case. Gate valves eighteen (18") inch and larger shall be equipped with non-rising stem bypass valves, wheel and nut operated, of the following sizes:

- Gate valves 18" and 20" - 3" bypass
- Gate valves 24" and 30" - 4" bypass, stem 60,000

Gate valves 36" and 42" - 6" bypass, stem 80,000

All bronze metal used in the working parts of the valve, with the exception of the valve stem, shall have a tensile strength of 34,000 pounds per square inch.

Gate valves of the internal wedging type shall have solid wedges made of high grade bronze, having a tensile strength of at least 50,000 pounds per square inch, with wide bearing surfaces of sufficient thickness to guarantee no bending or denting under abnormal strain, and such bearing surfaces shall be ground to flat surfaces on each face. The wedges in valves twelve (12") inch and over may be trimmed with a heavy bronze mounting.

Gate valve stems or spindles shall be of high-tensile strength manganese bronze, or other non-corrodible metals which produce a valve stem or spindle having tensile properties at least equal to those of Class "A", Leaded High-Strength Yellow Brass (Manganese Bronze) Sand Castings, ASTM Designation B.132.

A thrust collar on the spindle shall be cast integral with the spindle. A spindle having a thrust collar fastened or upset by any mechanical means is not acceptable. (There shall be provided a stem collar bushing suitably machined, to permit repacking the valve when it is in full open position. The stuffing boxes and glands shall be bronze bushed). Stem seals shall be one "O" ring above and one stem "O" ring below the thrust collar forming a lubricant reservoir between to isolate and lubricate the thrust collar, bearing surfaces, and "O" rings. An anti-friction washer shall also be placed above the thrust collar to further accommodate operating torque.

All gray iron castings shall be made from superior quality iron, of touch and even grain, having a tensile strength of not less than 30,000 pounds per square inch, without blow or sand holes or defects of any kind.

Valve discs shall have an integrally cast ASTM B-62 bronze stem nut to provide disc rigidity and a positive travel stop to prevent over-compression of the resilient seat. The disc shall be open to flow on one side to prevent collection of corrosive products and debris.

The disc seat rings shall be molded natural rubber, internally steel reinforced, and shall seat against a machined, epoxy coated mating surface in the body of the valve. The disc seat rings shall be retained to the disc by self-setting type 304 stainless steel screws, making them replaceable.

All internal ferrous metal surfaces (machined or cast) shall be factory spray coated with two-component thermoset epoxy to a nominal thickness of 4 mils and the exterior shall be coated with asphalt varnish when underground and per Section PC when above ground.

All gate valves installed in horizontal position whose discs do not revolve shall be equipped with bronze tracks, rollers and scrapers. Valves installed flat in vertical lines shall be equipped with bronze shoes and slides.

The manufacturer shall be required to furnish the Owner with certified copies of the hydrostatic tests and physical test of all metals used in the manufacture of the valves.

Detail prints shall be furnished on all valves.

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Gate valves (including tapping sleeves and valves) shall be Mueller A-2362, or approved equal.

W.8.2. BUTTERFLY VALVES

Butterfly valves shall be of the full lug (water service) body style as noted on the plans. All valves shall be suitable for use with ANSI 125 pound flanges and meet the requirements of AWWA C-504. Bodies shall be cast or ductile iron.

Lug body valves shall have a retained seat and shall provide tight shutoff up to the full valve rating on dead end or isolation service without the use of downstream flanges.

All valves shall be furnished with self-lubricated bearings of TFE coated stainless steel. Shaft seals shall be provided to prevent leakage and to protect bearings from internal or external corrosion.

Seats shall be of the reinforced resilient type and shall be field replaceable. Seats shall also act as a body liner to prevent flow from contacting the body casting. Seats shall have flange sealing lips to provide a positive seal without use of flange gaskets.

Seats shall be of Neoprene for Water Service. Shafts shall be one piece and shall be of 316 stainless steel. Shaft diameter shall meet the 75B standard from AWWA specification C 504 for butterfly valves. Shafts shall be finish ground and polished to minimize bearing and shaft seal wear. Shafts of 8" and larger valves shall have a non-adjustable thrust collar.

Discs shall be bronze or semi-steel with welded nickel edge. The disc-to-shaft connections shall be type 306 stainless steel. Pins, shaft and disc of all valves shall be individually machined and completely interchangeable.

Valves shall be available with field interchangeable manual or powered actuators as required. The actuator-to-shaft connection shall be designed to shear and prevent internal valve damage if the disc closes on foreign material in the pipeline. All actuators shall provide external indication of disc position.

All manually actuated valves shall be operated using a cast iron housing designed for burial service with 2" square wrench nut actuator available in buriable construction. All units will have adjustable open and closed position stops with provision to prevent accidental adjustment changes. Operating shaft to be supported axially and radially at input end by permanently lubricated bronze thrust and sleeve bearings.

Valve and actuators shall be as manufactured by Mueller, DeZurik, American Darling or approve equal.

W.8.3. AIR VALVES

Air valves and vacuum valves, when shown on the plans or required, shall be the float and lever type, as is manufactured by CLA-VAL, Val-Matic, or equal. The inlet ends will be screwed for two (2) inch and smaller, and flanged for three (3") inch and larger.

W.8.4. BRASS VALVES

One and one-half (1-1/2") inch and two (2) inch brass valves, when shown on the plans or required, shall be of all brass construction with double discs, and parallel seats, and warranted for a water working pressure of 150 pounds per square inch.

They must be of non-shock type, with screw ends having internal standard pipe threads. They shall be fitted with a malleable iron operating wheel, and shall open by turning to the left.

W.8.5. INSTALLATION OF VALVES

All valves shall be installed as shown on the plans. For each valve the Contractor shall furnish and install a valve box, if necessary per the plans.

Valve boxes shall be three (3) piece screw type cast iron of the extension type and shall be similar to Mueller No. H-10360, Star Pipe Products VB562S, or an approved equal.

Valves shall be carefully handled and lowered into position in such a manner as to prevent damage to any parts of the valve.

Valves shall be placed in such positions as indicated on the plans with the stem in a vertical position and securely held until all connections have been made.

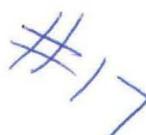
Valves and pipe fittings shall be set and jointed to new pipe in the manner herein specified for cleaning, laying, and jointing pipe. Hub ended valves shall be jointed to pipe only with lead joints. Flanged and mechanical joint valves will be preferred where suitable.

Cast iron valve boxes shall be firmly supported and maintained centered and plum over the wrench nut of the gate valve. The box cover shall be set flush with the surface of the ground or at such other level as may be directed.

W.9.1. FIRE HYDRANTS

Fire hydrants, when required and when shown on the plans, shall conform strictly to AWWA Specifications C-502 Fire Hydrants for Ordinary Water Works Service, with the following supplementary details and changes or additions:

1. Fire hydrants shall meet the requirements of the Texas State Board of Insurance.
2. Type of shut-off may be compression type with the flow or compression type against the flow.
3. Unless otherwise ordered inlet connection shall be six (6") inch standard mechanical joint hub, complete with all joint accessories. Inlet valve shall have not less than a five (5") inch opening.

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4. All hydrants shall be equipped with two (2) hose nozzles and one (1) pumper nozzle. The hose nozzles shall be two and one-half (2-1/2") inch nominal I.D. National Standard Thread. Pumper nozzle shall be four (4") inch nominal I.D. National Standard Thread.
 5. Unless otherwise required by pipe laying conditions, hydrants shall be furnished for a four (4') foot depth of trench.
 6. A drain opening will be required and drain valves operating through gravity will not be accepted.
 7. All fire hydrants shall open by turning to the left (counterclockwise).
 8. All fire hydrants shall be painted with two (2) coats of paint over one (1) shop coat. Color shall be silver upon approval from city.
 9. No hydrant will be accepted that requires less than twelve (12) turns to open.
 10. Hydrants shall be of the breakable type, designed to break approximately three (3") inches, but not over five (5") inches above the ground line. These parts shall be of the breakable flange type, or integral flange with sawed bolts. Breakable flanges screwed to the standpipe are not acceptable. Flanges shall be so designed that an end wrench can be used on the nuts and bolts. Provision shall be made in the design of the stem to disconnect the stem from the hydrant parts above the standpipe breakpoint in the event of traffic accident. If breakable or sleeve type couplings are used, they shall have sufficient torsional strength such that a torsional failure of the stem will occur at some point other than at the coupling. Design of the coupling shall be such that when the coupling is broken no parts will come loose and fall into the hydrant, and the break will not occur through the pins or bolts holding the coupling to the stem.
 11. All hydrants shall be capable of being extended to accommodate future grade changes.
 12. Main valve seats on compression type hydrants closing with the flow shall be of such design that incorrect positioning is impossible and that the threads will be adequately guided into position. Arrangements shall also be made to hold the main valve gasket in place during assembly.
 13. All packing gland nuts shall be bronze.
 14. Gaskets furnished for ground line flanges shall be full face or the flange shall be recessed to hold the gasket in place.
 15. Operating stems whose threads are located in the barrel or waterway shall be of manganese, bronze, everdur, or other high quality, non-corrodible metal, and all working parts in the waterway shall be bronze to bronze.

Operating stems whose threads are not located in the barrel or waterway may be made of high grade bronze, genuine wrought iron or steel, and stem nuts shall be bronze. Iron or steel stems shall have a bronze, stainless steel or other non-corrodible metal, sleeve where passing through stuffing box or O-rings. Operating threads must be sealed against contact with the water at all times regardless of open or closed position of the main valve.

16. O-rings may be furnished in lieu of packing. They shall be the double O-ring type, designed so that the rubber rings move against a bronze surface.
17. Hydrants closing with or against the pressure must have a bronze cap nut to seal the bottom end of stem threads against contact with water.
18. Hydrants must be so constructed that the nozzle may be faced in any direction.
19. No hydrant will be considered which has not been regularly manufactured and in successful continuous use for at least ten (10) years.
20. Hydrants shall be Mueller A423, or approved equal.

W.9.2. FIRE HYDRANT INSTALLATION

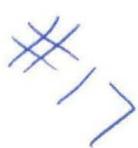
Fire hydrants shall be located as shown on the plans or as directed by the Engineer and shall be set truly vertical with the base resting upon a stone or concrete slab four (4") inches thick and approximately twelve (12") inches square. The base of the hydrant shall be surrounded by not less than two (2) cubic feet of clean crushed stone or gravel, size one (1") inch to two (2") inches. Pipe joints shall be made as specified for pipe laying. The hydrants shall be carefully and substantially blocked against firm trench walls with sound stone, sound slabs of old concrete or 2000 psi concrete, but no additional pay will be allowed for same.

W.10. INSPECTION

During the process of unloading, all pipe and accessories shall be inspected by the Contractor for loss or damage in transit. No shipment shall be accepted by the Contractor until notation of any lost or damaged material shall have been placed on the bill of lading by the agent of the carrier.

All pipe and accessories shall be laid, jointed, tested for defects and for leakage with pressure, and chlorinated in the manner herein specified in the presence of the Engineer or his authorized Inspector and subject to their approval.

All material found during the progress of the work to have cracks, flaws, or other defects will be rejected by the Engineer, and the Contractor shall promptly remove from the site of the work such defective material.



The Contractor shall be responsible for all material furnished to him or by him and shall replace at his own expense all such material that is found to be defective in manufacturing or that has become damaged in handling after delivery by the manufacturer. The Contractor shall be responsible for the safe storage of material furnished by or to him until it has been incorporated in the completed project.

Pipe fittings, valves and other accessories shall be unloaded at the point of delivery, hauled to, and distributed at the site of the project by the Contractor. They shall, at all times, be handled with care to avoid damage. In loading and unloading they shall be lifted by hoists, slid, or rolled on skidways in such a manner as to avoid shock. Under no circumstances shall they be dropped. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground.

In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pipe shall be handled in such a manner that a minimum amount of damage to the coating will result. Damaged coating shall be replaced in a manner satisfactory to the Engineer.

Pipe shall be placed on the site of the work parallel with the trench alignment and with bell ends facing the direction on which the work will proceed unless otherwise directed. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times.

W.11. PIPE HANDLING

Proper implements, tools, and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, and valves shall be carefully lowered into the trench piece by piece by means of derrick ropes or other suitable tools or equipment in such a manner as to prevent damage to pipe or pipe coating. Under no circumstances shall pipe or accessories be dropped into the trench.

At all times when pipe laying is not in progress, the open ends of the pipe shall be closed by approved means. No trench water shall be permitted to enter the pipe. All foreign matter or dirt shall be removed from the pipe, and it shall be kept clean by approved means during and after laying. No pipe shall be laid in water or when trench conditions are unsuitable for such work.

Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat workmanlike manner without damage to the pipe. Concrete pressure pipe shall not be cut on the job without the approval of the Engineer.

W.12.1. DUCTILE IRON PIPE LAYING AND JOINTING

The spigot shall be centered in the bell and the pipe forced "home" and brought into true alignment. Water lines shall be laid such that the full length of the barrel of the pipe shall rest on undisturbed or compacted fill or gravel cushion for the entire length of the joint of pipe except at bell holes, to insure that there is no beam action of the pipe. It shall be secured

there with earth carefully tamped under and on each side of it, excepting at the bell holes. Care shall be taken to prevent dirt from entering the joint space. No blocking up of the pipe or joints will be permitted. Whenever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to make small angles in alignment to avoid obstructions, to plumb stems, or for other reasons, the degree of deflection shall not exceed that shown by the Handbook of the Cast Iron Research Association.

Although the above section applies primarily to bell and spigot pipe, all applicable portions apply as well to "Tyton", "Bell-tite", or "Fastite" and mechanical joint pipe.

W.12.2 JOINTING PIPE

Materials: All component parts are to be furnished with and included in the price bid for pipe. The materials consist of a circular rubber gasket of modified bulb shape in cross section.

Procedure: Remove any foreign matter in the gasket seat of the socket, wipe gasket clean, flex gasket and place in socket with the large round end or bulb end entering first. Seat gasket evenly around inside of the socket with the groove fitted over the bead. Remove any bulges. Apply a thin film of lubricant furnished by the pipe manufacturer to the inside surface of gasket. No lubricant other than that furnished with the pipe by the pipe manufacturer will be allowed to be used. Wipe plain end of pipe to be entered, clean and place in approximate alignment with the bell of the pipe to which it is to be joined. Apply a thin film of the lubricant to the outside of the plain end for about one (1") inch back from the end. Align the pipe and carefully enter the plain end into the socket until it just makes contact with the gasket. Complete joint assembly by forcing the plain end of the entering pipe past the gasket until it makes contact with the bottom of the socket. For pipe in sizes 10" and larger, a jack-type tool will be used to make up the joint and complete the assembly of the joint in forcing the plain end of the pipe past the gasket.

Deflection of Joints: The maximum deflection at each joint will not exceed 5 degrees for sizes through 12", 4 degrees for 14" and 16", and 3 degrees for 18", 20" and 24" pipe sizes. If a profile is shown on the plans, the Contractor will be required to lay the line to conform to the grades shown. If it is necessary that water line shall have over 42 inches of cover in order not to exceed the manufacturer's recommendations for deflection of the pipe, the Contractor shall excavate the ditch with no extra compensation. Regardless of the depth of ditch necessary, the Contractor shall, under no condition, exceed the manufacturer's recommendations for deflection of the pipe at joints. The Contractor will receive no extra compensation for extra depth necessary to cross existing utility lines.

Attention is called to the fact that concrete cylinder pipe must be laid on grade to insure proper jointing of the pipe. The grades will be determined in such a manner so as to avoid excessive use of fittings and specials and to provide a uniform grade between low points and high points. No additional compensation will be paid for extra trench depth required, to meet these conditions. Any differences of opinions concerning the grades as set by the Engineer must be resolved by the Contractor prior to pipe laying.

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W.12.3. CONCRETE BACKING

Concrete having compressive strength of not less than 2000 pounds per square inch shall be used as a cradle or backing where shown on the plans or where directed by the Engineer. All materials including aggregates, cement, and water, as well as the mixing and placing of the concrete, shall be approved by the Engineer. Bends of twenty-two and one-half (22-1/2) degrees and greater, plugs, and all tees, crosses, etc. shall be placed between solid ground and the fitting to be anchored; the area of bearing on pipe and on ground in each instance shall be that required by the Engineer. The backing shall, unless otherwise directed, be placed so that the pipe and fitting joints will be accessible for repair.

Concrete shall be composed of normal Portland Cement, coarse aggregate, fine aggregate, and water proportioned and mixed properly in a concrete mixer. Transit mix concrete will be allowed. Portland Cement shall be Type 1 and shall be fully protected until incorporated in this work. Gravel to be used for coarse aggregate shall consist of clean hard, durable grains, and shall be free from an excess of salt or alkali and foreign materials. Concrete shall have a compressive strength of not less than 2000 pounds per square inch at twenty-eight (28) days and shall not have less than three (3) sacks of cement nor more than six and three-quarters (6-3/4) gallons of water per cubic yard of concrete.

W.13.1. SERVICE CONNECTIONS

Water service connections shall be made by tapping the mains at specific points as designated by the Engineer. Service taps shall be made after the mains have been laid. The work shall be done by experienced workmen with suitable tapping machine and tools.

The PVC (as called for on the plans) service pipe shall be connected to the corporation cock at the main and laid in the trench from one side to the other every ten (10') feet to give ample space for expansion and contraction of the pipe. The service pipe shall have a cover of twenty-four (24") inches, except where the service pipe shall pass under the curb. At this point the service pipe shall be a minimum of eighteen (18") inches under the top of the curb or a minimum of six (6") inches under the bottom of the curb and gutter section. Excessive bending of the pipe which will injure or reduce the cross sectional area of the pipe will not be permitted. The length of the service line shall extend from the mains to a point two (2') feet back of the street curb where curb exists, or to the property line if no curb exists. If there is a curb, the curb shall be marked with the letter "W" in good quality blue paint at the point where the service pipe passed under the curb.

W.13.2. SERVICE CONNECTION MATERIALS

Tapping service saddle shall be 3/4" Mueller BR2S double stainless steel straps CC thread, or pre-approved equal. Epoxy-coated cast iron saddle is acceptable.

Compression corporation stops shall be 3/4" (1-1/2" for dual meters) Mueller H-15006N, or pre-approved equal, with Mueller CC threaded tapering inlet and Insta-tite connection for CTS PE pipe on the outlet.

The service pipe shall normally be 3/4-inch polyethylene (PE) tubing meeting ASTM D 2737; it shall be pressure rated at 200 psi working pressure and must bear the National Sanitation Foundation seal of approval for potable water service. Polyethylene plastics shall be Designation PE3408 (Grade P34 with hydrostatic design stress of 800 psi). PE tubing shall be standard copper tube size (CTS) outside diameter, with Standard Dimension Ratio (SDR) of 9.

Meter valve in meter box shall be 3/4" Ford Straight Ball Meter Valve B43-332W-G-NL, or approved equal.

Water meters shall be 5/8" x 3/4" Neptune T-10 direct read, or pre-approved equal.

Water meter boxes shall be provided with each water meter and shall be of black plastic design DFW Alliance DFW1200-12, or approved equal, for a 3/4" water meter.

W.14. CONNECTION TO EXISTING WATER MAINS

Where indicated on the plans and/or hereinafter specified, the Contractor shall connect the new main with existing mains or lines. The Contractor shall furnish all labor, materials, equipment or services required for the locating and uncovering of the existing line, the making of cuts in the existing line, the removal, relocation, and lowering of existing lines as required, dewatering of the trench, connecting of the existing line into the new main and any and all appurtenant work required for a complete connection. Relocated mains or lines shall be laid so that all valves so relocated or installed shall be set vertically.

Only such connections to existing mains as are necessary to load, test and sterilize mains under construction with water from city mains will be permitted prior to the sterilization of new mains. All other connections to existing mains from a new main being constructed shall be made only after the new main has been adequately and satisfactorily sterilized and the Engineer or his inspector has authorized the connections to be made. Contractors will be required to plug and block lines, crosses, tees or other fittings installed in the new main to permit testing and sterilization prior to the making of connections. Such plugs and blocking shall be adequate to withstand a test pressure of 150 pounds per square inch.

Where cut-ins are made immediately adjacent to valves which are under pressure, the Contractor shall take all necessary precautions to brace such valves with temporary blocking and bracing which shall be of ample size and properly placed to prevent movement or blowing off of any pipe, valves or fittings due to water pressure on the main.

Connections to existing water mains shall be made at the locations shown, as specified, and/or as directed by the Engineer. All such connections shall be made in a most expeditious and workmanlike manner to cause the least inconvenience to water customers and to traffic and shall be made at night unless otherwise approved by the Engineer. The detailed schedule of operations for making each connection shall be approved by the Engineer or his inspector before any work thereupon is commenced.

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W.15. HYDROSTATIC TEST

After the pipe has been laid and backfilled but prior to replacement of pavement each valved section of newly laid pipe shall be subjected to a hydrostatic pressure test. For any section being tested the pressure applied shall be such that at the highest point in the section the pressure shall be 127.5 pounds per square inch. Adjustment as required shall be made for differential in elevation between the low point of the section being tested and the centerline of the pressure test gauge. The maximum pressure shall be 180 psi at the lowest point.

Each valved section of pipe shall be slowly filled with water, and the specified test pressure measured to the point of lowest elevation, shall be supplied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, and all necessary apparatus including gauges and meters shall be furnished by the Contractor. The Owner will furnish water for filling lines and making tests through existing mains.

The duration of each pressure test shall be four (4) hours. Before applying the specified test pressure all air shall be expelled from the pipe. To accomplish this taps shall be made, if necessary, at the points of highest elevation and afterwards tightly plugged. At intervals during the test the entire route of the pipe line shall be inspected to locate any leaks or breaks. Any defective joints, cracked or defective pipe, fittings, or valves discovered in consequence of this pressure test shall be removed and replaced with sound material in the manner provided, and the test shall be repeated until satisfactory results are obtained.

Allowable hydrostatic leakage rates must comply with the following formula:

$$L = \frac{ND(P^{1/2})}{7,400}$$

Where: L = Allowable leakage, gph
N = Number of joints in the length of pipeline tested
D = Nominal diameter of the pipe, in.
P = Average test pressure during the leakage test, psig (150 to 180 psig)

Should any test of pipe in place 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.

Leakage is defined as the quantity of water supplied into the newly laid pipe, or any valved section of it, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

W.16. STERILIZATION OF WATER MAINS

During the construction operations workmen shall be required to use utmost care to see that parts of the structures, inside of pipes, fittings, jointing materials, valves, etc., the surface of which come in contact with City water are maintained in a sanitary condition.

Every effort must be made to keep the inside of the pipe, fittings and valves free of all foreign matter, sticks, dirt, rocks, etc. As each joint of pipe is being laid it must be effectively swabbed so that all foreign matter is removed. All fittings and exposed open ends of pipe must be blocked or capped until the line is completed.

When the entire pipe line or certain selected sections thereof have been completed, tested and made ready for turning over to the Owner ready for use, the line or section of line shall be thoroughly sterilized according to AWWA C-651 and the following procedure:

1. The line shall be flushed out, completely replacing its entire volume with water from the Owner's mains.
2. Chlorine will be injected into the section of line being sterilized so that its entire capacity will be filled with water containing chlorine in the amount of fifty (50) p.p.m. or in such other quantity as determined by the Engineer. The sterilizing agent shall be introduced at one end of the section and the water released from the opposite end until the sterilizing agent is present at the discharge end in such quantity as to indicate a residual-chlorine of fifty (50) p.p.m. or as otherwise determined by the Engineer. All valves shall be opened and closed several times and the sterilizing solution permitted to remain in the pipe line section for not less than twenty-four (24) hours.
3. At the end of the sterilizing period the sterilizing solution shall be discharged from the pipe and replaced with water direct from a main of the Owner.
4. A sample of water from the sterilized main shall be taken every 1,000 feet in accordance with TCEQ Chapter 290.44(f)(3) from a suitable tap (not through a fire hydrant) under the supervision of the Engineer or his Inspector and submitted to an approved testing laboratory or the State Health Department for analysis. If the test shows a satisfactory quality of water, the line so sterilized shall then be placed in service by the Contractor who shall notify and assist the Water Superintendent in location and operation of all valves installed by the Contractor. If the sample shows unsatisfactory quality of water, the process of sterilization shall be repeated until a satisfactory water is obtained.

Sterilization of the line or any section thereof shall not be commenced until the Engineer's approval of the method, apparatus, sterilizing agent, and the section of the line has been obtained.

W.17. DECHLORINATION

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The Contractor shall dechlorinate the discharge water when flushing the lines in accordance with AWWA C651-99.

W.18. CLEAN-UP

During construction the Contractor shall maintain the premises in an orderly, neat, and presentable manner. Scraps and debris shall not be left scattered but shall be assembled together and such as are unusable shall be moved from the premises or disposed of to the satisfaction of the Engineer. When construction of the contract has been otherwise completed, the Contractor shall remove all left over construction materials, equipment, scraps, debris, and rubbish. Earthwork shall be smoothed and graded to the lines shown on the plans. Backfill over all trenches shall be left in a uniform and neat condition.

W.19. MEASUREMENT AND PAYMENT

The bid items include the work of every nature required for the completion of the job in every respect except as may be otherwise provided for in these specifications. The Contractor shall include the furnishing of all materials and labor, including any incidental labor, in his bid prices.

Pipe: Pipe will be measured from center of fitting to center of fitting or end of pipe without any deduction for the length of intermediate fittings or valves. Payment will be made at the price bid per foot for furnishing and installing pipe, which bid price will include all costs for the complete pipe installation, including trenching and backfill, and shall include all work not otherwise provided for in these specifications.

Fittings: Payment for fittings will be at the unit price per ton bid for such work. This shall include the furnishing and installation of the fitting. This unit price shall also include the cost of concrete backing or blocking. Weight shall be determined from the manufacturer's catalogs. No separate payment will be made for galvanized pipe fittings. If mechanical joint fittings are used, payment will be based on weights of mechanical joint fittings and joint accessories.

Gate valves and tapping sleeves and valves will be paid for at the unit price bid for each, which price shall include the cost of the valve or tapping sleeve and valve, as well as the valve box and labor complete in place.

Fire Hydrants: Payment for the furnishing and installing of fire hydrants will be made at the unit price bid, complete in place.

Connections to Existing Mains: Payment for valves, fittings, pipe, etc., will be made at the unit price bid for the various items. No additional payment will be made for "WET" connections, but a lump sum will be paid for each "DRY" connection made as specified in these specifications.

Concrete Backing: No separate payment will be made for concrete backing or blocking of fittings, valves, etc. The Contractor shall include such costs in the price bid for setting fittings, valves, etc.

Hydrostatic Test: No separate payment will be made for the hydrostatic test. The cost of the test shall be included in the bid price for pipe in place.

Sterilizing: No separate payment will be made for sterilizing the main. The cost of such work shall be included in the price bid for pipe in place.

Water Services: Water services will be paid for as a lump sum bid for each water service connection. The lump sum will include tapping the main, furnishing and installing the corporation stop, and the copper service line necessary to connect to the existing water service.

W.20. SANITARY SEWER AND WATER MAIN SEPARATION DISTANCES

The following separation distances shall be maintained between potable water and wastewater treatment plants, and waterlines and sanitary sewers.

Water lines and sanitary sewers shall be installed no closer to each other than 9 feet from outside of pipe to outside of pipe in all directions. Water lines and sanitary sewers that parallel each other must be installed in separate trenches. No physical connection shall be made between a drinking water supply, public or private, and a sanitary sewer or any appurtenances. Any facilities for permitting discharge of drinking water into the sewer or any appurtenance thereof shall be constructed to prevent any possibility of sewage entering the drinking water system.

Where the nine foot separation distance cannot be achieved, the following guidelines will apply:

New waterline installation - parallel lines.

1. Where a new potable waterline parallels an existing, non-pressure or pressure rated wastewater main or lateral and the licensed professional engineer licensed in the State of Texas is able to determine that the existing wastewater main or lateral is not leaking, the new potable waterline shall be located at least two feet above the existing wastewater main or lateral, measured vertically, and at least four feet away, measured horizontally, from the existing wastewater main or lateral. Every effort shall be exerted not to disturb the bedding and backfill of the existing wastewater main or lateral.
2. Where a new potable waterline parallels an existing pressure-rated wastewater main or lateral and it cannot be determined by the licensed professional engineer if the existing line is leaking, the existing wastewater main or lateral shall be replaced with at least 150 psi pressure-rated pipe. The new potable waterline shall be located at least two feet above the new wastewater line, measured vertically, and at least four feet

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away, measured horizontally, from the replaced wastewater main or lateral.

3. Where a new potable waterline parallels a new wastewater main, the wastewater main or lateral shall be constructed of at least 150 psi pressure-rated pipe. The new potable waterline shall be located at least two feet above the wastewater main or lateral, measured vertically, and at least four feet away, measured horizontally, from the wastewater main or lateral.

New waterline installation - crossing lines.

1. Where a new potable waterline crosses above a wastewater main or lateral, the segment of the waterline pipe shall be centered over and must be perpendicular to the wastewater main or lateral such that the joints of the waterline pipe are equidistant and at least nine feet horizontally from the centerline of the wastewater main or lateral. When crossing an existing Texas Commission on Environmental Quality Page 74 Chapter 290 - Public Drinking Water wastewater main or lateral and it is disturbed or shows signs of leaking, the wastewater main or lateral shall be replaced for at least nine feet in both directions (18 feet total) with at least 150 psi pressure-rated pipe embedded in cement stabilized sand (see clause (v) of this subparagraph) for the total length of one pipe segment plus 12 inches beyond the joint on each end.
 - a. The potable waterline shall be at least two feet above an existing, non-pressure rated wastewater main or lateral.
 - b. The potable waterline shall be at least six inches above an existing, pressure-rated wastewater main or lateral.
2. Where a new potable waterline crosses a new, non-pressure rated wastewater main or lateral, the segment of the waterline pipe shall be centered over and shall be perpendicular to the wastewater main or lateral such that the joints of the waterline pipe are equidistant and at least nine feet horizontally from the centerline of the wastewater main or lateral. The potable waterline shall be at least two feet above the wastewater main or lateral. Whenever possible, the crossing shall be centered between the joints of the wastewater main or lateral. The wastewater pipe shall have a minimum pipe stiffness of 115 psi at 5.0% deflection. The wastewater main or lateral shall be embedded in cement stabilized sand (see clause (v) of this subparagraph) for the total length of one pipe segment plus 12 inches beyond the joint on each end. The materials and method of installation shall conform to one of the following options:
 - a. Within nine feet horizontally of either side of the waterline, the wastewater pipe and joints shall be constructed with pipe material having a minimum pressure rating of at least 150 psi. An absolute minimum vertical separation distance of two feet shall be provided.

The wastewater main or lateral shall be located below the waterline.

- b. All sections of wastewater main or lateral within nine feet horizontally of the waterline shall be encased in an 18-foot (or longer) section of pipe. Flexible encasing pipe shall have a minimum pipe stiffness of 115 psi at 5.0% deflection. The encasing pipe shall be centered on the waterline and shall be at least two nominal pipe diameters larger than the wastewater main or lateral. The space around the carrier pipe shall be supported at five-foot (or less) intervals with spacers or be filled to the springline with washed sand. Each end of the casing shall be sealed with watertight non-shrink cement grout or a manufactured watertight seal. An absolute minimum separation distance of six inches between the encasement pipe and the waterline shall be provided. The wastewater line shall be located below the waterline.
3. When a new waterline crosses under a wastewater main or lateral, the waterline shall be encased as described for wastewater mains Texas Commission on Environmental Quality Page 75 Chapter 290 - Public Drinking Water or laterals in clause (ii) of this subparagraph or constructed of ductile iron or steel pipe with mechanical or welded joints as appropriate. An absolute minimum separation distance of one foot between the waterline and the wastewater main or lateral shall be provided. When a new waterline crosses under a wastewater main, the procedures in §217.53(d) of this title (relating to Pipe Design) must be followed.
4. Where a new potable waterline crosses a new, pressure rated wastewater main or lateral, one segment of the waterline pipe shall be centered over and shall be perpendicular to the wastewater line such that the joints of the waterline pipe are equidistant and at least nine feet horizontally from the center line of the wastewater main or lateral. The potable waterline shall be at least six inches above the wastewater main or lateral. Whenever possible, the crossing shall be centered between the joints of the wastewater main or lateral. The wastewater pipe shall have a minimum pressure rating of at least 150 psi. The wastewater main or lateral shall be embedded in cement stabilized sand (see clause (v) of this subparagraph) for the total length of one pipe segment plus 12 inches beyond the joint on each end.
5. Where cement stabilized sand bedding is required, the cement stabilized sand shall have a minimum of 10% cement per cubic yard of cement stabilized sand mixture, based on loose dry weight volume (at least 2.5 bags of cement per cubic yard of mixture). The cement stabilized sand bedding shall be a minimum of six inches above and four inches below the wastewater main or lateral. The use of brown coloring in cement stabilized sand for wastewater main or lateral bedding is recommended for the

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identification of pressure rated wastewater mains during future construction.

Waterline and wastewater main manhole or lateral manhole or cleanout separation. The separation distance from a potable waterline to a wastewater main manhole or lateral manhole or cleanout shall be a minimum of nine feet. Where the nine-foot separation distance cannot be achieved, the potable waterline shall be encased in a joint of at least 150 psi pressure class pipe at least 18 feet long and two nominal sizes larger than the new conveyance. The space around the carrier pipe shall be supported at five-foot intervals with spacers or be filled to the springline with washed sand. The encasement pipe shall be centered on the crossing and both ends sealed with cement grout or manufactured sealant.

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SECTION TW
CONDUCTIVE TRACE WIRE

TW.1. GENERAL

Install electrically continuous trace wire with access points as described herein to be used for locating pipe with an electronic pipe locator after installation.

TW.2. SUBMITTALS

Submit manufacturer's data on materials furnished that indicate compliance with the specifications regarding materials used.

Indicate on as-builts location of each trace wire test station.

TW.3. MATERIALS

Trace wire to be fourteen (14) gauge minimum solid copper with thermoplastic insulation recommended for direct burial. Wire connectors to be 3M DBR, or approved equal, and shall be watertight to provide electrical continuity.

TW.4. TESTING REQUIREMENTS

Contractor shall perform a continuity test on all trace wire in the presence of the Engineer or the Engineers' representative. If the trace wire is found to be not continuous after testing, Contractor shall repair or replace the failed segment of the wire.

TW.5. INSTALLATION

Trace wire shall be installed on all water mains. The wire shall be installed in such a manner as to be able to properly trace all water mains without loss or deterioration of signal or without the transmitted signal migrating off the trace wire.

Trace wire shall be installed in the same trench and inside bored holes and casing with pipe during pipe installation. It shall be secured to the pipe as required to insure that the wire remains adjacent to the pipe. The trace wire shall be securely bonded together at all wire joints with an approved watertight connector to provide electrical continuity, and it shall be accessible at all trace wire access points.

Trace wire access points shall in general be no more than five-hundred (500) feet and at every proposed 24" x 24" x 6" concrete valve box collar. Concentrations of multiple proposed valves near pipe intersections, i.e. tees or crosses, may require more than one access point assembly

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in each concrete valve box collar. Trace wire access points shall be within public right-of-way or public utility easements.

At the point of connection between cast or ductile iron water mains, with any non-iron water main, the trace wire shall be properly connected to the iron pipe with a cad weld or approved equivalent. Trace wire welds shall be completely sealed with the use of an approved mastic type sealer specifically manufactured for underground use. Mastic shall be applied in a thick coat a minimum of 2 inches thick and shall be protected from contamination by the backfill material with the use of a plastic membrane.

Trace wire shall be laid flat and securely affixed to the pipe at 10 foot intervals. The wire shall be protected from damage during the execution of the work. No breaks or cuts in the trace wire or trace wire insulation shall be permitted. At water service saddles, the trace wire shall not be allowed to be placed between the saddle and the water main.

Except for approved spliced-in connections, trace wire shall be continuous and without splices from each trace wire access point. Where any approved spliced-in connections occur, 3M DBR water tight connectors, or approved equal, shall be used to provide electrical continuity.

At all water main end caps, a minimum of 6 feet of trace wire shall be extended beyond the end of the pipe, coiled and secured for future connections. The end of the trace wire shall be spliced to the wire of a six pound zinc anode and is to be buried at the same elevations as the water main.

For directional drilling, auguring or boring installations, four #14 trace wires shall be installed with the pipe and connected to the trace wire at both ends, or cad welded to the existing iron pipe at both ends.

Spliced connections between the main line trace wire and branch connection trace wire shall only be allowed at water main tees, crosses or at iron or copper water services where a portion of the branch connection water main or water service is replaced with a non-iron or non-copper material. The branch connection trace wire shall be a single trace wire properly spliced to the main line trace wire. Where the existing branch connection is neither iron nor copper, then the new branch connection trace wire shall be properly spliced to the existing trace wire on the branch connection.

At all repair locations where there is existing trace wire, the trace wire shall be properly reconnected and spliced as outlined above.

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SECTION SWP3

STORM WATER POLLUTION PREVENTION PLAN

SWP3.1 PREPARATION AND NOTIFICATION PHASE

A. Storm Water Pollution Prevention Plan

The Contractor shall be responsible for preparation of the Storm Water Pollution Prevention Plan (SWP3). The Contractor may incorporate as a part of the SWP3 the erosion control details and notes which are included in the project plan set. The SWP3 shall include all elements required by TPDES General Permit No. TXR150000 as issued by the Texas Commission on Environmental Quality, effective date, March 5, 2008. The SWP3 must be retained on-site at all times during the construction of the project. The Contractor shall complete the document in Attachment 1 and insert into the SWP3.

B. Notice of Intent and Construction Site Notice

The Contractor shall submit a Notice of Intent (NOI) to the Texas Commission on Environmental Quality. The application fee and annual Water Quality Fee shall be paid for by the Contractor. A Construction Site Notice and NOI are required for areas where the land disturbed is equal to or greater than five (5) acres. For disturbed areas where the acreage is between one (1) and five (5) acres, only a Construction Site Notice is required. A copy of the NOI (and/or Construction Site Notice) shall be given to the County. Both forms shall be posted at the project site in a location where it is readily available for viewing by the general public, local, state, and federal authorities.

An Authorized Representative of the Contractor shall sign the NOI and/or Construction Site Notice, and Attachment 1. The authorized representative must be someone at or near the top of the management chain, such as the president, vice president, or a general partner, who has been delegated the authority to sign and certify this type of document. See 30 TAC, 305.44 of the TCEQ Rules and Regulations for requirements related to Application for Permit.

A NOI must be postmarked at least seven (7) days before construction begins. If the NOI form is submitted electronically via the STEERS Program, construction may begin the same day as the NOI is submitted.

SWP3.2 CONSTRUCTION/IMPLEMENTATION PHASE

Once the NOI has been mailed, the Contractor may start construction of the project as early as seven (7) days after the NOI is postmarked, or immediately if the NOI is submitted electronically through STEERS. The Contractor must: (a) implement the controls, (b) inspect and maintain the controls, (c) maintain records of construction activities, (d) update/change the plan to keep it current, and (e) have plans accessible as outlined in the SWP3.

A. Implement Controls

The first action that should be taken is to construct or perform the controls that were selected for the SWP3. The controls must be installed and/or constructed in the order indicated in the sequence of major activities. Stabilization measures must be applied within the time frame specified in the permit.

To ensure that controls are adequately implemented, it is important that the work crews who install the measures are experienced and/or adequately trained. Improperly installed controls can have little or no effect and may actually increase the pollution of storm water. It is also important that all other workers on the construction site be made aware of the controls so that they do not inadvertently disturb or remove them.

B. Inspect and Maintain Controls

Inspection and maintenance of the protective measures that are part of this plan are as important to pollution prevention as proper planning, design/selection, and installation. The Contractor shall provide for the systematic inspection of the SWP3 Controls.

Inspection - Inspection shall be at least every 14 days and within 24 hours after the end of a storm of 0.5 inches or more, or every seven days. All disturbed areas of the site, areas for material storage, locations where vehicles enter or exit the site, and all of the erosion and sediment controls that were identified as part of the plan must be inspected. Controls must be in good operating condition until the area they protect has been completely stabilized and the construction activity is complete. The inspector for the Contractor shall sign all inspection reports.

Maintenance/repairs - The inspector must record any damages or deficiencies in the control measures on an inspection report form provided for this purpose. These reports document the maintenance and repair and to prove that inspection and maintenance were performed. The Contractor should correct damages or deficiencies as soon as practicable after the inspection but in no case later than seven (7) days after the inspection. Any changes that may be required to correct deficiencies in the SWP3 should also be completed and dated in the document as soon as practicable after the inspection but in no case later than seven (7) days after the inspection.

C. Maintain Records of Construction Activities

In addition to the inspection and maintenance reports, the inspector shall keep records of the construction activity on the site. In particular, the inspector shall keep a record of the following information:

- The dates when major grading activities occur in a particular area.
- The dates when construction activities cease in an area, temporarily or permanently.
- The dates when an area is stabilized, temporarily or permanently.

These records can be used to make sure that areas where there is no construction activity will be stabilized within the required time frame.

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D. Update/Change the Plan

For a construction activity to be in full compliance with its TPDES Construction General Permit, and for the SWP3 to be effective, the plan must accurately reflect site features and operations. When it does not, the plan must be changed. The plan must also be changed if the operators observe that it is not effective in minimizing pollutant discharge from the site.

E. Provide for Plan Location and Access

The General Permit has specific requirements regarding plan location and access.

Plan location - A copy of the SWP3 must be kept at the construction site from the time construction begins until the site is finally stabilized.

Access - Although plans and associated records are not necessarily required to be submitted to the State, these documents must be made available upon request to the State or local agency who is approving erosion and sediment control plans, or storm water pollution prevention plans. If site storm water runoff is discharged to a municipal separate storm sewer system, the plans must be made available upon request to the municipal operator of the system.

SWP3.3 FINAL STABILIZATION/TERMINATION PHASE

Operators of a construction site must continue to comply with permit conditions until: (1) they no longer meet the definition of an Operator of a construction site; or (2) the construction activity is complete, all disturbed soils have been finally stabilized, and temporary erosion and sediment controls have been or will be removed. A permittee should submit a Notice of Termination (NOT) to inform TCEQ that he/she is no longer an Operator of the construction activity.

A. Final Stabilization

Final stabilization is defined by the General Permit as meaning that all soil disturbing activities at the site have been completed, and that a uniform perennial vegetative cover with a density of 70 percent of the native background vegetated cover (ie, original conditions) for unpaved areas not covered by permanent structures has been established or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed.

B. Notice of Termination

A NOT should be completed and submitted to TCEQ and the County when the site has been finally stabilized or when an Operator of a construction activity changes. Information to be included on the NOT includes the location of the construction site; the name, address, and telephone number of the Operator terminating coverage; the TPDES General Permit number; an indication of why coverage under the permit should be terminated for the Operator; and a signed certification statement.

Note that when there is a change in operators of a construction activity, the new Operator must submit a NOI to be covered by the permit at least seven (7) days before the change in Operator.

C. Record Retention

Following the termination of construction activities, the permittees must keep a copy of the SWP3, all reports and actions required by the General Permit, and all the data used to complete the NOI for a period of at least three years following final stabilization. Prior to submitting the NOT, the Contractor will furnish the County copies of all NOIs, certificates, and inspection forms for record retention purposes.

SWP3.4 MEASUREMENT

The erosion control items to be measured shall be the items listed in the Proposal Section of this Project Manual. All other erosion, sediment and water pollution control devices and measures required, both temporary and permanent, shall be considered subsidiary to the bid item "Storm Water Pollution Prevention Plan" and no direct measurement will be made. Preparation and updating of the "Storm Water Pollution Prevention Plan" including all reports and records to be maintained shall not be measured, but shall be considered subsidiary to the bid item "Storm Water Pollution Prevention Plan".

SWP3.5 PAYMENT

The erosion control items to be measured shall be paid for at the unit price bid per unit as stated in the Proposal section of this Project Manual. The unit price will be full compensation for furnishing all labor, materials and equipment necessary to install, maintain, and remove (if required) the erosion control items.

All other erosion, sediment and water pollution control devices and measures required, both temporary and permanent, shall be bid as a lump sum price for the bid item "Storm Water Pollution Prevention Plan". Preparation and updating of the "Storm Water Pollution Prevention Plan" including all reports and records to be maintained shall be included in the lump sum price for the bid item "Storm Water Pollution Prevention Plan". The lump sum bid price for the "Storm Water Pollution Prevention Plan" will be full compensation for furnishing all labor, materials and equipment necessary to install, maintain, and remove (if required) all items and actions necessary to maintain and complete the "Storm Water Pollution Prevention Plan" requirements for this project.

Costs for the Contractor's Application Fee for the NOI and the annual Water Quality Fee shall be included in the lump sum bid for the "Storm Water Pollution Prevention Plan".

Costs for personnel to inspect the protective measures that are a part of the "Storm Water Pollution Prevention Plan" shall be included in the lump sum bid for the "Storm Water Pollution Prevention Plan".

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Pollution control measures may be applicable to Contractor operations outside the right of way and easement area where such work is necessary as a result of roadway related construction such as construction and haul roads, field offices, equipment and supply areas, and material sources. Pollution control measures outside the right of way will not be measured for payment but shall be performed at the Contractor's expense.

SWP3-5

ATTACHMENT 1

**Storm Water Pollution Prevention Plan
Roles and Responsibilities**

SWP3-6

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**STORM WATER POLLUTION PREVENTION PLAN
ROLES AND RESPONSIBILITIES**

This is a shared Storm Water Pollution Prevention Plan (SWP3) between the below Primary Operators. The role of each Operator is listed below.

PRIMARY OPERATOR (COUNTY):

SIGNATURE: _____
PRINTED NAME: _____
ADDRESS: _____

RESPONSIBILITIES:

- Operational control over plans and specifications, including the ability to make modifications to those plans.
- Day-to-day operational control of activities necessary to ensure compliance with the SWP3 for the site.

PRIMARY OPERATOR (CONTRACTOR):

SIGNATURE: _____
PRINTED NAME: _____
ADDRESS: _____

RESPONSIBILITIES:

- Operational control over plans and specifications, including the ability to make modifications to those plans.
- Day-to-day operational control of activities necessary to ensure compliance with the SWP3 for the site.

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SECTION HY
HYDROMULCHING

HY.1. SCOPE

This item shall consist of sowing of seeds, fertilizing, mulching with cellulose fiber and other management practices along and across such areas as are indicated or as directed by the Engineer.

HY.2. MATERIALS

All seed must meet the requirements of the Texas Seed Law including the labeling requirements for showing pure live seed (PLS), name and type of seed. Seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within nine months of the time of delivery to the project. Each variety of seed shall be furnished and delivered in separate bags or containers. A sample of each variety of seed shall be furnished for analysis and testing when directed by the Engineer. The amount of seed planted per acre shall be of the type specified below.

Water shall be clean and free of industrial wastes and other substances harmful to the growth of grass or the area irrigated.

The fertilizer used shall have an analysis of 13-13-13.

Cellulose Fiber Mulch shall be natural cellulose fiber much produced from grinding clean whole wood chips. The mulch shall be designed for use in conventional mechanical planting, hydraulic planting of seed or hydraulic mulching of grass seed, either alone or with fertilizers and other additives. The mulch shall be such that, when applied, the material shall form a strong, moisture-retaining mat without need of an asphalt binder.

HY.3. SEEDING

The seed bed shall be previously prepared as specified and hydraulic planting, which is capable of placing all material in a single operation, shall be used.

March 1 to September 15 C Hydraulic planting mixture and minimum rate of application per 1,000 square feet:

Hulled Bermuda Seed (PLS=0.83)	Water Soluble Fertilizer	Natural Wood Fiber Mulch	Soil Tackifier
1 lb.	15 lb.	45.9 lb.	1.4 lb.

September 15 to March 1 C Add 7 pounds per 1,000 square feet of winter rye with a PLS=0.83 to above mixture.

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HY.4. MEASUREMENT

Measurement will be by the square yard of surface area as shown on the plans.

HY.5. PAYMENT

The work performed and materials furnished, as prescribed by this item, and measured as provided under Measurement, will be paid for at the unit price per square yard. This price is full compensation for furnishing materials, including water for hydromulching operations, mowing, labor, equipment, tools, supplies, and incidentals. Fertilizer will not be paid for directly but will be subsidiary to this Section.

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SECTION TF
TEMPORARY FACILITIES

TF.1. GENERAL

The provisions of the "General Information" and "Special Instructions" form a part of this section.

TF.2. SCOPE

This section covers the furnishing of all appliances, labor, materials, tools, transportation, and services required to perform and complete all preliminary work and temporary construction required for the construction and site as indicated on the drawings and as specified.

TF.3. TEMPORARY ELECTRIC SERVICE

Electric service required in the performance of the contract shall be furnished and paid for by the Contractor who shall furnish, install, and maintain all temporary poles and overhead construction, transformers, meters, drops, and other wiring and fittings for both light and power at locations required in the work, and shall bear the cost of making the service connections.

TF.4. SANITARY FACILITIES

The Contractor shall provide, install, and maintain, for the duration of the work, temporary outside toilet facilities for the use of the workmen. The toilet facilities shall be adequate, housed on a weather-tight and elevated floored structure and located advantageously. The toilet shall be kept in a clean and sanitary condition until the completion of the work, then shall be removed from the site, and the portion of the site occupied by the same properly cleaned up, graded, and left in acceptable condition.

TF.5. BARRICADES

The Contractor shall erect temporary barricades as required to safely conduct the work.

Barricades shall be substantially built of posts not to exceed eight feet (8') apart and not less than 1" x 6" rails. The top rail shall not be less than 36 inches from the ground, and the open spaces approximately 12 inches. Where barricades join to or are within four (4') feet of any parts of a building which is to be reconstructed, they shall be of sufficient height and be sheathed solidly with one (1") inch boards, to provide the necessary protection.

TF.6. PUMPING AND DRAINAGE

Surface or subsurface water or other fluid shall not be permitted to accumulate in excavations nor under structures. Should such conditions develop or be encountered, the water or

other fluid shall be controlled and suitably disposed of by means of temporary pumps, piping, drainage lines and ditches, dams, or other methods as approved by the Engineer.

TF.7. DUST PALLIATION

Throughout the entire contract period, the Contractor shall effectively dust-palliate the working area, roads used in the operations, and involved portions of the site with such frequency as will satisfactorily allay the dust during all hours that work is being performed. This shall include watering with trucks; including all necessary materials and labor.

TF.8. CLEANING

The Contractor shall from time to time remove all dirt and rubbish caused by the work from the structures and site. At completion of the work, the Contractor shall thoroughly clean the interior and exterior of all building, structures, equipment, etc., including hardware, floors, roofs, sills, ledges, glass or other surfaces where debris, dust, dirt, and paint spots may have collected. All glass shall be washed clean at completion.

TF.9. PAYMENT

No separate payment will be made for work covered under this section of the specifications and all costs in connection therewith shall be included in the contract price for the items to which the work pertains.

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SECTION GSR
GROUND STORAGE RESERVOIRS

GSR.1. GENERAL

This section includes the design, fabrication, erection, and testing of the proposed 26,000-gallon welded steel ground storage tank, with steel roof and concrete foundation.

The tank shall conform to the dimensions on the drawings and shall also conform in all particulars with the latest Standard Specifications for Elevated Steel Water Tanks, Standpipes and Reservoirs of the American Water Works Association D 100 or D 100 Appendix C and subsequent amendments thereto.

This work shall include all structures, accessories, fittings, excavations, grading, backfill and incidentals required for the construction of a welded steel reservoir on a concrete foundation, complete in place. Except as otherwise shown on the drawings or specified herein, Contractor shall furnish and install all materials, equipment and devices of an approved design in a manner approved by the Engineer.

All plate, piping, angles, structural components, etc. shall have minimum 1/4" steel thickness. Design calculations provided by tank manufacturer shall determine if thicker steel is required.

The tank and components shall be sandblasted and painted per Protective Coatings Section herein.

The sterilization of the water tank will not be part of this contract. The leak test and monitoring of settlement must still be performed.

GSR.2. MEASUREMENT AND PAYMENT

No separate measurement and payment for work performed under this Section. The Contractor shall include the cost for this work in the contract bid price for work of which this is a component part.

GSR.3. WORK DESCRIPTION

The work shall include all equipment, materials, labor and superintendence, as described herein and shown on the plans, including, but not limited to:

Sandblast and paint (per Protective Coatings Section herein) all interior and exterior, new components, including exterior piping.

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Install New:

- a. Excavation/subgrade.
- b. Concrete Slab.
- c. Entire Welded Steel Tank unit and appurtenances, including roof design.

The Contractor shall furnish and install with the tank the following accessory items:

- a. Outside Tank Ladder w/Cage.
- b. 12" Inlet Riser Pipe through top of tank.
- c. 12" Outlet Connection Flange. Blind flanged.
- d. 12" Equalization Line Flange. Blind flanged.
- e. 12" Overflow/Drain Pipe with gate and flap valves.
- f. One (1) 30" Square Roof Hatch.
- g. One (1) 30" Circular Shell Manway.
- h. 24"W x 12"D Flush Type Cleanout Door.
- i. 12" Screened Roof Vent Flange (stainless 16 mesh) with vent.
- j. One (1) 3" Flanged Coupling for future level probes. Blind flanged.
- k. One (1) 3" Flanged Coupling for spare connection. Blind flanged.
- l. Target Float Mechanism with stainless steel wire, float and target.
- m. Three (3) 1" Threaded Couplings one (1) foot from tank floor for future SCADA.
- n. One (1) 1" Threaded Coupling three (3) feet from bottom of the tank with sample tap.
- o. Painted Steel Perimeter Handrail with toe plate.
- p. Foundation Anchors as recommended by tank manufacturer.

GSR.4. REFERENCES

- A. AWWA D 100 - Standard for Welded Steel Tank for Water Storage
- B. AWWA B 300 – Standard for Hypochlorites
- C. AWWA C 207 – Standard Specification for Steel Pipe Flanges
- D. AWS B 3.0-77 – Standard for Welding Procedures and Performance Qualifications
- E. API 650 – Standard for Welded Steel Tank for Oil Storage
- F. ASTM A 6 – Standard for General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling
- G. ASTM A 20 – Standard for Steel Plates for Pressure Vessels
- H. ASTM A 307 – Standard for Carbon Steel Bolts and Studs

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- I. ASTM C 509 – Standard Specifications for Elastomeric Cellular Performed Gasket and Sealing Material
- J. ASTM 4940-89 – Standard for Conducting Analysis of Water Soluble Ionic Contamination of Blasting Abrasives
- K. AISC 316 – AISC Manual of Steel Construction

GSR.5. SUBMITTALS

Design Drawings and Calculations: Contractor shall prepare design drawings, for submittal to the Engineer. All drawings shall be dimensioned, easily readable, and adequately referenced. Drawings shall contain the following minimum information for each tank:

- 1. Plan view, elevation view, and section views as necessary, drawn to a scale as required for clarity.
- 2. Location, size, and type of all wall and roof penetrations.
- 3. Location and size of all piping, connections, and appurtenances.
- 4. Fabrication details and details of all connections.
- 5. Material specifications (ASTM designation) and code or standards references.
- 6. Describe AWS welding procedure proposed.

Design calculations are to be submitted on 8-1/2" x 11" paper, easily readable and suitable for easy reproduction.

All design drawings and calculations are to be prepared by, or under the direct supervision of, and officially sealed by a Professional Engineer licensed in the State of Texas attesting to the conformance with design criteria.

Test Reports:

- 1. Furnish mill test reports.
- 2. Submit weld test reports prior to initiation of painting.

GSR.6. DESIGN REQUIREMENTS

Design, fabricate, erect, and test in accordance with "AWWA Standard for Welded Steel Tanks for Water Storage" (AWWA D100), except as modified herein and as may be shown on plans.

Design in accordance with Section 14 of AWWA D100 will NOT be acceptable.

Comply with applicable OSHA Rules and Regulations.

Tank Design Loads:

1. Dead load plus 30 pounds per square foot live load for roof.
2. Wind load velocity of 115 mph from any direction.
3. The seismic design category is Seismic Design Category "A". The site soil class is Site Soil Class "C". The design spectral response acceleration in the short period range (S_s) = 4.8%g. The design spectral response acceleration at a period of 1.0 second (S_1) = 2.1%g.
4. Design for at least the following load combinations:
 - a. Dead + water + live or
 - b. Dead + water + wind or
 - c. Dead + wind

Allowable stresses for load combinations that include wind may be increased by 1/3 as long as specified allowable for dead load + water + live are not exceeded.

Steel Roof Design:

1. Tank roof to be so supported and erected that no ponding water will occur.
2. The roof will have a slope of 12:1 horizontal:vertical.
3. Roof shall be free-standing, self-supported. Internal columns or beams are not allowed.
4. Roof plates shall be welded on the top side with a full fillet weld on all seams, seal weld all interior and exterior seams.
5. Tank shell at roof connection shall include a minimum 3" channel (4.1 lbs/ft) continuous channel, rolled to inside tank radius, seal welded.

GSR.7. QUALITY ASSURANCE

Conduct performance tests to qualify welders and welding operators in accordance with AWS B3.0-77

Quality control for all welding shall be in accordance with AWWA D100:

1. Contractor shall vacuum test all bottom plate welds. Test corner welds by oil penetrate. Include costs for these tests in the cost of the tank.
2. Field inspection by means of radiographs will be performed as recommended by AWWA D100, Section 11, at Contractor's expense.

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3. All areas found to be defective shall be repaired by the Contractor at his expense.
4. Any retesting to check repaired areas will be paid for by the Contractor.

GSR.8. MATERIALS

Structural and Other Metals: As per AWWA D100.

Accessories as shown on Plans include (applicable as shown on plans):

1. Exterior tank ladder/cage, roof hatch, vent, overflow and drain piping.
2. Inlet, outlet, equalization, and overflow pipe to be as shown on plans.
3. Roof Vents:
 - a. Configuration and materials of construction as shown on plans.
 - b. Screens (16 mesh) are to be installed on all vents. Screens for all vents to be AISC 316 Stainless Steel with 50% opening area and stainless steel bands.
4. Safety Handrails: Provide in accordance with plans.
5. Overflow Assembly: Size and configuration per plans and welded per AWWA D100.
6. Shell Clean-Out Fittings: Provide flush type shell clean out fittings as shown on plans. Design and installation to be per AWWA D100 and API 650.
7. Roof Hatches:
 - a. Install roof hatches as shown on plans. Roof hatches are to be located between rafters, as applicable. Hatches are to be constructed from 1/4" thick steel.
 - b. All roof hatches shall be provided with a hinged cover and hasp for locking. The hatch opening shall have a curb at least 4-inches high, and the cover shall have a downward overlap of at least 2 inches.
8. Piping Connections, Sumps and Drains:
 - a. Provide piping connections, sumps, and drains as shown on plans.
 - b. For shell or roof penetrations less than three (3) inches diameter, use half or full forged steel couplings for piping connections unless shown otherwise on Plans.
 - c. For shell or roof penetrations three (3) inches in diameter or larger, use flanged nozzles. Reinforce shell or roof plate as required by AWWA D100 and API 650. All flanges to be flat face in compliance with AWWA C207, Class D.
9. All tank protrusions shall be reinforced per AWWA.

10. Target Float Mechanism: Provide in accordance with plans.
11. Shell Manway: 30" circular manway on side of tank shell to be installed in accordance with the plans.

GSR.9. JOINT FABRICATION

- A. Tank Shell: Butt Welds.
- B. Welded Steel Roof and Bottom: Lap Weld.

GSR.10. FIELD ERECTION

- A. Welded Steel Reservoirs:
 1. All welded steel reservoirs and appurtenances to be constructed per AWWA D100 and applicable portions of API 650, Section 5.5, except Contractor may elect to suspend the requirement for rolling of shell plate provided all erection tolerance requirements of this specification are met.
 2. Square and bevel all shell plates prior to delivery to the job site.
 3. Assemble and weld plates to maintain proper curvature.
 4. No de-coiled steel shall be used in the tank shell construction.
 5. Roll top channel to the curvature of the tank prior to shipment to the job site.
 6. The tank will be measured for conformance to the criteria stated below at various times throughout construction. Construction of the tank may be halted by the Engineer and corrections required prior to re-commencement of construction should deficiencies be noted in one or more of the criteria.
 7. Plumbness: The maximum out-of plumbness of the top of the shell relative to the bottom of the shell shall not exceed 1/200 of the total tank height. The out-of plumbness in one shell plate shall not exceed the permissible variations for flatness and waviness as specified in ASTM A6 or ASTM A20, whichever is applicable.
 8. Roundness:
 - a. Radii measured at 1 foot above the bottom. Tolerance shall not exceed $\pm 1/2"$.

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9. Peaking and Banding: Local deviations from the theoretical shape (for example, weld discontinuities and flat spots) shall be limited as follows:
 - a. Peaking at vertical weld joints shall not exceed 1/2 inch. Peaking at vertical weld joints shall be determined using a horizontal sweep board 36 inches long.
 - b. Banding at horizontal weld joints shall not exceed 1/2 inch. Banding at horizontal weld joints shall be determined using a vertical sweep board 36 inches long.
 - c. Flat spots measured in the vertical plane shall not exceed the appropriate plate flatness and waviness requirements given in ASTM A6 and A20, whichever is applicable.
10. Measurements: Measurements listed in items above shall be taken as each tank ring is completed. Contractor shall repair defects, correct alignments and take other corrective actions as required to insure each tank ring is constructed in strict compliance with these specifications prior to proceeding with additional tank rings.

B. Cleanliness:

1. Provide proper sanitary waste facilities.
2. Only healthy personnel may enter tank.
3. If necessary, Owner's physician will judge physical fitness of all persons entering tank.
4. Keep interior of tank and accessories clean and free from foreign matter.

GSR.11. MONITORING TANK SETTLEMENT

Tank settlement for new tanks is to be monitored by the Contractor during initial filling of the tank. The tank monitoring program shall conform to the following minimum requirements:

- A. All survey data must be sealed and certified by a Registered Professional Surveyor or Licensed Engineer in the State of Texas.
- B. Establish eight (8) reference points at the top of the concrete slab foundation, equally spaced around the periphery. One point shall be located at or near the suction outlet.
- C. Record the initial elevation at these eight points when tank erection is complete and before filling with water.
- D. Record the elevations at the eight (8) points when tank is full to overflow.

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- E. Record elevations again approximately 24 hours after tank is filled.
- F. Submit each set of tank readings to the County for review.
- G. If the tank settles more than two inches in any location, Contractor shall at his expense adjust piping connections at couplings so as not to exceed the piping alignment tolerances of the couplings.
- H. Elevations are to be related to benchmarks described in the Plans.

GSR.12. WELDING & INSPECTIONS

All joints, whether butt or lap and whether floor, wall, or roof panels, must be continuously welded on the interior as well as the exterior.

ALL JOINTS MUST BE SMOOTHED BY MECHANICALLY GRINDING TO REMOVE SLAG, SPATTERS, AND ALL ROUGH EDGES.

Weld inspection shall be spot radiographs in accordance with AWWA Specifications, Section 11. The radiographs shall be submitted to the Engineer for approval and paid for by the Contractor.

GSR.13. TEST

Prior to final acceptance, Contractor shall fill tank with water and shall satisfactorily repair any leaks or other defects.

The initial supply of water required for leak test shall be supplied by the Owner. Additional water required for subsequent leak tests shall be at the Contractor's expense.

Do not sterilize tank.

GSR.14. GUARANTEE

The Contractor shall guarantee the entire structure against any defects of materials or workmanship for a period of one (1) year following acceptance by the Owner and make any necessary repairs or alterations during that period.

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SECTION SG
SUBGRADE PREPARATION

SG.1 SCOPE OF PROJECT

The work to be done under this section includes the furnishing of all superintendence, labor, materials and equipment required for all demolition, clearing, excavation, grubbing, filling, grading and preparation of subgrade for paving, and excavation and grading at intersection stubs to meet grade of cross roads.

All excavation under this contract will be unclassified and will not be measured or paid for as a separate bid item. The cost of excavation shall be included in the appropriate bid item of the Proposal.

If a geotechnical report was prepared for this project and is referenced in the drawings for particular structures, piping, etc., the report shall take precedence over any other requirements listed in the plans and specifications.

SG.2. CLEARING AND GRUBBING

The entire area within limits of grading and including borrow areas shall be cleared of all structures, obstructions and vegetation except trees or shrubs specifically designated for preservation shall be carefully trimmed as directed and shall be protected from scarring, barking or other injuries during construction operations.

In areas to receive embankment and/or base material, tree stumps and roots greater than 2" in diameter shall be removed to a depth of 18" below existing or finished grade, whichever is greater.

SG.3. EXCAVATION

Excavation shall include removing all materials existing above subgrade or finished grade as applicable and removing unsuitable materials existing below subgrade or finished grade. Disposal of excavated materials shall be by one of the following methods:

1. To the extent available or required, top soil shall be salvaged and utilized for backfill and grading.
2. Materials suitable for inclusion in embankment and onsite grading shall be utilized to the extent required for such embankment and grading.
3. All unsuitable materials and other excavated materials excess to excavation and grading requirements shall be wasted on sites obtained by Contractor, unless otherwise directed by the Owner, and in a manner

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satisfactory to Engineer. Contractor shall file written permission of property owners of such waste sites with Engineer prior to depositing any materials thereon.

Contractor shall exercise care in all excavation work to avoid damage to existing improvements. Contractor shall execute his work in such manner as not to damage such underground utilities and appurtenances.

SG.4.1. EMBANKMENT

Areas to receive fill, backfill or embankment shall be cleared and grubbed of all materials not suitable for inclusion in embankment, including vegetation, organic matter, debris and other objectionable materials. Sloping ground surfaces steeper than 4 to 1 slope shall be plowed, benched or otherwise broken in such manner that fill material will blend with existing surfaces, as approved. Water shall be applied to prepared surfaces when required to obtain optimum moisture content.

SG.4.2. EMBANKMENT MATERIAL

Embankment, fill and backfill shall be constructed of suitable materials approved by Engineer. Materials shall be free from trees, brush, roots, other organic matter, debris or frozen materials. Insofar as practicable, materials shall be selected excavation from roads to be paved or adjoining unimproved streets not currently scheduled for paving. Minor quantities of gravel, broken stone or broken concrete may be included provided individual particles of such materials are reduced to a maximum dimension of 4 inches.

SG.4.3. CONSTRUCTION METHODS

Embankment shall be constructed in successive layers, not to exceed 8 inches in depth, loose measurement, brought to a uniform moisture content and uniform blend of materials by sprinkling, aerating, mixing by blades or disc; and compacted to a uniform density by rolling with tamping type roller loaded to develop a compactive effort of not less than 550 pounds per square inch of tamping area and with suitable pneumatic rollers. Steel wheel rollers will not be allowed as compacting devices for earthwork unless of the vibrating type; and the top 1 inch of each lift is scarified before the next lift is placed.

Material shall be thoroughly blended and maintained at near optimum moisture content during compaction operation. Materials shall be removed from soft places during compaction and replaced with acceptable material to obtain uniform density throughout the embankment. Should a crust form on any layer, such surface crust shall be scarified before succeeding layers are placed thereon.

Areas not accessible to heavy equipment shall be constructed by alternate methods acceptable to Engineer.

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SG.5. SUBGRADE FINISHING

Areas to be paved shall be finished accurately to grades and cross sections as shown on the plans and established in the field, and thoroughly compacted to specified densities. Swales, valley gutters and other irregularities in section as shown on the plans or established in the field, shall be accurately formed in the subgrade during the finishing operation. Optimum moisture content shall be maintained in all areas during finishing operations and until base material is placed.

On completion of compaction and shaping operations, all areas shall be rolled with three-wheeled roller to secure a dense smooth surface. Subgrade shall be checked by measurement, from taut string, from shoulder to shoulder on cross section and by means of a sixteen (16) foot straight-edge longitudinally. Variations of more than one-half (1/2) inch shall be corrected. Contractor shall furnish a satisfactory straight-edge, 16 feet in length.

During construction, fills and excavations shall be kept shaped and drained. Ditches and drains along the subgrade at street intersections shall be maintained in such manner as to drain the subgrade effectively at all times.

SG.6. MISCELLANEOUS GRADING

Except as otherwise directed or shown on the plans, approaches to intersection stubs shall be graded to present a reasonably smooth and compacted surface free of irregular changes. Finish shall be that ordinarily obtained by competent operation of a motor grader. All ditches, slopes, approaches to intersections and storm drains shall be graded so as to drain readily.

SG.7. DENSITY REQUIREMENTS

Unless otherwise noted on plans, soils in all areas (whether cut or fill) to receive structures or flexible base, shall be compacted not less than 95% of maximum density as determined by ASTM D 1557. Embankment below the foregoing areas shall be compacted to not less than 95% of maximum density. Blended embankment material having a plasticity index (PI) greater than 35 shall be compacted to exceed 100% maximum density.

On projects or portions of projects where laboratory control of density is not employed, Contractor shall provide such equipment and perform all sprinkling, aerating, mixing and rolling operations as directed by the Engineer.

When lime stabilization is required in the subgrade, compaction and density shall be in accordance with other sections of these specifications.